Sept. 7, 1965 J. T. GRIFFIN 3,204,674

STEP SAWMILLING WITH BY-PRODUCT CHIP PRODUCTION

Filed March 12, 1962 2 Sheets-Sheet 1

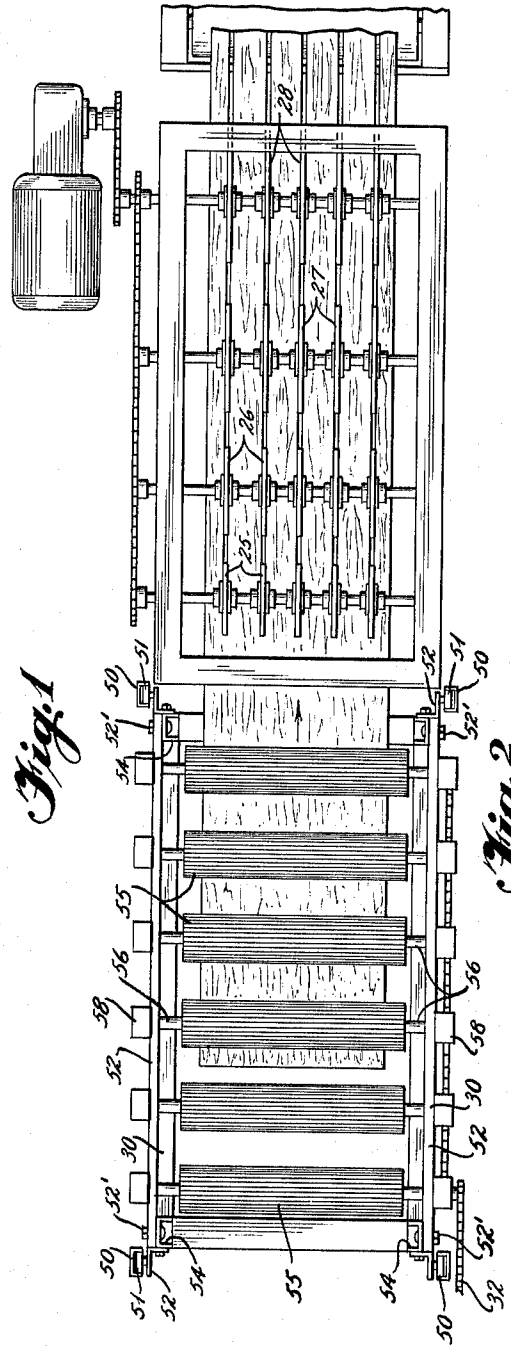

Fig. 1

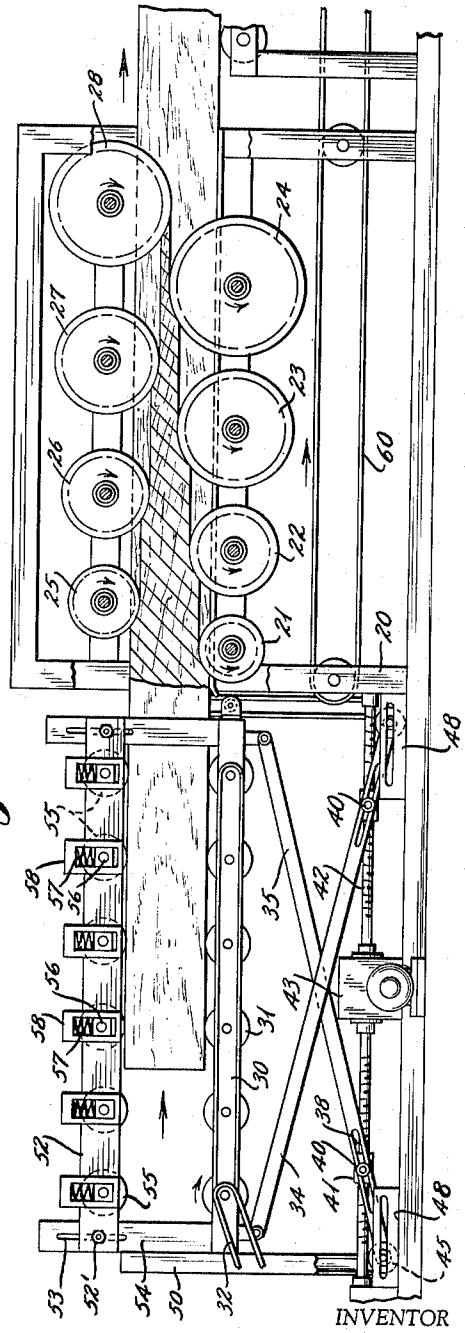

Fig. 2

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Fig. 3

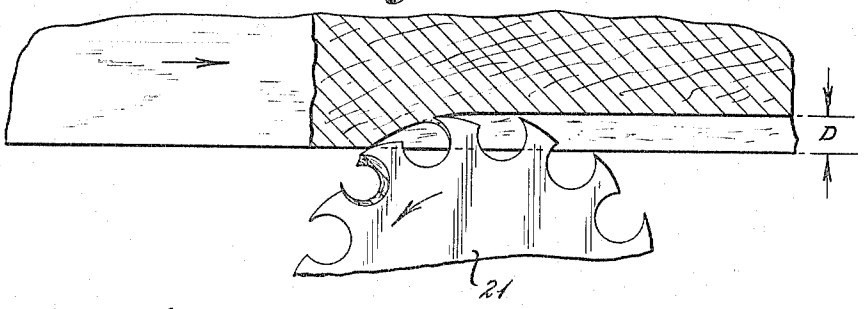


Fig. 4

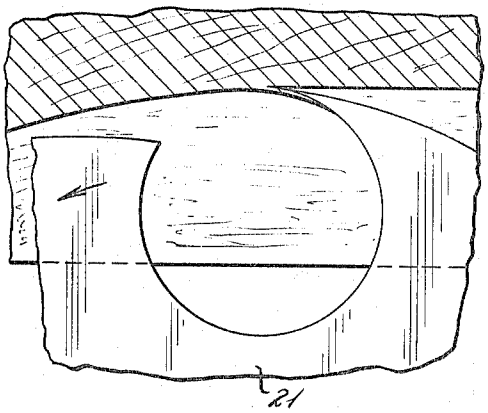


Fig. 5

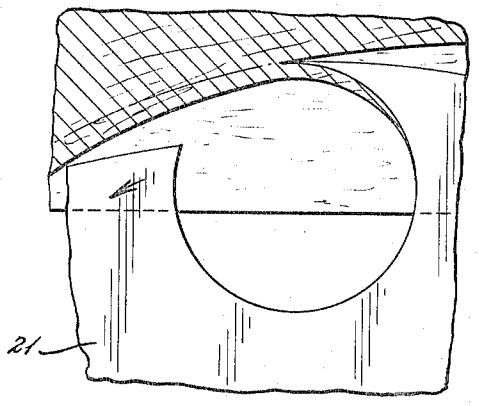


Fig. 6

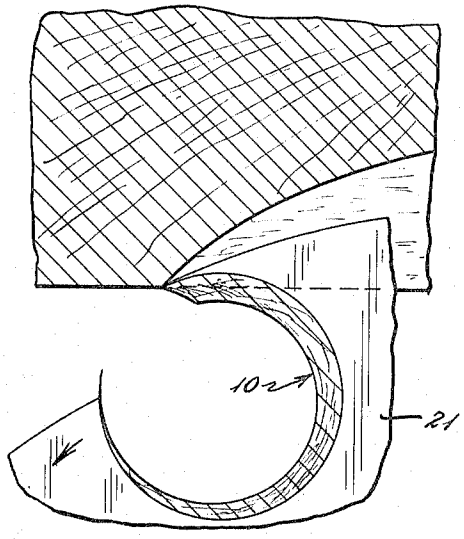


Fig. 7

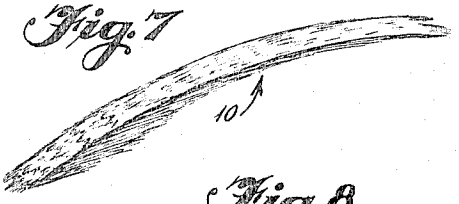
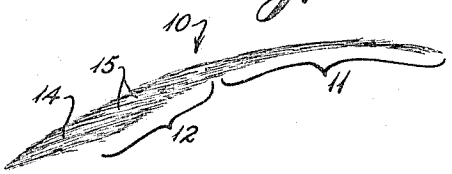


Fig. 8



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United States Patent Office 3,204,674 Patented Sept. 7, 1965

3,204,674

STEP SAWMILLING WITH BY-PRODUCT CHIP PRODUCTION

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Filed Mar. 12, 1962, Ser. No. 179,073
4 Claims. (Cl. 144—326)

This application is a continuation in part of my application Serial No. 816,181, filed May 27, 1959, issued March 13, 1962, as Patent No. 3,024,820, the latter a continuation-in-part of my application Serial No. 685,848, filed September 24, 1957, now abandoned.

