

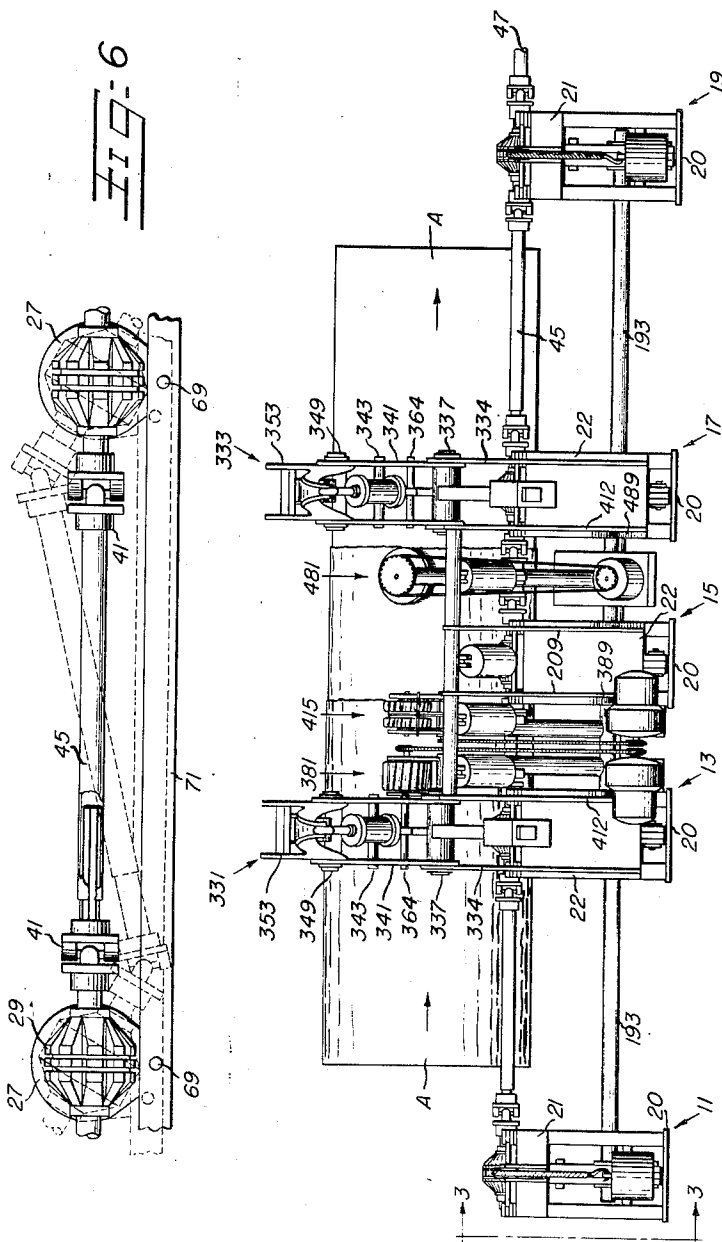
Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 1



INVENTOR.

