United States Patent [19]

Chapman

[11] **3,780,778**

[45] **Dec. 25, 1973**

[54] **SAWING AND CHIPPING MACHINE**

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[22] Filed: **Mar. 27, 1972**

[21] Appl. No.: **238,115**

[30] **Foreign Application Priority Data**

Aug. 14, 1971 Great Britain 38,232/71

[52] **U.S. Cl.** .... **144/39,** 144/223, 144/176, 144/162 R

[51] **Int. Cl.** **B27c 1/08,** B27l 11/02

[58] **Field of Search** .... 144/39, 162 R, 176, 144/223, 3 P, 3 R; 241/293; 83/848

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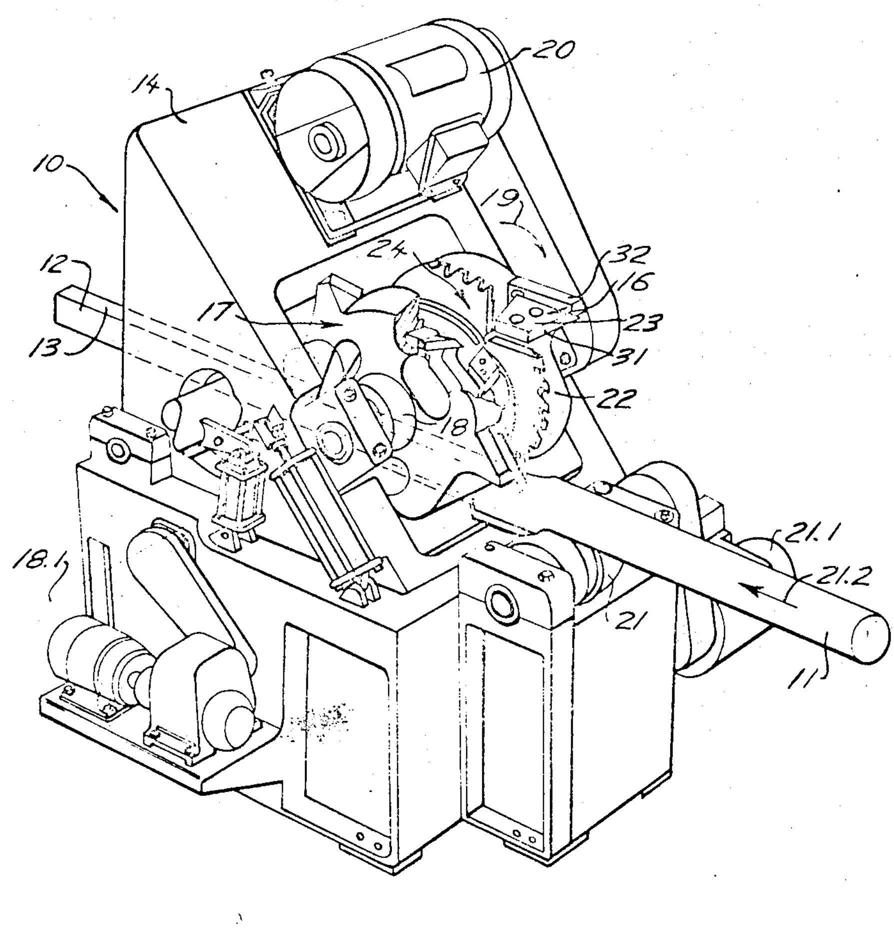
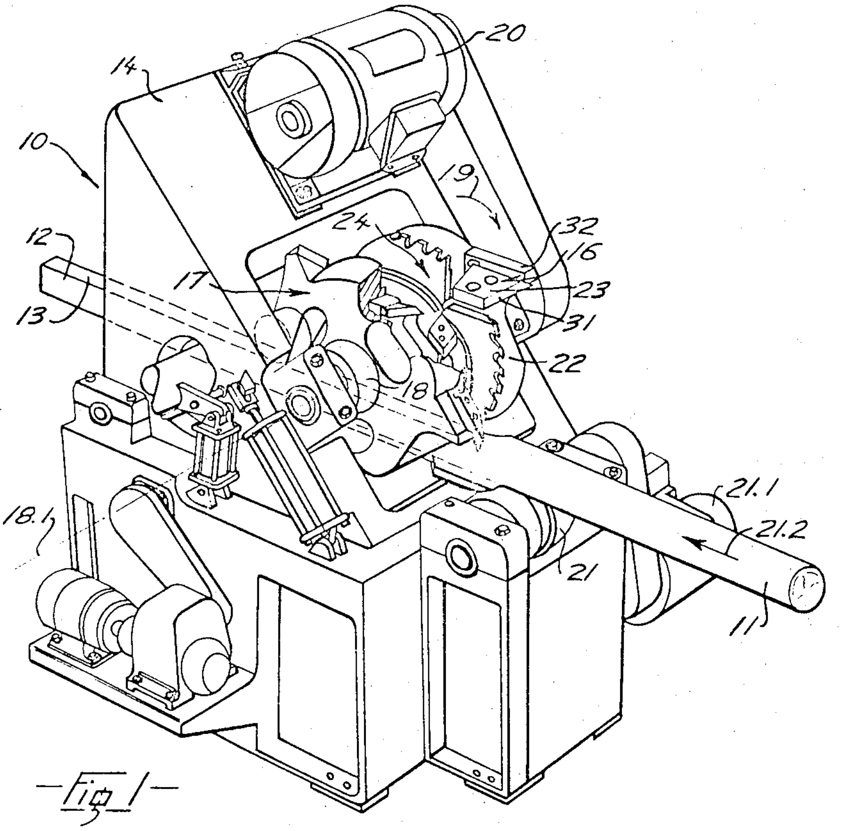
[57] **ABSTRACT**