This invention relates to conservation of our natural resources and the economic welfare of wood processors and more particularly to the production of usable chips as a by-product of the manufacture of an increased yield of lumber.

Within recent times, approximately twenty years, the cost of timber and lumber has greatly increased, the current cost in some categories being about fifteen hundred percent of its previous cost. Previously, when timber was by comparison so inexpensive, the tops of trees, sawdust, slabs, edgings and other by-products of sawmilling were usually wasted. More recently, with timber and lumber commanding a higher price, efforts have been made to more completely utilize forestry products. Such utilization has included the manufacture from relatively small tree tops and from slabs and edgings of chips usable for pulp and other wood products, such as fiberboard and flakeboard. Furthermore, as described in my copending application, the production of useful chips as a by-product of sawing, instead of producing waste sawdust, has been practiced.

Due to the relatively high price at which lumber may be sold compared to the value of pulpable chips, it has appeared that economic benefits should result if the yield of lumber from logs could be increased by reducing the amount of sawdust or saw chips produced during the sawing operation. However, due to the carrying on of many sawing operations in the field, frequently under adverse conditions and with relatively unskilled labor, many operators have believed it necessary to provide for a relatively large margin of error in sawing in order to avoid the possible overtaxing of their equipment. Such margin of error has sometimes involved the use of a thicker saw than is apparently necessary. Hence, saving in kerf loss by attempting to improve existing procedures has been limited.

In an attempt to derive benefit from the by-products of sawmilling the operators have employed chipping machines to reduce slabs and edgings, and usable chips have been produced as a by-product of sawing, as described in my copending application. With existing sawmilling practices, the size and character of such by-product chips has been limited, and a portion thereof has been regarded as too fine for use and has been separated by screening and discarded. Screening of chips produced by chippers has also been practiced, with a portion wasted.

Accordingly, it is an object of the present invention to provide sawing procedures and apparatus by means of which the yield of lumber resulting from the sawing of logs and cants and from resawing may be substantially increased.

A further object is to provide sawing procedures and apparatus by means of which substantially longer and more useful chips of selected size and characteristics may be produced as a by-product of the sawing of lumber.

A further object is to provide sawing procedures and apparatus by means of which the yield of lumber

may be substantially increased and an elongated chip of selected size and characteristics produced as a by-product.

A further object is to provide sawing procedures and apparatus by means of which the yield of lumber may be increased, the power requirements reduced and an improved product produced.

A further object is the production of chips as a by-product of sawing, which chips are of a selected size and type.

These and other objects of the invention will become apparent from the following description in conjunction with the accompanying drawings, in which:

FIG. 1 is a plan view of a multiple saw layout in accordance with the present invention;

FIG. 2, a side elevation of the apparatus of FIG. 1 with parts broken away,

FIG. 3, a fragmentary schematic detail illustrating the cutting action of a saw in accordance with the present invention,

FIGS. 4, 5 and 6, enlarged detail views illustrating the progressive cutting action of a single tooth,

FIG. 7, a perspective of a typical chip in accordance with the present invention, and,

FIG. 8, a side elevation of the chip of FIG. 7.

Briefly stated, the present invention contemplates the employment in sawmilling of equipment proportioned to the operation to accomplish the desired result. More specifically, the invention contemplates the use of a saw having a diameter approximately five to twenty times the depth of cut at which it is operated, to which logs or cants are fed longitudinally, with the longitudinal advance between succeeding tooth cuts being approximately one eighth to one inch and not in excess of approximately two to three times the kerf width, the tooth gullets being of sufficient size to accommodate the chips without substantial compaction, and the kerf width being selected in accordance with the characteristics of the desired chip and obtainable substantially below that heretofore obtainable in circular sawing. The chips produced in accordance with the present invention are of a novel type, having a larger portion that is substantially unitary and unfragmental cut substantinally parallel to the grain and approximately 50 to 75% of the length of the chip and a remaining portion consisting of offset side-by-side connected fragmentary portions which are separable along cleavage lines or planes and curved inwardly.