JOHN L. GYLLENBERG

BY

Buckhorst and Cheatham  
ATTORNEYS

Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 2

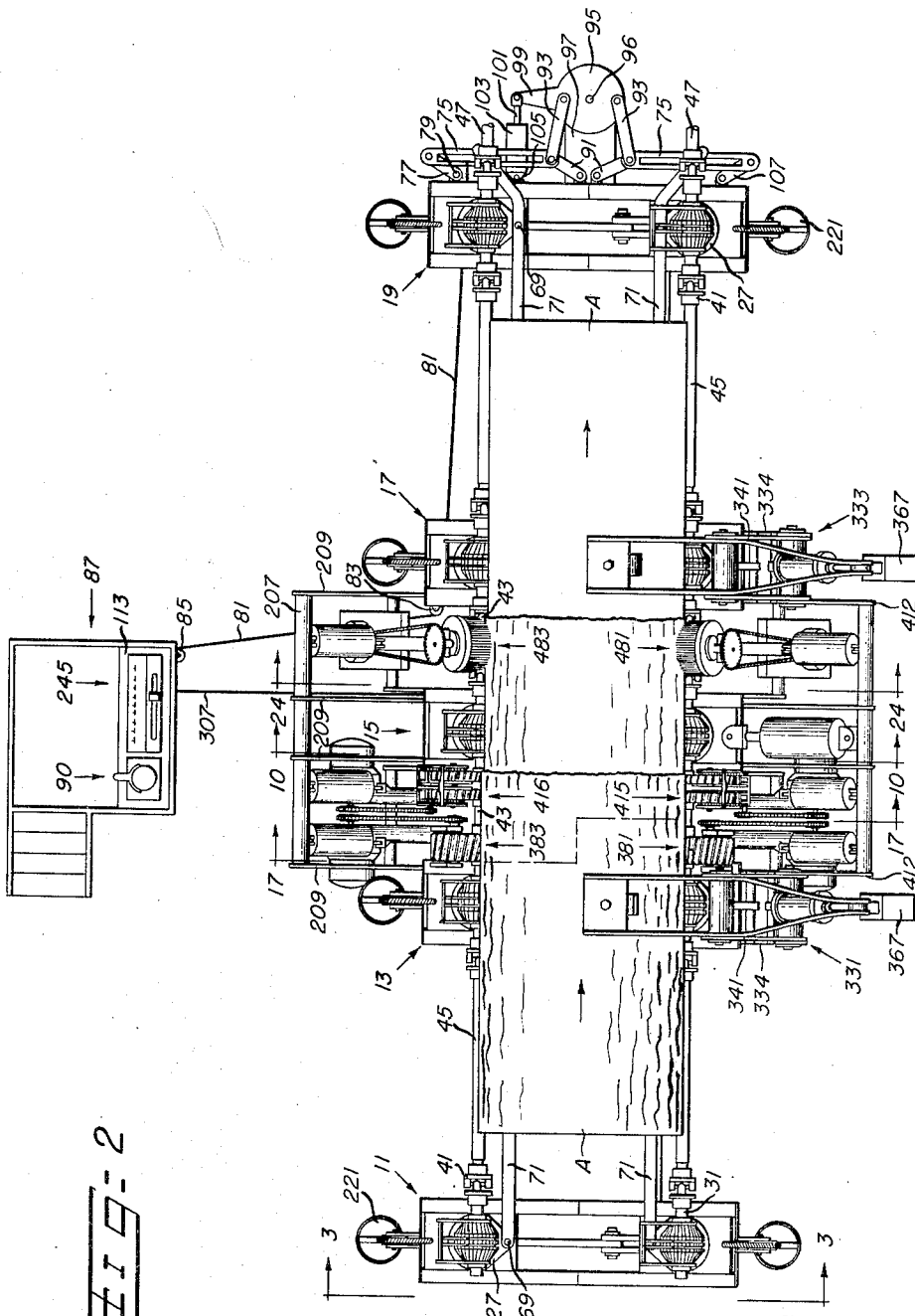


FIG. 2

INVENTOR.  
JOHN L. GYLLENBERG  
BY  
Buckhorn and Cheatham  
ATTORNEYS

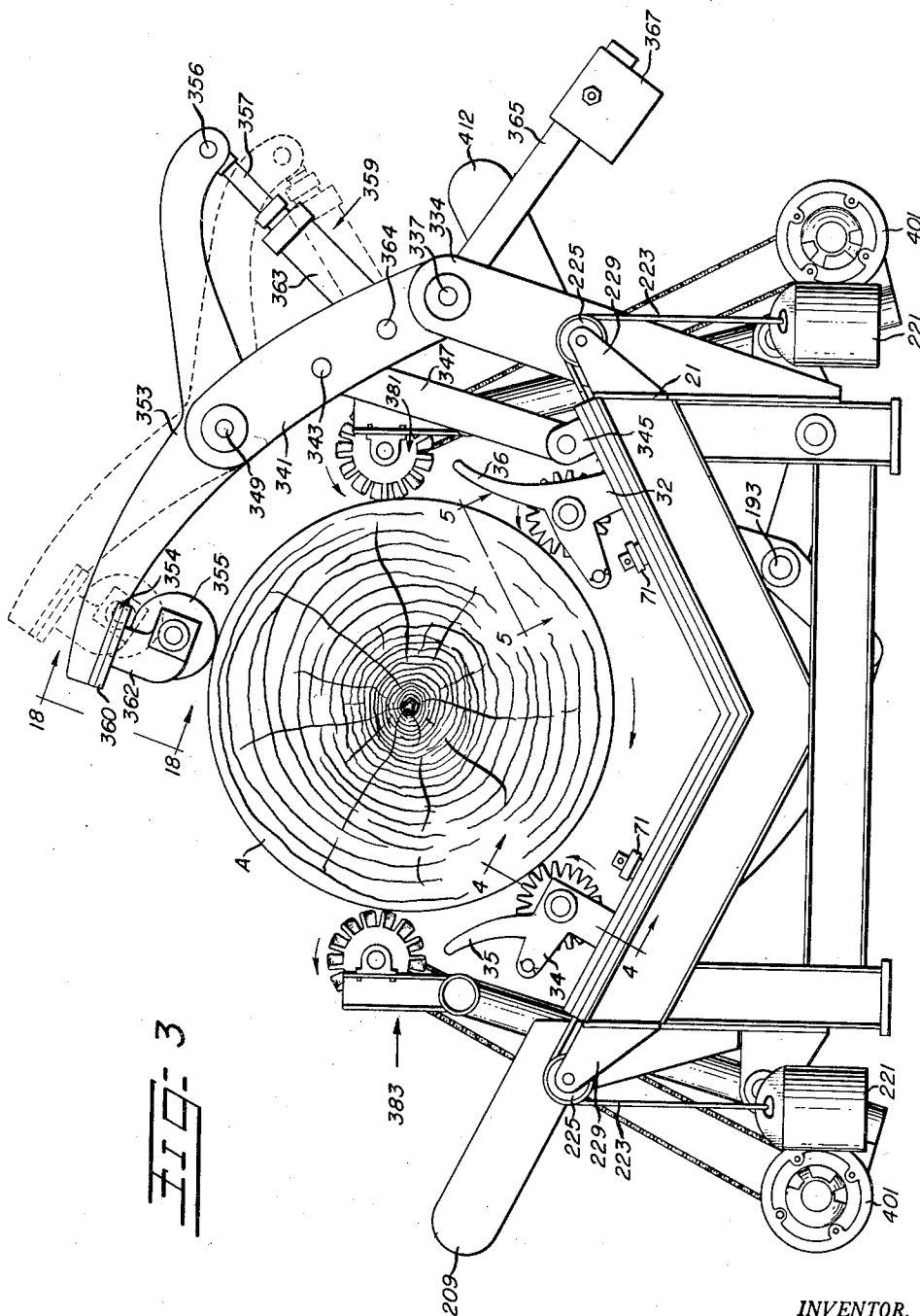