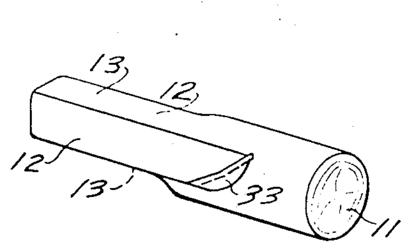
A sawing and chipping machine for providing a sawn face on a log having a rotable head on which a circular saw and chipping knives are mounted for sawing a slab from a moving log and at the same time reducing the slab to chips suitable for pulping.

7 Claims, 10 Drawing Figures

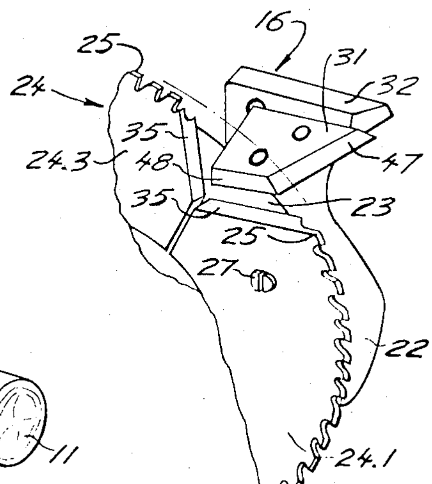




-Fig 1-



-Fig. 2-A-



-Fig. 2-

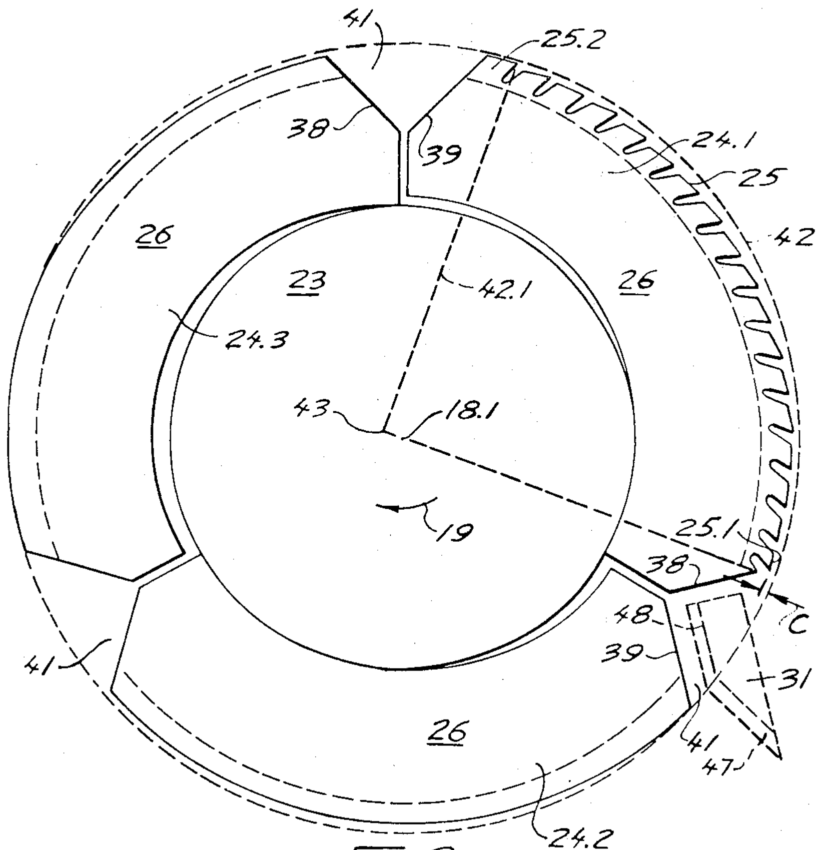


Fig. 3

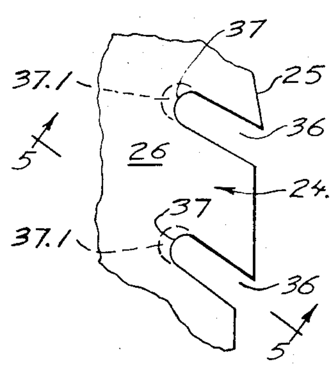


Fig. 4

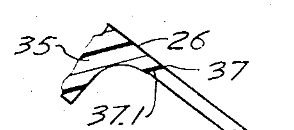


Fig. 5

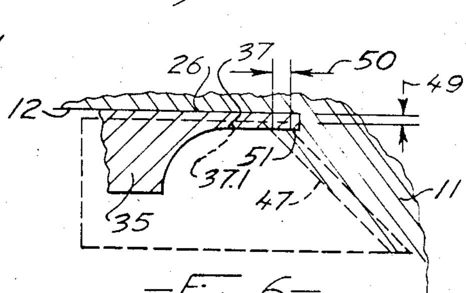
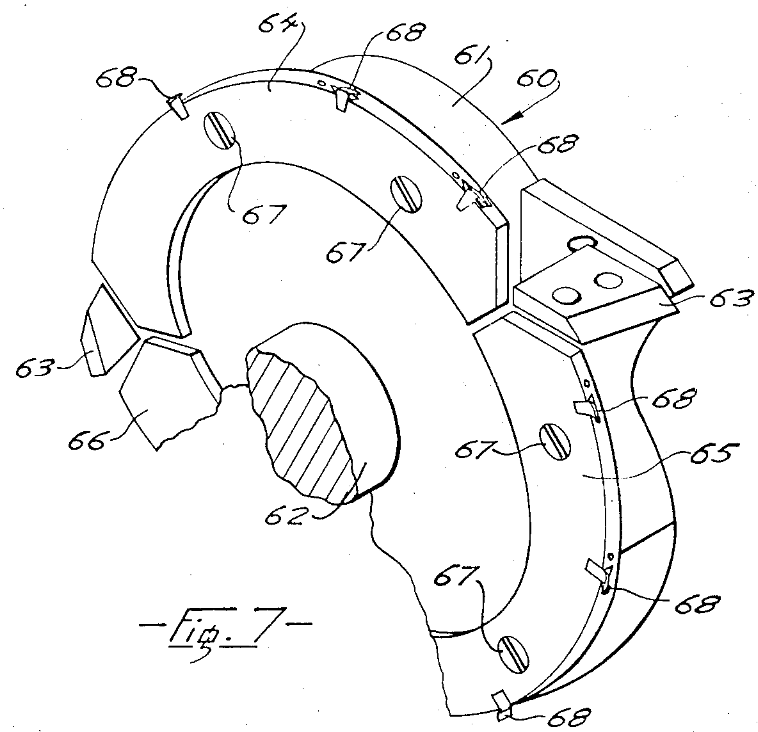
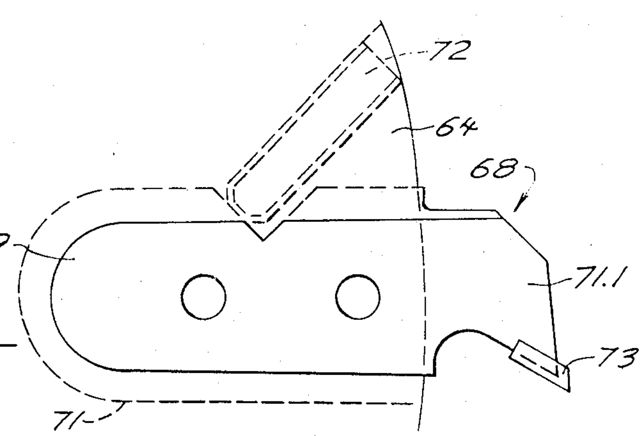


