This invention relates to apparatus for cutting a piece of lumber into pieces of smaller size and in particular to a machine for slicing a block of lumber to form laths or similar items that are usable, if desired, as materials of construction.

In the past, laths and the like have been made from blocks of lumber by performing one or more sawing operations on the block. A sawing operation has a variety of characteristic disadvantages, among them the fact that it gives a rough-surfaced product, the fact that considerable waste in the form of sawdust is produced, and the fact that the block that is being sawed not infrequently tends to split in the direction of the grain. This invention has for its object, by providing methods and means for slicing the block, to obviate these disadvantages. It provides a relatively dense, smooth-surfaced product, produces no sawdust to be burned or hauled away, and is not accompanied by any important amount of splitting even when the direction taken by the grain departs abruptly from the direction in which the cut is being made.

Other objects and advantages of the invention will be apparent from the specification which follows and from the accompanying drawings in which:

Figure 1 is a perspective of a wood slicing machine of the kind to which the invention relates, certain of the parts near the right-hand end 14 being broken away in order to reveal details of the interior construction;

Figure 2 is an end elevation of the framework and associated mechanism from the left-hand end of the framework as seen in Figure 1; i.e., looking to the right from a position approximately half-way along the machine;

Figure 3 is an end elevation of the framework and associated mechanism as seen from the right-hand end of the machine as shown in Figure 1;

Figure 4 is a side elevation of the same portion of the machine as seen from the near side in Figure 1;

Figure 5 is a side elevation of the same portion of the machine as seen from the far side in Figure 1;

Figure 6 is a longitudinal central section on a vertical plane showing the details of certain parts of the machine that are seen in elevation in Figures 4 and 5;

Figure 7 is a plan of the same portion of the machine;

Figure 8 is a plan of a modification in which a laterally operating ram is used to guide the lumber; and

Figures 9 and 10 are respectively a plan and a side elevation of a further modification, the plan of Figure 9 being viewed as if from line 9—9 of Figure 10.

In Figure 1, which shows substantially the entire machine, the framework carrying the slicing mechanism is designated 1. The framework has a feed zone including a feed portal 2 at the left-hand end of the framework 1 as seen in Figure 1. At its opposite end it has a discharge zone including a discharge portal 3. The discharge zone is provided with a short run-off table 4. In a corresponding relation in the feed zone is a relatively longer table 5 on which is supported the block of lumber to be sliced. Designated 6, the block can be of a height lending itself to the production of laths or the like, usually about 3', in a typical case be about twice as wide as it is high, and can be of any convenient length; for example, about 6'. Operating on the trailing end of block 6 is a ram 7 to which, by means of an associated crosshead 70, is applied a force communicated by way of piston rod 8 from a movable piston (not shown) in a stationary power cylinder 9.

The latter, which may be considered representative of a variety of suitable devices for applying a longitudinally acting force to ram 7, is shown in the drawings as provided with conduits 10 and 11 by means of which a pressure fluid such as oil can be admitted and withdrawn. The operation of the piston in power cylinder 9 is controlled by suitable valve mechanism in a housing 12, which valve mechanism is operated by a handle 13. To the valve housing 12 oil or other pressure fluid is fed by means of a line 14 leading from a pump 15 driven by a motor 16, such pressure fluid being supplied to the pump by a line 17 from a reservoir 18. A line 19 re-admits the pressure fluid to reservoir 18 after it returns to valve housing 12 by conduit 10 or 11, as the case may be, from that end of power cylinder 9 from which the pressure fluid is being exhausted.

Feed table 5, ram 7 and pressure cylinder 9 are all in alignment with the longitudinal axis of framework 1. As seen in Figure 1, framework 1 incorporates four outwardly facing channel-shaped uprights 21. To them are connected, by welding or any other suitable way, four inwardly facing channel-shaped springers 22. Four outwardly facing channel-shaped cross pieces 23 suitably attached to uprights 21 and springers 22 complete the framework. Together, uprights 21 and cross pieces 23 define the openings that constitute feed portal 2 and discharge portal 3.

On each of the two opposite sides of framework 1 a series of six upper brackets 24 are attached at appropriate intervals to the adjacent top stringer 22. Upper brackets 24 are formed as shown in Figure 1 of suitably shaped angle pieces that are bolted to upper stringers 22. All twelve upper brackets 24 face toward feed portal 2; however, upper brackets 24 are attached upper bearing blocks 25, one to each of the brackets. Thus each of the two upper stringers 22 carries a series of six brackets and a series of six bearing blocks. The upper bearing blocks 25 on each side line up transversely with the upper bearing blocks 25 on the opposite side. In the bearing blocks that appear in section in Figure 6 can extend between them transversely of the longitudinal axis of the framework.