Conventional sawing and kerf loss of fine particles of unmerchantable sawdust.

In the production of lumber from logs it has been the practice to employ circular saws, sash gang saws and band saws. Sash gang and band saws have the advantage of operating with a relatively narrow kerf, but are relatively expensive, require skilled labor, and may have a production rate lower than those of circular saws. Hence, in some portions of the industry, such as the southeastern part of the United States, sawmills employ circular saws almost exclusively.

In order to accommodate an appropriate range of log sizes circular sawmills use relatively large saws. Since the periphery of large saws is more flexible than that of small saws of the same thickness, it has been necessary to employ relatively thick saws in the larger diameters in order to have the necessary stiffness to withstand the sawing operation. The thickness of such saws in some instances has been greater than necessary if the operation were performed with precision equipment. However, the saving which may be accomplished by improved precision in many instances has been relatively small or impractical to achieve.

In conventional sawing the prevailing consideration has been to make an accurate cut through the log or cant under a range of conditions and with as little wear and injury to the saw equipment as possible. This has resulted in conventional operation being practiced by saws rotating at relatively high speed and with the feed held below a point at which the saw appears to experience any difficulty in making the cut. Such operation produces fine sawdust, since each tooth takes a very small bite from the wood.

Kerf chips produced as a by-product of sawing

In my copending application, Serial No. 816,181, filed May 27, 1959, the economic and conservation importance of producing usable saw ships as a by-product is stated. That application also describes the relationship between the feed rate, the number of teeth and the number of revolutions per minute in order to produce a specified length of bite per tooth along the longitudinal grain. In that application, however, it was contemplated that a single saw would cut completely through the log or cant. Since saws designed to cut entirely through the log or cant must usually handle a relatively large range of log or cant sizes, it is apparent that the outer periphery of the saw must protrude substantially beyond the side of the log or cant. Hence, it will be apparent that under that condition the cutting action of the teeth is substantially transverse to the longitudinal grain. Under such circumstance the longitudinal advance between successive tooth bites longitudinally of the grain is substantially equal to the length of the chip produced along the grain.

The desirability of a substantially longer chip than was heretofore practically commercially available as a by-product of commercial sawing has been indicated by the practice in some mills of using a blend of chips produced by commercial chippers and kerf chips produced in accordance with the practice of my copending application, Serial No. 816,181. Such commercial chips which are produced from slabs and edgings, rather than as a by-product of sawing, have a substantial percentage of chips whose length varies from ⅝ of an inch to about an inch in length along the longitudinal grain.

The publication "Characterization of Sawdust and Shavings for Pulp," Report No. 2212, March 1961, Forest Products Laboratory, states that the fiber length of chips tends to decrease with decrease in particle size, and that the strength values of pulps appear to be relatively in accord with the fiber length values.

It is also known that pulping apparatus may not be able to satisfactorily process fines or particles that are below a certain size.

The present invention makes possible decreased kerf and an increased and selected size chip as a by-product of circular sawing

The present invention contemplates the use of a plurality of circular saws mounted for rotation in the same plane and making co-planar cuts to different depths in the log or cant in order that lumber and chips of the desired characteristics and useful for pulp or other purposes may be produced in the same operation. As a result of such plural arrangement the load on each saw is substantially less than where a single saw is required to cut entirely through a log or cant. Hence, the width of kerf may be reduced in order to produce a higher proportion of merchantable lumber.

In the head sawing of pine in the Southeastern United States it has been the practice to use a saw which produces a kerf about 5/16 of an inch wide, the sawdust produced being waste. When producing kerf chips with approximately a quarter-inch bite the kerf has usually been about ⅜ of an inch wide. In accordance with my present invention, it is possible to substantially reduce

the width of the kerf and at the same time produce chips having appropriate characteristics of length and thickness.

Other advantageous results accompany the present invention. For example, since a relatively narrow kerf is cut and the depth of cut is small, it is possible to produce lumber that is more accurately machined and has a smoother face than that resulting from ordinary practice. Hence, the wear on planing knives and the loss from planing are reduced.