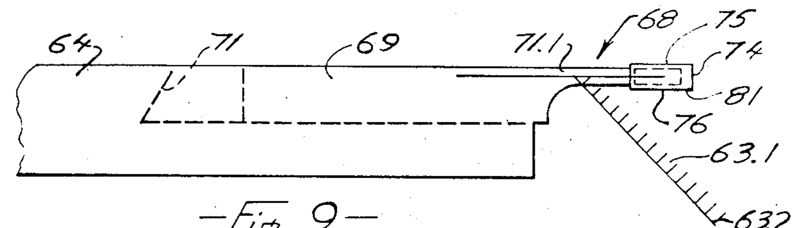
Fig. 6



-Fig. 7-



-Fig. 8-



-Fig. 9-

SAWING AND CHIPPING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to machines for sawing and chipping logs and in particular to chipping and sawing head assemblies for such machines.

2. Prior Art

In production of lumber from logs it is common practice to chip, rather than to saw, the log to a dimension suitable for further reduction to dimensioned lumber. Chips can, advantageously, be used in pulping operations and kerf loss, normally associated with a sawing operation, is eliminated in chipping.

In some applications, however, it is necessary to provide a sawn rather than a chipped face. Although machines have been developed which automatically saw slabs from the log and then convert the slabs to chips, kerf loss is still a problem in these machines.

SUMMARY OF THE INVENTION

The present invention provides a sawing and chipping machine in which kerf loss is materially less than in prior art machines known to the present inventor.

A machine according to the invention includes a combined sawing and chipping head assembly which commences sawing of a slab from a log to provide a flat sawn face and, at the same time, reduces the slab being cut to wood chips suitable for use in pulping.

In one embodiment of the present invention the head assembly includes a head rotatable about an axis perpendicular to the log, the head having a circular saw mounted thereon. The saw is segmented having individual, circumferentially extending, segments which are spaced apart to provide gaps for chipping knives which project between adjacent spaced saw segments. As the saw cuts the log to produce a sawn face, the chipping knives progressively reduce to chips the slab being cut.

Radius of each saw tooth of each segment is greater than that of a preceeding tooth by a distance such that extra load which, otherwise, would be applied to a tooth following a gap, is distributed essentially uniformly to each tooth of the segment. That is to say, the saw segments are eccentric with respect to the axis of rotation of the head.

In another embodiment of the machine the saw rather than having conventional saw teeth has chipping teeth which chip a kerf and which are dimensioned and spaced so that wood chips meet minimum dimension standards for pulping chips.

A detailed description following, related to drawings, gives exemplification of a machine according to the invention which, however, is capable of expression in means other than those particularly described and illustrated.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective of one embodiment of a sawing and chipping machine according to the invention,

FIG. 2 is an enlarged fragmented isometric projection of a portion of a head assembly,

FIG. 2A is a perspective of a portion of a log showing detail of cut,

FIG. 3 is an elevation of a head assembly showing relative positions of saw segments and chipping knives,

FIG. 4 is a fragmented partly sectioned detail showing a portion of a saw segment,

FIG. 5 is a section on 5—5 of FIG. 4,

FIG. 6 is a fragmented detail section of a saw segment, and a chipping knife shown in broken outline, illustrating relationship of cuts taken during operation,

FIG. 7 is a perspective view showing partially, an alternate form of a head assembly,

FIG. 8 is an enlarged side view of a chipping tooth of the head assembly of FIG. 7,

FIG. 9 is a section on 9—9 of FIG. 8 showing the relationship of cuts taken by the chipping tooth and a chipping knife.