Attached to the two lower stringers 22 are two series of six lower brackets 26, one series on each side of the machine. The lower brackets 26, like upper brackets 24, are formed from angle pieces bolted to framework 1; however, lower brackets 26 are offset from upper brackets 24 and face in the opposite direction; i.e., toward discharge portal 3. Attached to lower brackets 26 are lower bearing blocks 27, one for each of the several brackets. Each series of lower bearing blocks 27 is aligned with the like series on the opposite side of the framework in such manner as to permit the shafts 28 seen in cross section in Figure 6 to run between them transversely of the longitudinal axis of the framework. It will be noted that even though the upper and lower brackets are offset from each other, the bearing blocks of the upper and lower series are in parallel alignment with the bearing blocks of the upper series, the six upper shafts 28 overlying the six lower shafts 28.

The shafts 28 of the upper series of shafts terminate on opposite sides of the machine in the threaded outer ends 30, which result in the least advantageous position in Figure 7. Except at their threaded outer ends, the shafts will have a uniform diameter of, say, 1 1/8", in a typical case. Mounted on the threaded outer ends of the shafts 28 are the nuts 29. The
latter abut the outer ends of the long sleeves 30 and the short sleeves 31 seen in Figure 7, all of which are characterized by an internal diameter that is the same or substantially the same as that of shafts 28; e. g., 17/8". The sleeves 30 and 31 seen in Figure 7 are carried by upper bearing blocks 25 in surrounding relation to the shafts 28 of the lower series. In the operation of the machine sleeves 30 and 31 rotate in upper bearing blocks 25 and the shafts within them tend to rotate with them.

Below sleeves 30 and 31 as seen in Figure 7 are similar sleeves, similarly designated, that surround the shafts 26 of the lower series, the same being carried by lower bearing blocks 26.

In each case, there is between each long sleeve 30 and each aligned short sleeve 31 an assembly consisting of (a) a group of circular slicing knives (for example, knives 32 and 33 at the left-hand end of Figure 6; also knives 34 and 35 at the right-hand end of Figure 6); (b) a plurality of sleeve-like spacers of the same diameter as sleeves 30 and 31; and (c) a guide element taking the form of a scoring collar 36. The knives, spacers and scoring collar are arranged at suitable intervals and in appropriate relation to each other in the space between the inner end of the given long sleeve and the outer end of the aligned short sleeve. The assembly as a whole is identical for a given upper shaft and for the lower shaft which directly underlies it. Thus each two superimposed shafts, together with the groups of slicing knives mounted on each shafts, may be considered to constitute a station. In the stretch between feed portal 2 and discharge portal 3 there are six such stations, respectively designated A, B, C, D, E and F.

Considering Station A in detail, it will be seen from Figures 2 and 7 that each shaft 28, upper and lower, carries a group of three beveled circular knives separated from each other by two undesignated sleeve-like spacers.

On each upper shaft, a group of upper knives 32 and on each lower shaft a group of lower knives 33 is separated from the scoring collar 36 on the same shaft by a sleeve-like spacer 37. Thus by the expedient of tightening the nuts 29 at the outer ends of shafts 28 against the outer ends of long sleeves 30 and short sleeves 31, the circular knives, the scoring collars and the spacers which separate them can be clamped together to form a unit. At the same station; e. g., Station A, each upper unit is opposed by a like lower unit.

As appears from Figures 2 and 6, the circular knives 32 of the upper group and the circular knives 33 of the lower group do not come together at Station A. They are separated from each other by a distance which, in the embodiment of the invention shown, is of the order of about 1/4". Thus by the expedient of tightening the nuts 29 of the outer ends of shafts 28 against the outer ends of long sleeves 30 and short sleeves 31, the circular knives, the scoring collars and the spacers which separate them can be clamped together to form a unit. At the same station; e. g., Station A, each upper unit is opposed by a like lower unit.

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At Stations B, C, D and E, like conditions obtain except that whereas scoring collars 36 are of the same diameter at all stations, the knives at succeeding stations increase in diameter by uniform increments. Such increments, in the embodiment of the invention shown, are of an order of about 1/4". Thus, whereas the knives at Station A have a diameter such that they can cut their way into block 6 only to a depth of about 1/4" on each side of the block, those at Station B are of such diameter that they can cut their way to the extent of about 1/2" on each side thereof; at Station C, the cut is increased to 1/4"; at Station D, the cut is further increased to 1/4"; and at Station E, it is still further increased to 1/4".