A further advantage is that the operation may be performed at a desirably high rate of speed and with relatively unskilled labor. In contrast, in using a sash gang or a band saw skilled operators are required, the first cost is high, the sawdust is too fine for use in pulping, and in a sash gang the rate of operation is relatively slow, having a maximum feed of about 40 feet per minute. In sawing in accordance with the present invention, however, the feed rate may be increased to any desired speed provided the required feed ratio is maintained.

Furthermore, through the use of one or a plurality of saws of appropriate diameter and thickness operating at appropriate longitudinal advance between successive tooth bites and with appropriate depth of cut and adequate gullet capacity the nature and size of chips may be controlled in order to produce chips for selected purposes and at the same time increase the proportion of lumber produced over that produced conventionally by circular sawing.

The arrangement and operation described results in the cutting action of the teeth being substantially along the grain of the wood instead of substantially transverse thereto as with previous practice. Since the chip is cut substantially lengthwise of the grain, its length may be substantially in excess of the length of the calculated bite. By the use of my present invention it is possible to produce a superior chip adapted to specific requirements.

In experimental runs I have produced chips with a kerf of ⅛ to ⅜ of an inch, the calculated bite varying from ⅛" to 1" and the chips varying from one-quarter inch to in excess of two inches in length.

Due to the increased length of the chips, fibers are maintained more intact than when relatively small chips are produced, and the proportion of fines produced is reduced so that it does not exceed that which is acceptable in ordinary pulping practice. Hence, it should not be necessary to remove as many fines by screening and most of the entire chip by-product should be usable.

The production of such chips with saws which have adequate gullet capacity reduces the mechanical stresses on the fibers, resulting in a larger proportion of relatively long fibers, thereby affording increased strength. Furthermore, the chips may be more uniformly sized to suit the pulping or other operation with respect to both length, breadth and thickness and are, therefore, more acceptable to processors than chips produced heretofore. Such chips may also be used for other purposes, including the manufacture of fiberboard, flakeboard and the like.

In my experiments I have been concerned chiefly with producing lumber with reduced kerf and chips which would apparently be suitable for pulping, although chips for other purposes may be produced.

In my experiments the kerf width varied from one eighth to three-eights of an inch. If desired, the kerf might be larger, although the lower yield of lumber would be undesirable under present economic conditions.

The tests indicate the feasibility of producing lumber with the by-product of the new chips, and with a substantial saving in kerf thus providing an increase in lumber yield. Although the tests were conducted only down to a one-eighth inch kerf, it is believed that the kerf could be reduced to about a sixteenth of an inch if a further saving in lumber or a chip of less breadth were desired.

In the experiments the depth of cut was varied from one-half inch up to four and one-quarter inches, using saws varying in diameter from 8½ inches to 24 inches. The importance of the depth of cut will be appreciated when its relationship to the length of chip is understood. Bearing in mind that it is desired to cut as nearly as possible lengthwise of the grain as opposed to transversely, it will be understood that a larger diameter saw cuts a longer chip than a smaller diameter saw when operating at the same depth of cut. Where a deep cut is taken with a small diameter saw it will be found that at the forward end of the chip a substantial quantity of the fragmental portions run transversely. Hence, the average chip length of all the fragmental portions is smaller than that of a chip having a smaller quantity of such fragmental portions. By using a larger diameter saw the cut of a tooth is more nearly tangential to the length of grain, and hence the amount of transverse fragmentation at the forward end of the chip is reduced and the effective length of the chip or its fragmental portions is increased.

Since the utility of a saw blade for producing elongated chips is related to its diameter and the depth of cut, I have attempted to discover the relationship at which elongated chips may be satisfactorily produced. Such elongated chips may be produced with a saw of relatively small diameter where the depth of cut is shallow. Such chips may be extremely thin and may have utility in certain fields although it is doubtful that they are desired for the production of pulp. Hence, it is believed that chips having greater thickness, that is, produced at greater depth of cut, are preferred.

It should be remembered that the size of the gullet in all cases must be adequate to receive the chips with little or no compaction, as such compaction and the attendant friction tend to break up the chips and their fibers. Reference has already been made to the desirability of producing an elongated chip, that is, a chip without excessive substantial fragmentation portion at its end. Such fragmentation portions not only reduced the average effective chip length but also contain a substantial quantity of fines, which may be undesirable.