DETAILED DESCRIPTION

FIGS. 1 and 3

FIG. **1** shows one embodiment of a sawing and chipping machine, generally **10**, sawing and chipping a log **11** to provide a timber having opposite sawn side surfaces **12—12** and upper and lower chipped surfaces **13—13.** The machine has a frame **14**, and a pair of axially aligned chipping head assemblies **16** and **17** which are spaced as shown on a common horizontal drive shaft **18**, having a rotational axis **18.1**, the drive shaft being driven in a direction, arrow **19**, by an electric motor **20**.

Feed rollers **21**, driven by an electric motor **21.1**, feed the log between the head assemblies in a direction, arrow **21.2**, at right angles to the axis **18.1** of the drive shaft **18**.

The head assembly **16** has a head **22** having a face **23** confronting the log. A segmented circular saw **24** having three saw segments **24.1, 24.2, 24.3** see FIG. 3, is mounted on the face **23** of the head, the saw segments having teeth, severally **25**, which project outwards of a periphery of the head and have inner faces, severally **26**, which lie in a common plane confronting the log **11**. Machine screws **27**, see FIG. **2**, which secure the saw segments to the head are counter sunk so that heads of the screws are inwards of the faces **26** of the segments.

FIGS. 2 and 2A

Chipping knives, severally **31** are bolted to projections **32** on the chipping head, a chipping knife being located between adjacent pairs of saw segments and being sited relative to the saw segments, as hereafter to be described, so that, see FIG. **2** they progressively chip away a slab being cut from the log by the saw as the log is fed through the machine providing a chipped end face **33** on the slab.

FIGS. **2, 3, 4,** and **5**

The saw segments **24.1, 24.2, 24.3**, see FIG. **3**, are the same, consequently only saw segment **24.1** is fully illustrated and described.

The saw segment **24.1**, see FIGS. **2, 4,** and **5**, has a thick inner portion **35** (FIG. **1**) from which the teeth **25** project. Ratio of thickness of saw tooth and inner portion **35** is not fixed. Optimum thickness ratio is dependent on saw tooth length. The saw teeth are spaced apart conventionally to provide gullets **36** which have rounded bottoms **37**, see FIG. **4**, bevelled away from the face **26** as seen at **37.1**.

FIG. 3

FIG. **3** shows, diagrammatically, disposition of the saw segments **24.1, 24.2,** and **24.3** on the head **16**.

As illustrated, leading and following ends **38** and **39** of the segment **24.1** are cut back as are the leading and following ends of the other segments, to provide gaps, severally **41**, to accommodate the knives, two knives only being shown. The gaps, as illustrated, are about five saw teeth in extent.

The segment **24.1** is a segment of a circular saw, tooth tips of which describe a circle **42** having a radius **42.1** and a center **43.**

It is seen that if the segments were to be positioned with the center **43** on the axis **18.1** of the head, the circle **42** described by the teeth tips would be concentric about the axis **18.1.** Consequently, the lead tooth of the segment would be overloaded to an extent equal to the cut which would be normally taken by saw teeth missing by reason of the gap preceeding the lead tooth. The lead tooth of the segment would, consequently, wear faster than the teeth following.

To obtain essentially uniform loading of each tooth in the segment the segment is located so that the center **43** is eccentric to the axis **18.1** of the head, with the trailing tooth **25.2** of the segment lying on the circle **42** and with the lead tooth **25.1** of the segment radially inset from the circle **42** a distance c such that

$$a/b = c/d$$

where:

a is distance between the trailing tooth of one segment and the lead tooth of a following segment,

b is distance between tips of adjacent teeth,

c is radial inset of the lead tooth of each segment from the circle **42,**

d is normal tooth bite of a circular saw having radius and tooth spacing equal to radius and tooth spacing of the segment.

Thus the extra load on each segment is distributed essentially uniformly to each tooth of the segment, and the saw teeth tend to wear uniformly.

FIGS. **2** and **6**

As seen in FIG. **2** in which one chipping knife is shown, the knife is trapezoidal having a bevelled cutting edge **47** which slopes inwards to flat inner end face **48.** The knife is mounted so that the face **48** lies in a plane parallel to the face **26** of the segment and, see FIG. **6,** extends into the kerf cut by the saw teeth but terminates short of the inner face **26** of the segment so as to provide a clearance **49** with the sawn surface **12** of the log.