**Feb. 5, 1957**

**J. L. GYLLENBERG**  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

**2,780,252**

Filed Oct. 16, 1953

11 Sheets-Sheet 3



INVENTOR.  
JOHN L. GYLLENBERG  
BY *Buckhorn and Cheatham*  
ATTORNEYS

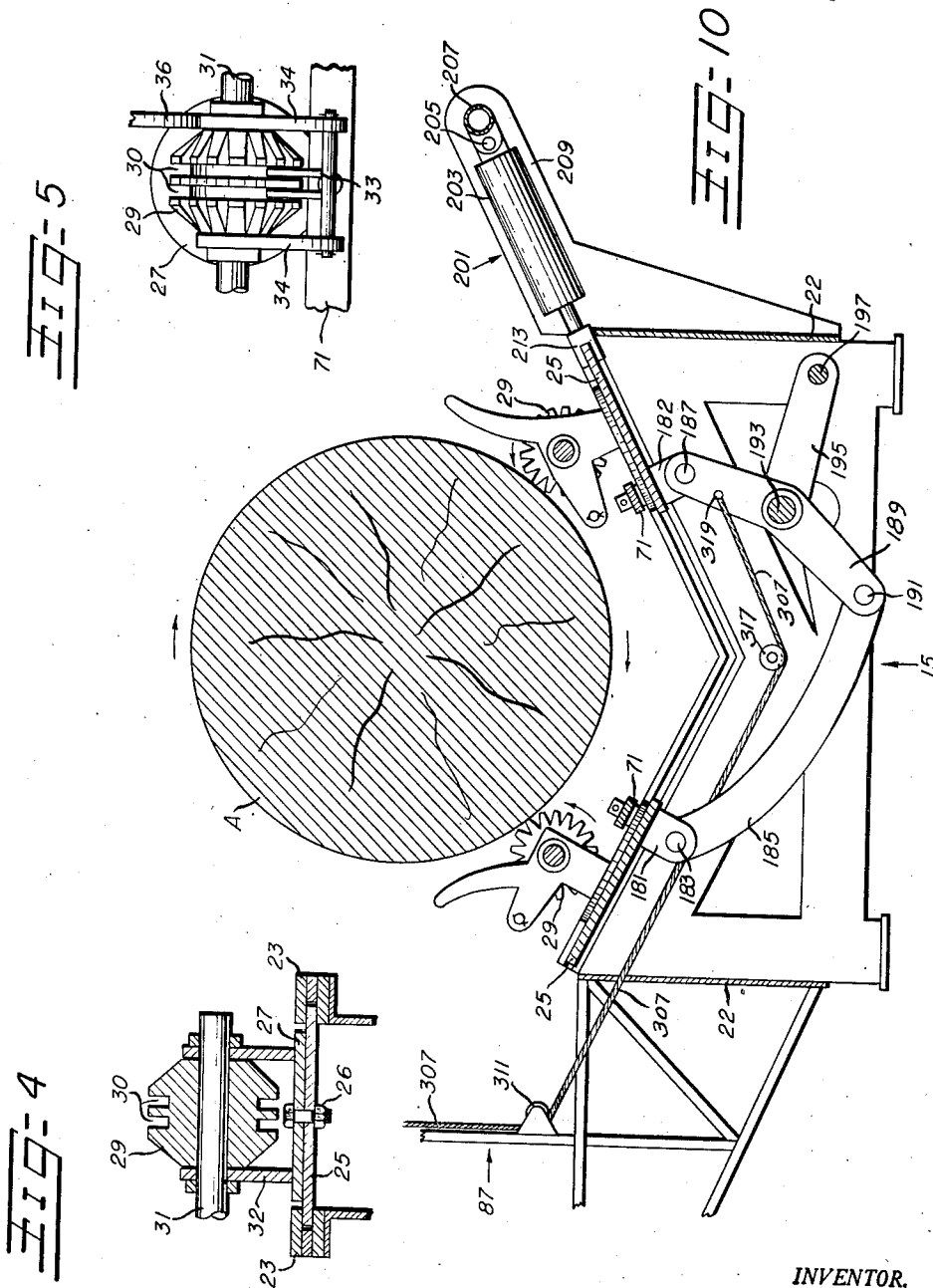
Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