My experiments have indicated that elongated chips which do not possess an excessive amount of fines or fragmentation portions may be produced with a depth of cut ranging from approximately 5% to 20% of the saw's diameter. Where fragmentation and fines of larger amounts are permitted, the depth of cut may run higher.

The length of bite is important in producing chips of selected size and type. The bite is the longitudinal advance between successive tooth bites longitudinally of the grain. The bite is calculated by dividing the longitudinal feed rate by the number of tooth cuts per unit of feed.

In conventional sawing the bite is usually below one-eighth of an inch and fine sawdust is produced. In my copending application the importance of a bite of approximately one-quarter inch is described. However, in that application the chips are produced by saw teeth moving substantially transversely of the longitudinal direction of the grain, and hence the chip length is substantially the same as or slightly longer than the calculated bite.

In my recent experiments the calculated bite ranged between about .10" to 1.0". Since most of the cutting action of the teeth is more nearly longitudinally of the grain, as previously mentioned, the effective chip length of many chips produced was several times the calculated bite, thereby producing chips with longer fibers than would be expected from the calculated bite.

Furthermore, by making tooth cuts substantially longitudinally of the grain and with a relatively shallow depth of cut accurate sawing of lumber may be achieved at calculated bites substantially in excess of those possible in sawing in which the saw cuts entirely through the log or cant. This apparently results from the fact that the tooth is under load for a smaller portion of its travel and that cutting substantially longitudinally is easier than cutting more transversely of the grain.

By employing bites up to about one-half inch, in which a substantial part of the cutting is along the grain, chips may be produced having integral portions along the grain which are an inch or more in length and which are more desirable for pulping. From the results of my experiments I have found that chips may be satisfactorily produced with a calculated bite up to about two or three times the saw kerf width, even up to one inch, although at such length of bite the tearing effect may be undesirable.

From the foregoing, it is apparent that in my copending application to which reference has been made the described method includes the operation of a circular saw to obtain a longitudinal advance or bite of each tooth within specified limits, that application being concerned with sawing entirely through a log or cant in one operation. In accordance with my present invention, as indicated, it is necessary to consider not only the bite but also the diameter of the saw, the depth of cut and the width of kerf.

The width of kerf selected is based upon the economic situation, namely, the desired saving in kerf loss, and also upon the lateral dimension desired of the chip. It is anticipated that the kerf, in the ordinary case, will range between ⅛" and ⅜" and will be below 5/16" if a saving in lumber produced over ordinary sawing technique is desired. No difficulty has been experienced in practicing the present invention with a kerf of ⅛ inch, and this represents a very substantial economic gain, even if there were no market for by-products chips.

In producing chips in accordance with the present invention, the chip **10** is characteristically curved as indicated in FIGS. 7 and 8 and has a relatively flat main elongated portion **11** and a more curved portion **12**. The legnth of the chip **10** may in an average case run about 2 inches, of which the portion **11** may be approximately 50%–75%. The portion **11** on inspection appears to consist of a substantially whole or unitary part or parts **13** and the portion **12** of fragmental parts **14** which may be separated along cleavage planes or lines **15**. The number of fragmental parts **14** is increased in thicker chips or those produced with a relatively small diameter saw operating at relatively great depth. Chips in which the number of fragmental parts **14** is not so excessive as to causing breaking off or an excessive quantity of fines, are produced with saws in which the ratio of the diameter to the depth of cut exceeds approximately ten to one, a ratio of approximately fourteen to one being very satisfactory.

The length of the fragmental parts **14** along the cleavage lines **15** is slightly longer that the bite of the tooth. Hence, in order to avoid a substantial proportion of fragments that are too short, it is desirable that the bite be as great as the minimum length of acceptable chip particles, such length being approximately one quarter inch.

The chip illustrated in FIGS. 7 and 8 when produced with a saw having adequate gullet capacity tends to be delivered in the whole state, with little breaking up on cleavage lines and may be of a size which may be handled by pulping digesters.

Various arrangements of apparatus for practicing the invention may be employed, both for head sawing and edging. For example, the saws may be adjustable in height so that the depth of cut which is desired for a particular job may be employed. To increase sawing accuracy, a new collar or stiffening ring may be used which extends radially almost to the level of cutting. Such saw collar permits the use of a relatively narrow kerf without sacrifice in accuracy, even though operating with a bite up to approximately one-half inch.