At Station F, the upper knives 34 and the lower knives 35 are of still larger diameter, the increase being just sufficient so that the knives 34 and 35 will make touching contact with each other as shown in Figures 3 and 6.

Thus by the time the block 6 has progressed under the influence of ram 7 from feed portal 2 to discharge portal 3, it has been sliced completely through by the operation of six pairs of opposing knives groups of progressively increasing effectiveness.

Since the scoring collars 36 are of the same diameter throughout, in the operation of the machine the knives, which score collars 36 are not increased in depth as the block 6 proceeds through the apparatus. Inasmuch as the score lines are introduced solely for guiding purposes, no increase in depth is necessary. It will be noted that at Stations E and F as seen in Figure 7, the spacers between the scoring collars 36 and the nearest of the knives, which score collars 36 are designated 38, are shorter than the correspondingly located spacers 37 at Stations A to D, inclusive. This results from the fact that at Stations E and F the knives are provided, in lieu of spacers of the same diameter as long sleeves 30 and short sleeves 31, with restraining collars 39 for restricting the freedom of movement of the ends of the laths that are being cut from block 6. The guiding functions of scoring collars 36 and restraining collars 39 are assisted by a guide rail 40, best seen in Figures 1 and 5. Guide rail 40 has cut-away portions 41 and 42 that engage the lower and upper ends of the cover shafts 28 at the ends thereof adjoining the guide rail.

In the embodiment of the invention shown in Figure 8, the scoring collars 36 are omitted. In lieu thereof, a second ram operating laterally on block 6 is employed. Such second ram is supported from a platform 46. It is operated from a power cylinder 47 mounted on the same platform.

From the piston (not shown) a piston rod 48 extends transversely of the longitudinal axis of the apparatus as a whole, such piston rod 48 carrying a roller-equipped cross head 49. The second ram so operating on block 6 urges it laterally against guide rail 40. This arrangement makes it possible to dispense with scoring collars 36 and, if desired, to increase the number of knives at each station.

In the further modification shown in Figures 9 and 10, the guide means for block 6 take the form of two opposed endless belts 61 and 62 traveling in the directions indicated by the arrows in Figure 9. The belts are preferably articulated, being conveniently made up of separable metal links 63 on each of which may, if desired, be mounted a rubber block 64 or some similar gripping element. Spring-pressed abutments 65 supported from a stationary standard 66 of the nature of a pressure plate urge belt 61 against one side of block 6; similar abutments 67 carried by a stationary standard 68 urge belt 62 into contact with block 6 on the opposite side of its longitudinal axis. Belt 61 is held at the desired level by two sprockets 69 and 70 mounted on two supporting spindles, while two similar sprockets 71 and 72 serve to hold belt 62 in opposing relation to it. If, as in Figure 1, block 6 is being urged through the apparatus by a ram at its trailing end, belts 61 and 62 will guide it the proper direction.

However, it is sometimes desirable to provide a positive drive for one or both series of shafts, in which case it becomes practicable to drive belts 61 and 62 from the power train serving the shafts. Such a system is shown in Figures 9 and 10, particularly in the latter. As there indicated, an electric motor 75 is attached to the framework of the machine to act as a source of power. By means of a drive sprocket 76 and a link belt 77, power from motor 75 is made to drive the various shafts and, in the embodiment of the invention shown, also belts 61 and 62. For this purpose, a double sprocket 78 is provided as indicated in Figure 10 and from it power is taken off to drive a sprocket 79 mounted on the near end of a horizontal shaft 80 that is provided with worms 81 and 82 (Figure 9) for driving the wheels such as wheel 83 (Figure 10) properly located in relation to the sprockets 70 and 72 at the ends of belts 61 and 62. Thus power from motor 75 can be
communicated to sprockets 58 and 72 and by means of means to gears 91 and 94, respectively.

Above the level of sprocket 18, link belt 77 engages sprockets 89 and 90 on the near end of the frame or station A. Leaving the station, it engages next sprocket 78 at the left-hand end of the machine as seen in Figures 9 and 10, in order that the knives at Stations A to F, inclusive, may be driven at a constant linear speed, which is desirable in order to prevent slip, the pairs of sprockets increase in size from Station A to Station F. They are of approximately the same diameter at each station as the knives at the same station. By this arrangement, the belts 61 and 62 and the knives at the various stations can be synchronized; i.e., driven at constant linear speeds, and the block 6 can be urged through the apparatus by the belts 61 and 62 without requiring that the machine extend rearwardly as in Figure 1 to accommodate the ram 7, piston rod 8 and power cylinder 9.