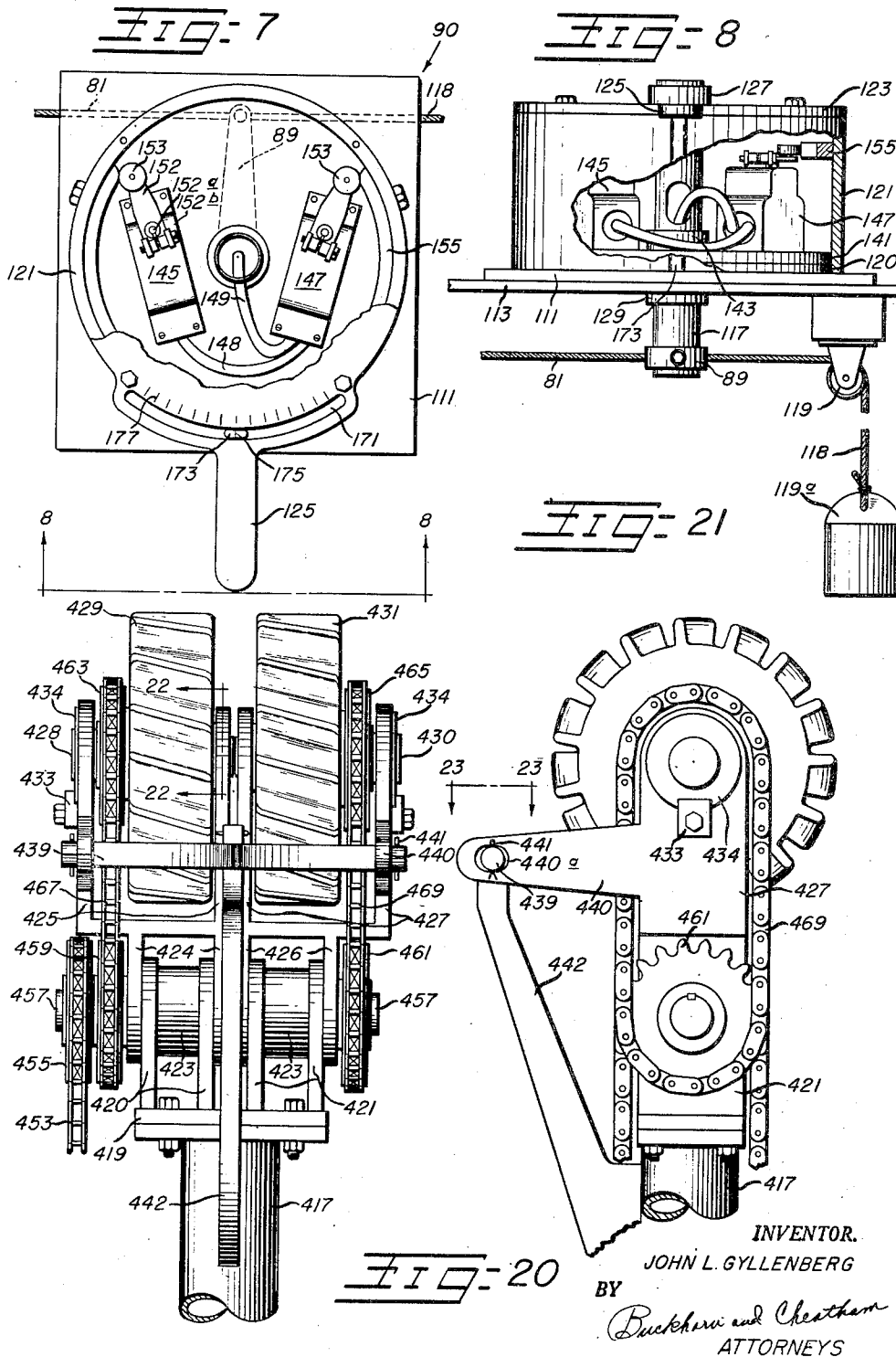
11 Sheets-Sheet 4



INVENTOR.  
JOHN L. GYLLENBERG  
BY  
*Duckhorn and Cheatham*  
ATTORNEYS

**J. L. GYLLENBERG**  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

11 Sheets-Sheet 5



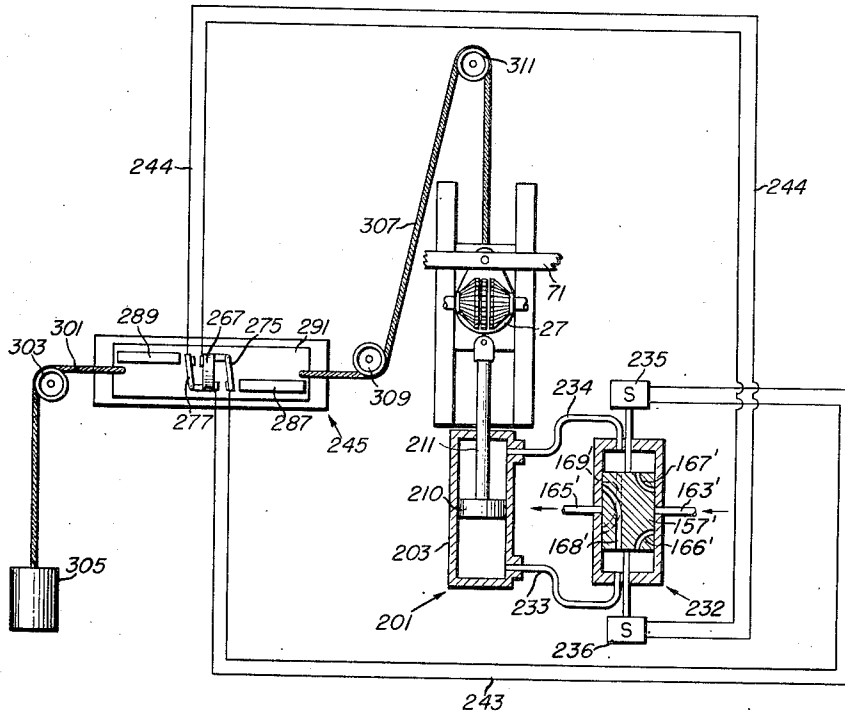
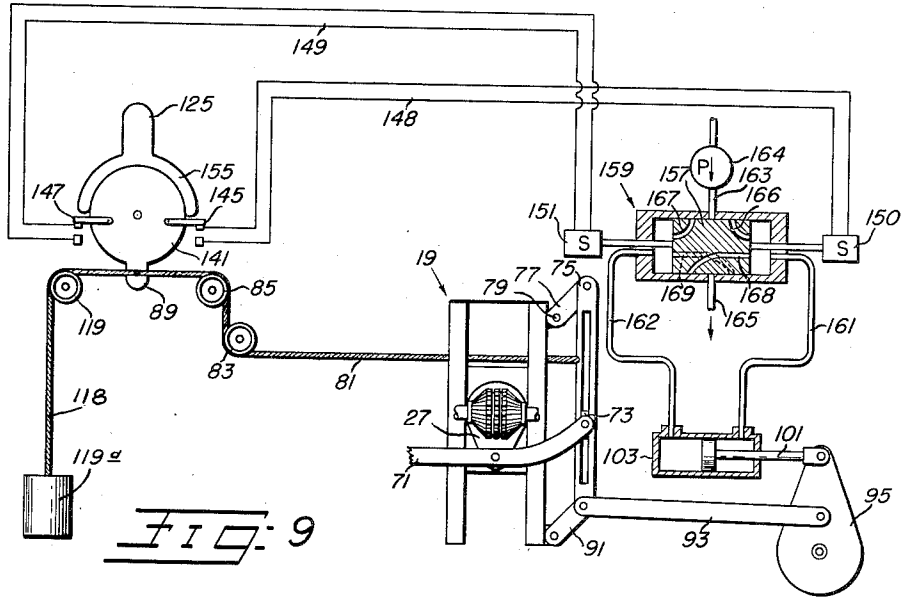
Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 6



INVENTOR.