As the head rotates depth of kerf is at a maximum following the trailing tooth of each segment and is at a minimum after the chipping knife following makes its cut. Difference **50,** see FIG. **6,** between maximum and minimum depths of kerf is a function of relationship of rate of feed of the log and rotational speed of the head, for a head having a given number of knives. This relationship, which also governs segment off-set to obtain uniform loading of the saw teeth of each segment, is such as to provide chips of required thickness for pulping, so that the difference **50** between maximum and minimum kerf depth is not greater than desired chip thickness.

The radial length of the trailing tooth of each segment is greater than the radial length of the chipping knife following so that cuts taken by the chipping knives are clear of the kerf bottom, leaving a lip **51.** Thus as the kerf bottom always precedes the cuts taken by the knives, a sawn surface is always provided on the log.

Tooth configuration of the saw segments is such that gullet length is always greater than maximum kerf depth so that the gullet bottoms are always open - i.e. clear of the slab.

The head assembly **17** is the same as the head assembly **16** consequently further description of the assembly **17** is deemed unnecessary. Further, as described previously, although the upper and lower surfaces **13** are chipped - rotatable chippers, not shown, being incorporated in the machine immediately following the heads **16** and **17** - it is to be understood that if four sawn sides are required head assemblies corresponding to head assemblies **16** and **17** and rotatable about an axis at right angles to the axis of the drive shaft **18** can be incorporated in the machine either to follow or to precede the head assemblies **16** and **17.**

OPERATION

When the log is fed between the head assemblies the saws produce the sawn surfaces **12—12,** see FIGS. **2A,** while the chipping knives chip away a slab being cut. As bottoms of the gullets are always open, sawdust produced by the teeth, as they progressively cut, is moved inward into the gullet and discharged laterally outwards by the bevelled gullet bottoms. Gullet length can therefore be considerably less than gullet length of conventional circular saws as sawdust storage space, normally provided by the gullets of conventional saws, is not necessary.

In all circular saws blade thickness must be less than kerf width so as to obtain clearance between the sides of the saw and walls of the kerf. In large diameter conventional circular saws saw blade thickness, in order to obtain sufficient rigidity, results in material loss of wood due to kerf.

In the machine **10** blade rigidity is obtained mainly by reason of the thick inner portion, and also due to the fact that the segments are fixed to the head. Tooth length of the saw segments can be materially less than tooth length of conventional circular saws for adequate tooth rigidity, hence thickness of the teeth can be materially less than blade thickness of conventional saws, thus materially reducing width of kerf and kerf loss.

FIGS. **7, 8** and **9**

FIGS. **7, 8,** and **9** show an alternate form of chipping head assembly, generally **60,** which can replace either or both of the chipping head assemblies **16** and **17.**

As seen in FIG. **7** the head assembly **60** has a head **61** mounted on a drive shaft **62** and having chipping knives, severally **63,** which are equidistantly spaced apart as described with reference to the chipping knives of embodiment **10.** Curved segments **64, 65,** and **66** which are similar to, and have the same thickness as, the saw segments of the head assembly **16** of the machine **10** are fastened to the head **61** by countersunk machine screws, severally **67.**

The segments **64, 65,** and **66,** unlike the saw segments **24.1, 24.2,** and **24.3** of the machine **10** do not have saw teeth, but have radially extending, equidistantly spaced chipping teeth, severally **68.** Typically, three chipping teeth, having the same cutting radius, are mounted on each segment.

FIGS. **8** and **9**

FIGS. **8** and **9** show one of the chipping teeth **68** on the segment **64.** The chipping tooth **68** has a thick shank portion **69** of trapezoidal cross-section which has a snug fit in a re-entrant angled recess **71,** in the segment **64,** and which is held in place by a set screw **72.** A thin shank portion **71.1** extends radially outwards beyond the periphery of the segment **64** and carries a chisel shaped insert **73**, suitably tungsten carbide, which has a transverse cutting edge **74** and parallel side cutting edges **75** and **76** - the edges **75** and **76** extending clear of side surfaces of the portion **71.1** of the shank. Shape of the insert results in production of chips rather than sawdust and a kerf having walls resembling those produced by a conventional circular saw.