Another means for adjusting the depth of cut is to employ a carriage or log or cant support which is adjustable vertically with respect to the saw. In a multiple saw head rig, where the logs pass between two or more saws on a conveyor chain, such chain may be arranged so that it can be raised and lowered vertically.

Since each saw preferably operates within certain limits so far as depth of cut is concerned, it is necesary to employ one or more saws to cut entirely through a log or cant of a dimension in excess of such depth of cut. This may be accomplished by (a) employing saws cutting from opposite sides of the log or cant, (b) two or more saws cutting from the same side, the second saw entering the groove cut by the first, or (c) a combination of these arrangements. Where two or more saws are used, these may be of the same or different diameters. If maximum uniformity in chips is desired, the saw should be of the same diameter and operate at the same depth of cut. On the other hand, if shorter chips mixed with longer chips are permissible, then the first saw or saws which cut from the outside of the log or cant may be of smaller diameter than the succeeding saw or saws.

It is recognized that the ability of a saw to withstand heavy sawing is dependent somewhat on the saw's stiffness. The stiffness, in turn, is dependent on the size of the saw, A small diameter saw which might be employed for making the initial cut would be stiffer than a larger diameter saw employed for making a subsequent cut in the same groove as the first saw. In some installations, especially where the logs or cants are of a substantial size, it may be necessary to employ saws cutting from opposite sides, such as over and under, in order to avoid the use of large saws having reduced stiffness or of increased thickness.

By the appropriate selection of the saw diameter, the depth of cut, the bite, and the width of kerf, chips having the desired size and of the desired type may be produced. Where the depth of cut proportionate to the saw diameter is larger than indicated the chip will have a greater portion with fragmental parts and a reduced relatively whole elongated portion. On the other hand, if the depth of cut is very thin, it may require the use of a large number of saws, which may be uneconomical, and the chips may not have enough body for use in the making of pulp. However, chips of this nature may be desired for other uses.

It is apparent that, the heavier the cut that a saw tooth makes, the stronger must be the tooth, other considerations being equal. Hence, if the sawmiller desires to produce chips of a given length and body thickness, it is understood that this requires a tooth which is thicker than in the case where a shorter or thinner chip is acceptable. However, by the present invention elongated chips satisfactory for pulping and other uses may be produced and at the same time the width of kerf substantially reduced from that employed in conventional circular sawing.

An example of one form of apparatus by which the invention may be practiced is illustrated in FIGS. 1 and 2, showing a gang edger. The edger includes a supporting framework **20**, on which a plurality of lower groups of saws **21**, **22**, **23** and **24** are mounted, upper saws **25**, **26**, **27** and **28** being mounted to cut from the other side of the board in the same planes. A bank or gang of five saws operating side by side is illustrated, although any desired number may be used.

Mounted adjacent to the saws is a board supporting and feeding mechanism. This mechanism includes spaced rails **30** in which a plurality of knurled feed rolls **31** are journaled and driven from a belt **32**, the rolls being interconnected by gearing or belting so that they rotate together. The supporting rails **30** are mounted on the inclined arms **34**, **35** of an elevating mechanism, the lower portions of the arms having elongated slots **38** receiving pins **40** whose horizontal position is controlled by internally threaded pin blocks which are adjustable in accordance with the revolving of a screw **42** driven by motor **43**. The ends of the arms **34**, **35** are supported on rollers **45** mounted in slideways **48**. Vertical guideways **50** extend upwardly forming corner posts for the elevating mechanism and receive rollers **51** mounted on brackets **52** attached to the ends of the rails **30**, thereby guiding the vertical motion of the rails and supporting elevating mechanism.

Upper spaced rails **52** are adjustably mounted by bolts **49** which are slidable in slots **53** in uprights **54** mounted at the ends of the rails **30**. Rotatably mounted between the rails **52'** are a plurality of hold-down rollers **55**, the shafts **56** of which are urged downwardly by springs **57** mounted in housings **58**.

Beneath the saws **21–28** is a conveyor belt **60** by means of which the chips may be carried away to a suitable collecting apparatus. In the operation of the apparatus the saws **21** and **25** make the initial cuts, following which the saws **22**, **26**, **23**, **27** and **24**, **28** make successive cuts, each extending more deeply into the wood.