JOHN L. GYLLENBERG

BY

*Buckhorn and Cheatham*  
ATTORNEYS

Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 7

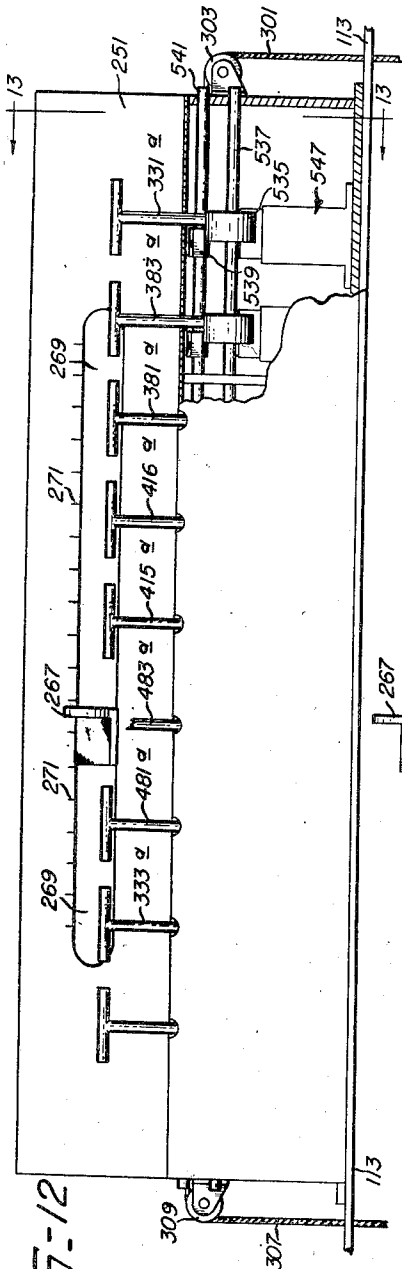


FIG-12

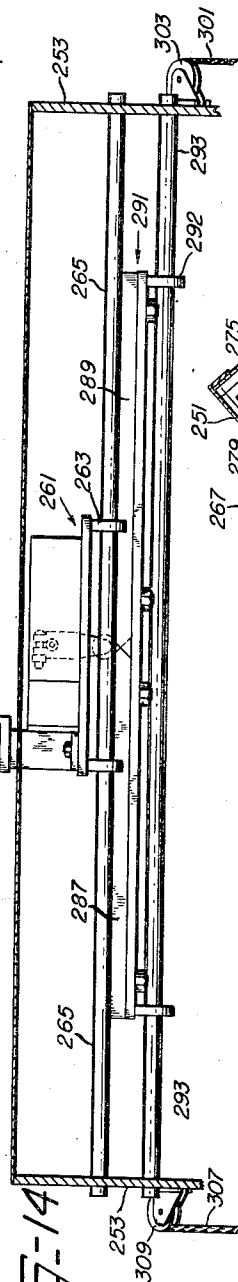


FIG-14

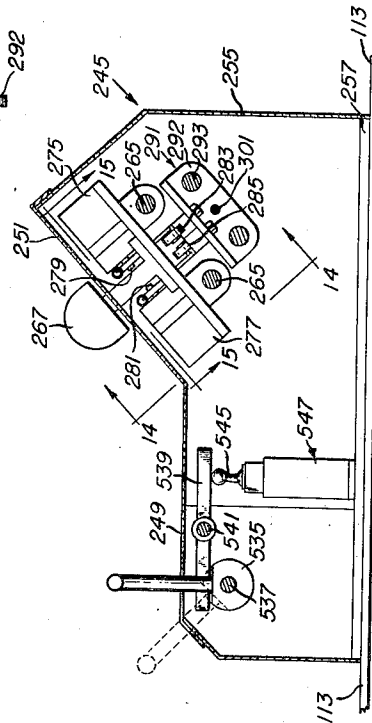


FIG-13

INVENTOR.  
JOHN L. GYLLENBERG  
BY  
*Buckhorn and Cheatham*  
ATTORNEYS

Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 8

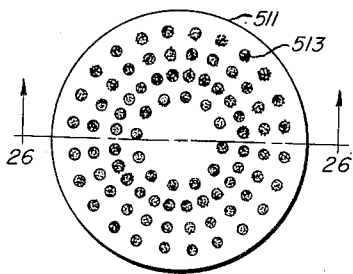


FIG. 25

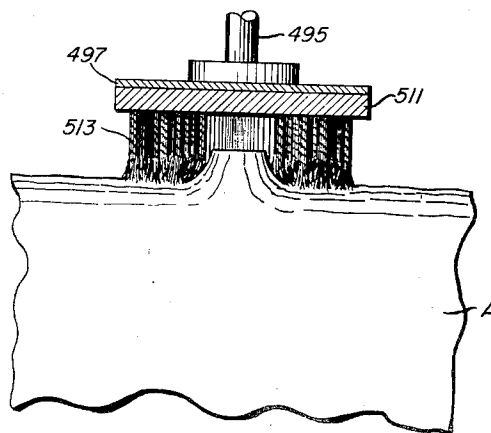


FIG. 26

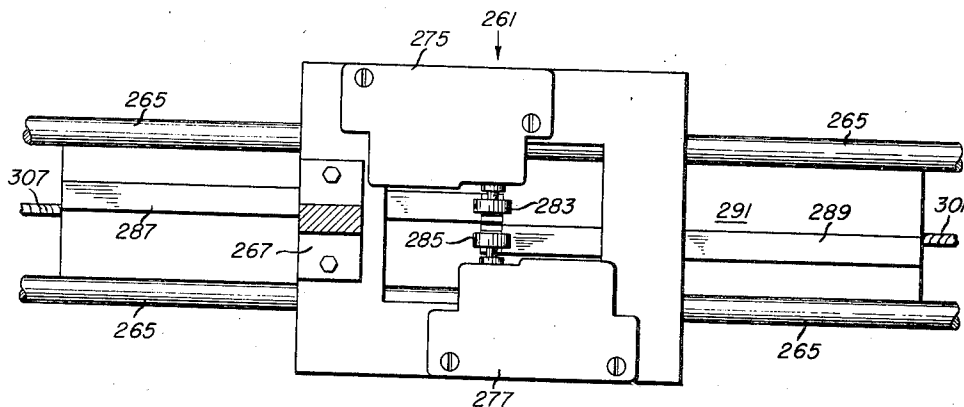


FIG. 15

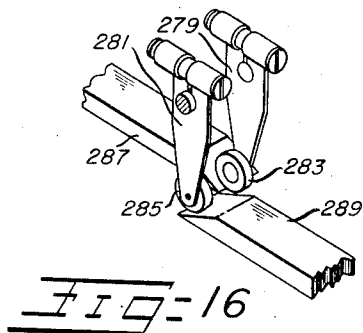


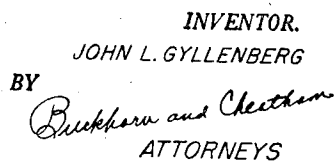
FIG. 16

INVENTOR.  
JOHN L. GYLLENBERG  
BY  
*Buckhorn and Cheatham*  
ATTORNEYS

Filed Oct. 16, 1953

**2,780,252**

11 Sheets-Sheet 9



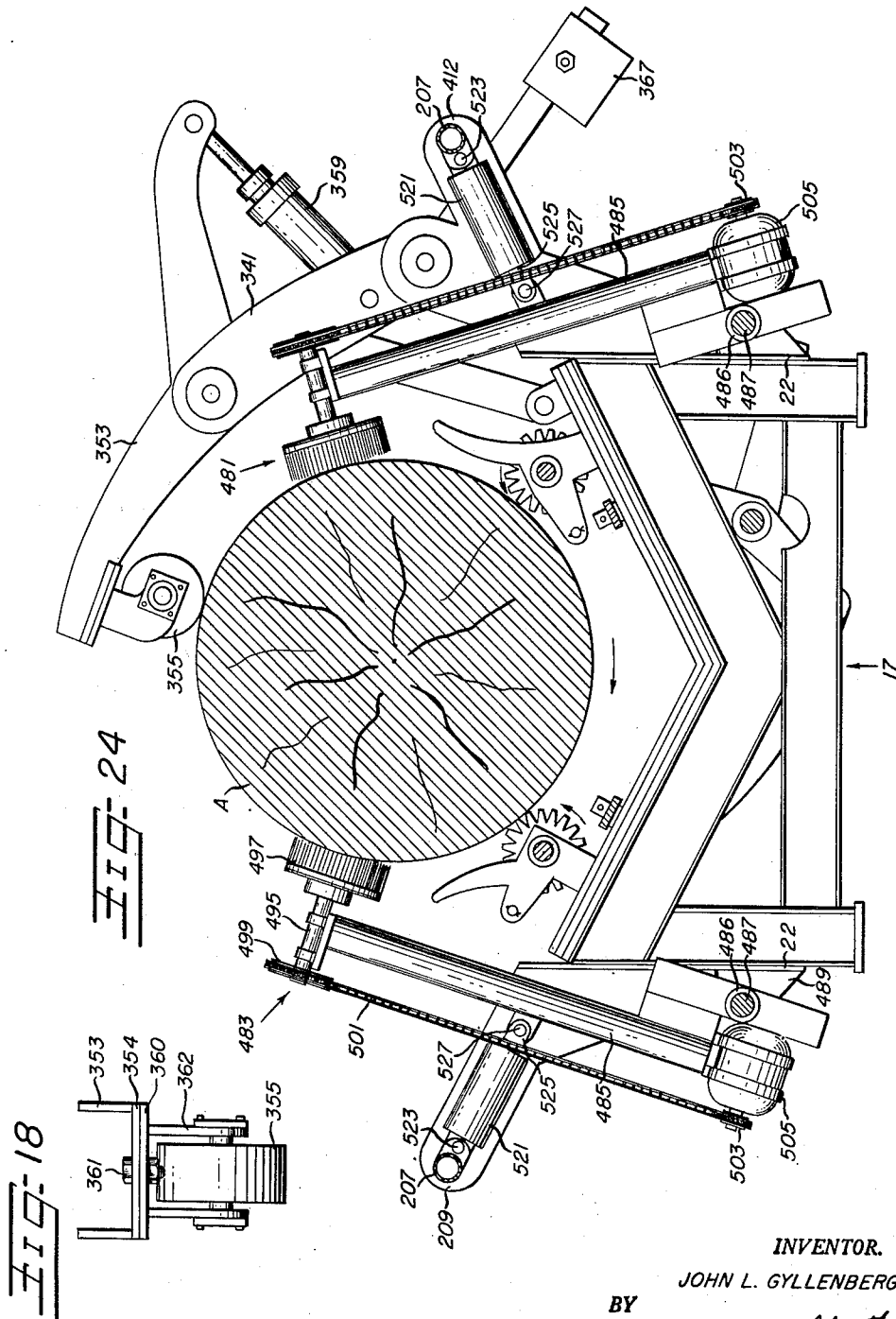
Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 10