It is apparent that changes may be made by those skilled in the art in the construction and arrangement of the parts of the machines shown in the accompanying drawings. Thus the number of knives of each group may, if desired, be decreased to two or even one; on the other hand, the number may also be increased so long as it is not increased beyond the point where the entire block 6 is sliced at one time into the exact number of laths that its width will provide. Different means for guiding the block through the machines may be employed in place of the means used for these purposes in the machines of Figures 1 to 10, inclusive. The positive drive of Figures 9 and 10 may be used without the particular guide means therein shown, as, for example, with any of the machines of Figures 1 to 8, inclusive. Other changes may also be made by those skilled in the art to which the invention pertains.

It is intended that the patent shall cover, by summarization in appended claims, all features of patentable novelty residing in the invention.

I claim:

1. Apparatus for slicing lumber comprising a framework having axially aligned feed and discharge zones therein for the lumber being sliced; a first series of knife-edged elements of progressively increasing size disposed in the stretch between the feed and discharge zones of the framework in series arrangement with each other in a single vertical plane parallel to the longitudinal axis of the framework each of which elements in turn cuts its way into the lumber as the lumber traverses said stretch; a second stepped series of knife-edged elements of progressively increasing size disposed in the stretch between the feed and discharge zones of the framework in series arrangement with each other in a single vertical plane parallel to the longitudinal axis of the framework each of which elements in turn cuts its way into the lumber as the lumber traverses said stretch; a second series of rotary knife-edged elements disposed in the above-mentioned single plane in opposition to the knife-edged elements of said first series, the edges of the knife-edged elements of said second series being approached incrementally by the edges of the knife-edged elements of said first series; and power means for positively driving the knife-edged elements of both the upper series and the lower series.

2. Slicing apparatus as in claim 1 in which, within the single vertical plane in which they are disposed, the axes of all knife-edged elements of the same series are in the same horizontal plane.

3. Slicing apparatus as in claim 2 in which, in the several steps preceding the last step, the magnitude of the increments is uniform from step to step.

4. Slicing apparatus as in claim 3 in which, in the last step, the increment is of substantially the exact magnitude required to complete the slicing operation.

5. Apparatus for slicing lumber comprising a framework having axially aligned feed and discharge zones therein for the lumber being sliced; guide means tending to maintain the lumber in the desired path of travel; a first series of knife-edged elements of progressively increasing size disposed in the stretch between the feed and discharge zones of the framework in series arrangement with each other in a single vertical plane parallel to the longitudinal axis of the framework each of which elements in turn cuts its way into the lumber as the lumber traverses said stretch; a second series of knife-edged elements of progressively increasing size disposed beneath the first series in the above-mentioned single vertical plane, the cutting edges of the knife-edged elements of said second series approaching the cutting edges of the knife-edged elements of said first series; and power means for positively driving the knife-edged elements of both the upper series and the lower series.

6. Slicing apparatus as in claim 5 in which the guide means include a stationary ram along one side of the path of travel of the lumber.

7. Slicing apparatus as in claim 6 in which the guide means include at least one ram located to one side of the path of travel of the lumber.

8. Apparatus for slicing lumber comprising a framework having axially aligned feed and discharge zones therein for the lumber being sliced; power means for urging the lumber therethrough; moveable guide means tending to maintain the lumber in the desired path of travel; a first series of knife-edged elements of progressively increasing size disposed in the stretch between the feed and discharge zones of the framework in series arrangement with each other in a single vertical plane parallel to the longitudinal axis of the framework each of which elements in turn cuts its way into the lumber as the lumber traverses said stretch; a second series of knife-edged elements of progressively increasing size disposed beneath the first series in the above-mentioned single vertical plane, the cutting edges of the knife-edged elements of said second series approaching the cutting edges of the knife-edged elements of said first series; and power means for positively driving the knife-edged elements of both the upper series and the lower series.

9. Apparatus for slicing lumber comprising a framework having axially aligned feed and discharge zones for the lumber being sliced; power means for urging the lumber therethrough; moveable guide means tending to maintain the lumber in the desired path of travel, said guide means operating laterally on the lumber; a first series of rotary knife-edged elements of progressively increasing size disposed in the stretch between the feed and discharge zones of the framework in series arrangement with each other in a single plane parallel to the longitudinal axis of the framework each of which elements cuts its way into the lumber as the lumber traverses said stretch; a second series of rotary knife-edged elements disposed in the above-mentioned single plane in opposition to the knife-edged elements of said first series, the edges of the knife-edged elements of said second series being approached incrementally by the edges of the knife-edged elements of said first series; and power means for positively driving the knife-edged elements of both series.

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