Using saws of varying diameter, as indicated in the drawings, the chips produced from the leading saws, that is, those of smaller diameter, are generally shorter along the grain than those cut by the succeeding saws of larger diameter, assuming that all saws cut at the same depth. In order to have the saws cut chips of similar size and characteristics, all the saws should be of the same diameter.

The foregoing is merely an illustration of one type of apparatus for practicing the invention. As has been stated, the invention may be practiced by other apparatus including one or more saws of the same or different diameters and whether such saws are operated as head saws, edgers, re-sawers or otherwise.

The invention has been described as contemplating the production of substantially elongated chips useful for certain purposes and with an accompanying increase in lumber by reducing the width of kerf. However, the production of generally longer chips as a by-product of sawing may be practiced with a wider kerf than is employed in conventional sawing, although such practice would appear to be uneconomical; alternatively, through the use of a large number of saws, an extremely shallow cut may be taken, thus producing a very thin chip, which is not believed desirable for pulping as presently practiced.

Accordingly, it will be apparent that the present invention contemplates the use of one or more circular saws operating at a selected depth of cut proportionate to the diameter of the saw or saws and with the feed of material thereto within selected limits, such saws having a tooth capacity adequate to receive the chip without substantial crowding and, if desired, a thickness less than that employed in conventional sawing, and whereby an elongated chip suitable for many purposes may be produced as a by-product of the sawing of lumber, with increased lumber yield over conventional practice.

It will be obvious to those skilled in the art that various changes may be made in the described embodiment and practice of the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is illustrated in the drawings and described in the specification, but only as indicated in the accompanying claims.

What is claimed is:

1. The method of sawing logs into usable boards and during the sawing operation forming chips of sufficient length along the longitudinal grain to be useful for making wood pulp, comprising providing teeth on a saw blade in spaced relation along the cutting periphery of the saw blade so that the teeth cut in succession, causing said saw blade to move at a selected peripheral speed and simultaneously with the operation of the saw at the selected peripheral speed feeding the log to the saw in a direction

in the plane of the saw at such a rate of feed with relation to the peripheral speed of the cutting teeth of the saw blade as to permit each tooth to make a cut along the longitudinal grain of the log so that the next succeeding tooth makes a further cut of approximately one-eighth to one inch spaced along the longitudinal grain, positioning said saw blade to cut at a depth of approximately one fifth to one twentieth of its diameter, and using the number of saws required to complete the cut, each saw successively increasing the total depth of cut, thereby producing usable chips in which the length of the major portion in the direction of the grain exceeds the longitudinal advance between succeeding teeth.

2. The method of operating a circular sawmill, comprising mounting a plurality of saws in the same plane, providing material supports for moving logs and cants longitudinally with respect to the saws, arranging the saws with respect to the supports so that the saws cut in the same plane substantially the same depth of material, each saw successively increasing the total depth of the cut, said depth being in the range of approximately one-fifth to one twentieth of the diameter of the respective saws, and advancing the material along the saws at a rate whereby the bite of each tooth is substantially in the range of one eighth to one inch.

3. The method of claim 2 and providing a gullet for each tooth sufficiently large to accommodate the material cut, without substantial compaction.

4. Sawmill apparatus for sawing lumber from logs and cants and for producing as a by-product chips of generally predetermined length, comprising a plurality of saws mounted to cut in the same plane, a log support mounted to feed logs longitudinally into and past said saws and at a predetermined rate of speed, said support being so positioned with respect to said saws that the first saw cuts only partially into said log and the succeeding saws cut the remainder of the kerf through the log, the first saw being so mounted with respect to said log support as to cut into said log at a depth of approximately one fifth to one twentieth of the saw diameter, the succeeding saws being mounted with respect to said log support so as to enter the kerf groove produced by the first saw and make a further cut of a depth of approximately one fifth to one twentieth of the diameter of the respective succeeding saw, the last of said succeeding saws completing the cut through the log and at a cutting depth not to exceed approximately one fifth of its diameter, the log support feeding the log at such a rate with relation to the peripheral speed of the cutting teeth of the saw blade as to permit each tooth to make a cut along the longitudinal grain of the log approximately one eighth to one inch in advance of the cut made by the immediately preceding tooth, thereby producing lumber and by-product chips in which the length of the major portion in the direction of the grain exceeds the longitudinal advance between succeeding teeth.

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