INVENTOR.  
JOHN L. GYLLENBERG  
BY  
*Buckham and Cheatham*  
ATTORNEYS

Feb. 5, 1957

J. L. GYLLENBERG  
LOG BARKING MACHINE HAVING BILATERAL  
CUTTERS, BRUSHES AND FEED ROLLERS

2,780,252

Filed Oct. 16, 1953

11 Sheets-Sheet 11

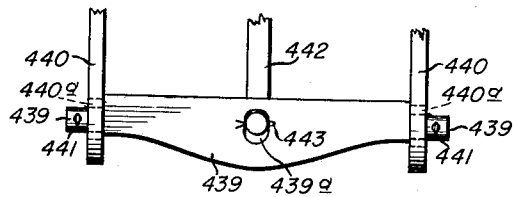
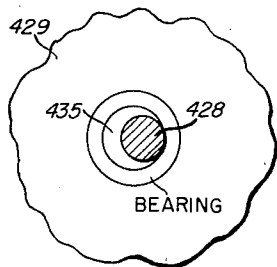


FIG. 22

FIG. 23

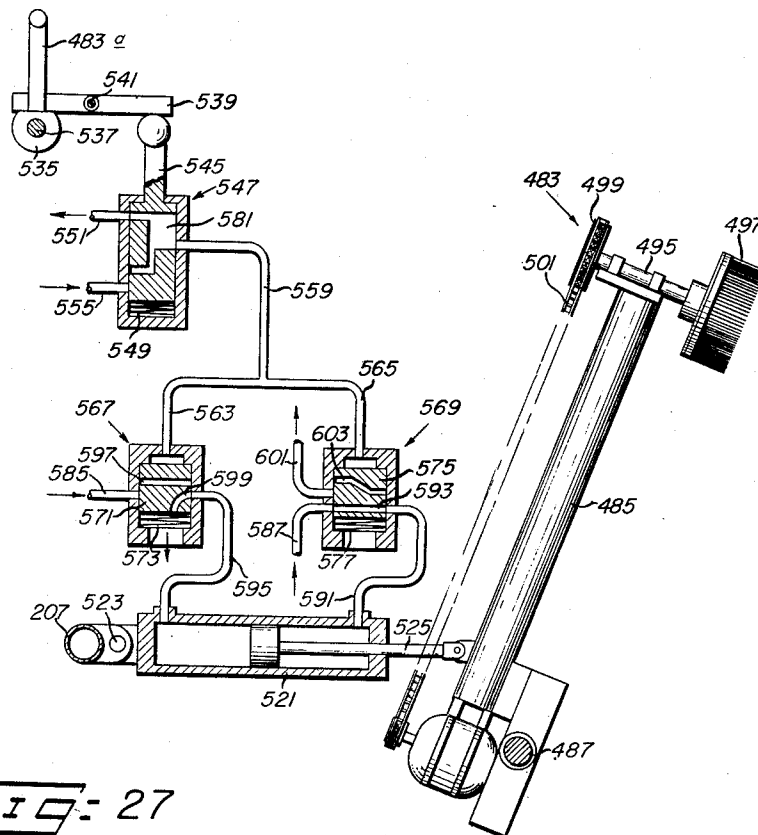


FIG. 27

INVENTOR.  
JOHN L. GYLLENBERG  
BY  
*Buckhorn and Cheatham*  
ATTORNEYS

# United States Patent Office

2,780,252

Patented Feb. 5, 1957

1

2,780,252

## LOG BARKING MACHINE HAVING BILATERAL CUTTERS, BRUSHES, AND FEED ROLLERS

John L. Gyllenberg, Baker, Oreg., assignor to  
Anthony Brandenthaler, Baker, Oreg.

Application October 16, 1953, Serial No. 386,491

11 Claims. (Cl. 144—208)

This invention relates to a machine for removing bark from logs, such machines being referred to as log-barking machines.

There has long existed a pressing demand for a machine capable of quickly and effectively removing the bark and underlying cambium layer from logs, as is evidenced by the numerous patents granted on such machines. A successful hydraulic log-barking machine has been developed comparatively recently, but this machine is very expensive and thus is available to only a small segment of the lumber industry. Mechanical log-barking machines are, in general, much less expensive than hydraulic machines, but, although hundreds of patents have been granted on such machines, it is well known in the trade that they have not proved successful, and none have been adopted by even a small segment of the industry.

Various reasons are attributed to these failures. A primary reason has been the inability of the machines to entirely remove the cambium layer from even straight logs, and if such material is not entirely removed, the slabs, edgings, et cetera, formed when the logs are cut into lumber, are not satisfactory for use in paper manufacture, which is a primary source of the demand for log-barking machines. Another important reason why prior mechanical log-barking machines have been failures is that, while some of them do a creditable job of removing a substantial portion of the bark and cambium from straight, cylindrical logs having few or no knots, branch stubs, and the like, which logs form only a small percentage of those handled at a mill, they have been incapable of handling bowed, crooked, and otherwise unsymmetrical logs, or logs with many knots and branch stubs. There are other reasons for the failure of prior mechanical log-barking machines, but the fact that none of them have been adopted by even a small segment of the industry shows conclusively that they have not been successful.

It is a main object of the present invention to provide a mechanical log-barking machine which costs only a fraction of the price of a hydraulic machine, and which is completely successful in removing not only the bark but also the underlying cambium layer from all logs suitable for sawmill work, including logs which are bowed and crooked, and those which are covered with knots and branch stubs.

The concepts of the present invention are embodied in a mechanical log-barking machine having, broadly speaking, toothed bark-removing means arranged to engage the surface of a log and to remove a large percentage of the bark, and to score, tear and remove at least some of the cambium layer, in combination with wire-brush means operable to work on the thus prepared log surface to entirely remove the little bark left thereon and entirely remove the cambium layer, such operations being carried out without any substantial damage to the useful wood fibers of the log.

As previously mentioned, prior mechanical log-bark-

2

ing machines have been unable to handle logs having knots and branch stubs, primarily because the bark-removing means simply rode over the knots and stubs and thus could not engage the bark immediately surrounding such knots and stubs.

The concepts of the present invention are more specifically embodied in a machine wherein the toothed bark-removing means is designed to swivel or turn upon engagement with a knot or stub and so to bring at least a portion of such toothed means into engagement with, and remove the bark from, the area immediately surrounding knots and branch stubs, and wherein the wire-brush means is formed or provided with a recess to enable it to effectively enclose and surround a knot or branch stub and remove the bark portions remaining thereon and therearound, and to entirely remove the cambium layer in such areas.

It is another object of the present invention to provide a log-barking machine having a novel log-rotating-and-feeding arrangement, and, in particular, comprising two elongated, extensible, articulated log-feeding members spaced to cradle a log therebetween, said members having incorporated therein spaced, toothed, log-feeding elements, there being means for rotating the members whereby the elements rotate a log, and means for disposing the axes of rotation of the elements angularly to the direction of extension of the members whereby the elements feed the log longitudinally along at a speed proportional to the magnitude of the angle of departure of said axes from said direction.