Relationship of the chipping teeth and the chipping knives of head assembly **60** is the same as the relationship of the saw teeth and the chipping knives of head assembly **16** and **17** so that the cut, line **63.1** FIG. **9** taken by a chipping knife is clear of the kerf bottom cut by a chipping tooth immediately preceding a knife so as to leave a lip **81**. The cut face of the slab immediately prior to a chipping knife cut is shown by the line **63.2** - distance between lines **63.1** and **63.2** being maximum chip thickness.

Chipping tooth width and number of chipping teeth per chipping knife is determined in accordance with minimum and maximum permissible dimensional standards for wood chips used in pulping. Typically wood chips are screened to separate undersized and oversized chips from acceptable - commonly, chips passing a screen having one and one-quarter inch openings and retained on a screen having three-eighths inch openings are considered acceptable for pulping. Consequently, chipping inserts having a width of, or slightly in excess of, three-eights inch result in the production of chips of acceptable width. Similarly, with the rotational speed of the head and feed rate of the log adjusted so that the chipping knives produce chips having a maximum length of one and one-quarter inches, ratio of three chipping teeth per chipping knife result in production of chips, by the chipping teeth, which meet minimum standard of length. Chipping tooth width and ratio of chipping teeth per chipping knife can, of course, be varied to suit varied dimensional standards.

The chipping head assembly **60** obtains substantialy maximum wood utilization as production of sawdust is, in effect, eliminated. Further, cutting action of the chipping teeth inserts results in provision of a flat planar side surface on a log which closely resembles a surface produced by a conventional circular saw rather than a surface provided by a conventional chipping knife.

I claim:

1. A sawing and chipping machine including:

a. means for feeding a log lengthwise through the machine,

b. a driven head member rotatable about an axis perpendicular to the log, the head member having an inner face,

c. a circular saw mounted on the inner face of the head member having teeth projecting outward of a periphery of the head for cutting a slab from the log as the log is fed through the machine,

d. chipping knives mounted on the head member for progressively reducing the slab to chips as it is being cut from the log by the saw, the chipping knives being disposed so that their cutting edges project into the kerf cut by the saw and terminate short of the saw face confronting the log and extend outwards beyond the periphery of the head member so as to provide a chipped end face on the slab clear of the periphery of the member.

2. A sawing and chipping machine as claimed in claim **1** in which the radius of each chipping knife is less than the radius of a saw tooth immediately preceding a distance such that a kerf bottom cut by the saw teeth precedes the chipped end face of the slab.

3. A sawing and chipping machine as claimed in claim **1** in which the saw has a tooth gap at each chipping knife greater in extent than one saw tooth and radius of the saw teeth increases uniformly and incrementally from the tooth immediately following a chipping knife to the tooth immediately preceding the next chipping knife so that extra cutting load occasioned by the tooth gap is distributed equally to each tooth.

4. A sawing and chipping machine as claimed in claim **1** in which the circular saw is segmented, having a segment extending between adjacent chipping knives, each segment being circumferentially spaced from an adjacent segment so as to present a tooth gap greater in extent than one tooth, each segment having a center of curvature offset eccentrically from the axis of rotation of the head a distance such that radius of the saw teeth of each segment increases incrementally from the lead tooth to the trailing tooth so that extra cutting load occasioned by the tooth gap is distributed equally to the teeth of each segment.

5. A sawing and chipping machine as claimed in claim **1** in which each saw tooth is chisel shaped having a transverse cutting edge and parallel side cutting edges for reducing kerf wood to chips.

6. A sawing and chipping machine as claimed in claim **1** in which the saw has a gullet between adjacent teeth, each gullet having a length in excess of maximum kerf depth so that the gullet bottoms open clear of the chipped end face of the slab, the gullet bottoms being outwardly bevelled so that wood cut by the saw is directed laterally outwards from the sawn surface of the log.

7. A sawing and chipping machine as claimed in claim **1** in which the saw has a substantially thick radial inner portion from which the saw teeth, thinner than said inner portion, radially project, the saw teeth and radial inner portion having inner log confronting faces extending in a common plane.

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