A further object of the present invention is to provide an arrangement of the type described immediately above, wherein there is a mechanism for moving feeding members toward and away from one another along inclined planes to provide a log-receiving cradle adapted to accommodate different-diameter logs, and whereby logs of different diameters may be fed into the cradle from a fixed-level log-input-feeding means.

A still further object of the present invention is to provide, in a log-barking machine having two log-rotating-and-feeding members adjustable toward or away from one another to vary the cradle provided thereby, log hold-down means arranged to engage the top of a log and hold the log down on the feeding members, the hold-down means being operatively connected to the feeding members to be movable, in response to a change in spacing between the members, to a position outwardly from its initial position, when the spacing between the members is increased, and inwardly from its initial position, when the spacing between the members is decreased, whereby the hold-down means is adapted to effectively engage and hold down logs of different sizes.

Further objects of the present invention are to provide a novel control system for controlling the size of the cradle provided by feeding members of the type described above, and for controlling the angular disposition of the axes of rotation of the toothed feeding elements, incorporated in such feeding members, relative to the direction of extension of such members.

Various other objects of the present invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a side view of a log-barking machine embodying the concepts of the present invention, showing a log of considerable size being operated on by the machine;

Fig. 2 is a plan view of the machine disclosed in Fig. 1;

Fig. 3 is an end view taken in the direction of the arrows 3—3 in Fig. 2;

Fig. 4 is a fragmentary, sectional view taken along line 4—4 of Fig. 3, showing the manner of supporting a log-feeding element;

Fig. 5 is a fragmentary, sectional view taken along line

5—5 of Fig. 3, showing the cleaning fork for a feeding element;

Fig. 6 (Sheet No. 1) is a view in plan showing one row of log-feeding elements and the connections between said elements, the full lines showing the feeding elements in their neutral positions and the dotted lines showing the elements in positions for feeding a log forwardly through the machine;

Fig. 7 (Sheet No. 5) is an enlarged plan view of the feeding-element angle-control box located in the control booth, parts being broken away for convenience in illustration;

Fig. 8 is a front view of the control box disclosed in Fig. 7, taken in the direction of the arrows 8—8 in Fig. 7, parts being broken away for convenience in illustration;

Fig. 9 (Sheet No. 6) is a schematic diagram of the feeding-element angle-control system;

Fig. 10 (Sheet No. 4) is a sectional view taken along line 10—10 of Fig. 2, showing part of the mechanism for changing the size of the cradle for a log;

Fig. 11 (Sheet No. 6) is a schematic diagram showing the manner of operation of the cradle-control system;

Fig. 12 (Sheet No. 7) is a front elevation of the control box for the cradle-control system for the various bark-removing instrumentalities, and for the log hold-down devices, parts being broken away for convenience in illustration;

Fig. 13 is a sectional view taken along line 13—13 of Fig. 12;

Fig. 14 is a sectional view taken along line 14—14 of Fig. 13, showing part of the cradle-control system;

Fig. 15 (Sheet No. 8) is a sectional view taken along line 15—15 of Fig. 13;

Fig. 16 is a fragmentary, perspective view showing the relation of the switch rollers to the two strip cams of the log-cradle-control system;

Fig. 17 (Sheet No. 9) is a sectional view taken along line 17—17 of Fig. 2, showing the construction of one of the first pair of bark-cutting-and-removing instrumentalities and one of the second pair of bark-cutting-and-removing instrumentalities;

Fig. 18 (Sheet No. 10) is a view taken in the direction of the arrows 18—18 in Fig. 3, showing the manner of mounting a hold-down roller;

Fig. 19 (Sheet No. 9) is a view taken along line 19—19 of Fig. 17;

Fig. 20 (Sheet No. 5) is an enlarged view taken along line 20—20 of Fig. 17, showing more fully the construction of one of the second bark-cutting-and-removing instrumentalities;

Fig. 21 is a side view taken from the right of the cutting device disclosed in Fig. 20;

Fig. 22 (Sheet No. 11) is a fragmentary, sectional view taken along line 22—22 of Fig. 21, showing the manner of eccentrically mounting a cutter;

Fig. 23 is a view taken along line 23—23 of Fig. 21, more fully showing the construction of the equalizer bar;

Fig. 24 (Sheet No. 10) is a sectional view taken along line 24—24 of Fig. 2, showing the construction of the wire-brush units;

Fig. 25 (Sheet No. 8) is a view looking at the operating face of a wire brush;

Fig. 26 is a sectional view through the wire brush showing the manner of its operation on a knot; and

Fig. 27 (Sheet No. 11) is a schematic view showing the manner of controlling and operating a wire-brush unit.

Referring to the accompanying drawings wherein similar reference characters designate similar parts throughout, there is disclosed a log-barking machine embodying the concepts of the present invention, and in which a log of considerable size is shown being processed. The machine comprises a frame including five upright, M-shaped, aligned frame sections 11, 13, 15, 17 and 19 spaced from one another as shown in Figs. 1 and 2, and

adapted to be directly or indirectly fixed to the floor of a building or other suitable structure. Each frame section comprises two spaced M-shaped members fixedly connected at their lower ends by base plates 20, and at the upper side portions thereof by side plates, relatively narrow side plates 21 being provided for the sections 11 and 19, and relatively deep side plates 22 being provided for the remaining sections (see Fig. 1).

#### Two spaced rows of log-rotating elements

Provided along each inclined, upwardly facing surface of each M-shaped member is a guide 23 (see Fig. 4), the guides on opposed frame members facing one another and slidably receiving a feed-element-supporting plate 25 of generally rectangular configuration (compare Figs. 2, 4 and 10). Each plate 25 is adjustably held in a selected position along the guides 23 in a manner to be presently set forth. Upon each feed-element-supporting plate 25 is pivotally mounted at 26, for swivel movement about an axis perpendicular to said plate, a feed-element pivot plate 27 of generally pear-shaped configuration, as shown in Figs. 2 and 6.

A toothed feed element 29, having conico-frustum ends and two annular grooves 35 therearound, is provided for each pivot plate 27, and has a shaft 31 journaled in uprights 32 (see Fig. 4) fixed to said pivot plate. A cleaning fork 33 (see Fig. 5) is provided for each feed element 29, and is supported by arms 34 forming extensions of the associated uprights 32, and fits within the upper portions of the annular grooves of the feed element to automatically clean the element as the element is rotated by means to be presently set forth. As is apparent from the arrows in Fig. 3, the feed elements 29 on each frame section rotate in the same direction, counterclockwise as shown, and so the arms 34 of both pairs of the uprights 32 on each frame section extend to the left, as the parts are depicted in Fig. 3, to dispose each fork 33 to the left of its feed element in position so that the prongs thereof effectively clean the feed element.

There is a curved log-retaining arm associated with each feed element, the left-hand retaining arm in Fig. 3 being given the reference numeral 35 and being secured to the nearest arm 34 shown (compare Figs. 3 and 5), whereas the right-hand retaining arm is given the reference numeral 36 and is secured to the right edge of the nearest upright 32.

As is apparent from Figs. 2 and 3, the feed elements 29 are arranged in two longitudinal rows to provide a cradle for a log labeled A, the elements being operable when rotated to rotate the log and, when arranged with their axes of rotation other than parallel to the direction of extension of said rows, to feed the log one way or the other along the machine, depending on which direction they are swiveled from their parallel positions.

#### Simultaneous articulation of all log-rotating elements to cause feeding of a log

Each row of the feed elements 29 is connected in end-to-end fashion in a manner to provide an elongated, extensible, articulated feed member. Figs. 2 and 6 best show this arrangement, and the arrangement will be described in connection with the top row of elements as the parts are depicted in Fig. 2. Connected to the opposite ends of each feed element shaft 31, except for the left-hand end of the leftmost shaft in Fig. 2, is a universal joint 41, and connecting the universal joints of the various feed elements of the row are two-part, spline-connected, telescopic shafts. The three centrally located feed-element shafts 31 are connected by relatively short two-part shafts 43, whereas there is a relatively long two-part shaft 45 connecting the shaft 31 of each end feed element with the shaft 31 of the adjacent feed element. A two-part, spline-connected, telescopic input shaft 47 (see Fig. 2) is connected and transmits power to the right-hand

5

universal joint on the right-hand end of the shaft 31 of the rightmost feed element of the row.

The opposite row of feed-element shafts are similarly connected and driven. By such an arrangement, the feed elements of a row are driven at the same speed in the same direction. The two input shafts 47 are arranged to drive the two rows of feed elements in the same direction, as is apparent from the direction-of-rotation arrows in Fig. 3.

When the feed elements are swiveled on their supporting plates by means to be presently described, the distances between the adjacent ends of the feed-element shafts varies, the two-part shafts varying in length to accommodate such action. The dotted-line position of the parts in Fig. 6 shows this action.

The mechanism for controlling the angular disposition of the axes of rotation of the feed elements will now be described. Referring particularly to Fig. 6, the pivot plates 27 of each row of feed elements 29 are pivotally connected at the protruding portions thereof at 69 to a control link 71 extending longitudinally of the machine. The right-hand end of each link, as the parts are depicted in Figs. 2 and 9, is bent outwardly and is pivotally connected to a sliding block 73 which is slidably received within the elongated slot of a slotted link 75. The slotted link 75 for the upper row of feed elements, as the parts are depicted in Figs. 2 and 9, is pivoted at its upper end to one end of a link 77, the latter being pivoted at 79 to the frame section 19.

A response cable 81 is connected at one end to the slotted link 75 and is trained about a sheave 83 rotatably mounted on the frame section 17 (see Figs. 2 and 9), and then about a sheave 85 mounted on a control booth generally indicated at 87. The cable is then connected at its other end to a response lever 89 (compare Figs. 2, 7 and 9) which forms part of a control box generally indicated at 90, about which more will be presently said.

The other end of the upper slotted link 75 (Fig. 2) is pivoted to two plain links 91 and 93, the former being pivoted to the frame section 19 and the latter being pivoted to an actuating disk 95. It is apparent that the link 77 and the link 91 provide a parallel linkage arrangement for the associated link 75, so that the slot of said link will always be maintained normal to the longitudinal axis of the machine. The disk 95 is pivotally mounted at 96 on a bracket 97 fixed to the frame section 19, and has an arm 99 pivotally connected to the piston rod 101 of a hydraulic actuator 103. The cylinder of said actuator is pivoted at 105 to the frame section 19.

The slotted link for the lower row of feed elements, as the parts are depicted in Fig. 2, is also connected to the frame section 19 and disk 95 by a second pair of links 91 and 93, and is also connected to said frame section by a link 107 for parallel movement.

It is evident that if the disk 95 is rotated counter-clockwise by the action of the hydraulic actuator 103, as the parts are depicted in Figs. 2 and 9, the upper slotted link 75 will shift its control link 71 to the left, whereas the lower slotted link 75 will shift its control link 71 to the right. This movement of the control links will angularly shift the axes of rotation of the feed elements clockwise from the neutral positions shown, and in such positions the feed elements will, upon rotation, feed a log forwardly from left to right. Since the control links will be moved equally in opposite directions, and since the upper link is located below its row of feed elements (still referring to Fig. 2), whereas the lower control link is located above its row of feed elements, the two opposed feed elements of each frame section will be adjusted the same angular extent in the same direction, so that their axes of rotation will remain parallel to one another and cooperate to evenly feed the log along the machine.

It is pointed out that if the disk 95 is turned by the actuator 103 in a clockwise direction, this action will cause an opposite angular disposition of the feed elements, 75

6

which will result in feeding a log rearwardly, or from right to left.

The control box 90 forms part of a general control system provided in the control booth, and is most clearly shown in Figs. 2, 7 and 8. The control box includes a square base plate 111 secured to a table or shelf 113 forming part of the control booth. A sleeve 117 slidably extends through the base plate 111 approximately centrally thereof and has the response-cable lever 89 fixed to the lower end thereof. Referring to Fig. 8, a cable 118, connected to the lever 89, is trained about a sheave 119 supported from the table 113 (see Figs. 8 and 9), the cable 118 suspending from the free end thereof a weight 119a which at all times urges the lever 89 clockwise as the parts are depicted in Fig. 9.

Fixed to the base plate 111 is a circular guide plate 120 (Fig. 8) apertured to receive the sleeve 117 therethrough. Guided by the guide plate is a rotary, cylindrical housing member 121 engaging the outer edge of the guide plate and having secured to its upper edge a cover plate 123. The cover plate 123 has a lever arm 125 formed integrally therewith and extending therefrom and by which the cover plate and housing member 121 may be turned relative to the base plate 111.

The sleeve 117 protrudes through the cover plate 123 and has mounted on the upper end thereof a set collar 127 by which the movable sleeve is supported on the cover plate 123. A lower set collar 129 is fixed to the sleeve 117 below the base plate 111, thus precluding endwise movement of the sleeve.

Supported by the guide plate 120 is a circular switch-supporting plate 141 apertured to receive the sleeve 117 therethrough, said supporting plate having a set collar 143 fixed concentrically thereto and adapted to be adjustably secured to the sleeve 117 for purposes of initial adjustment of the mechanism, the sleeve 117 and the switch-supporting plate 141 being operable only by movement of the response-cable lever 89. Mounted on the switch-supporting plate 141 are two normally open switch units 145 and 147 (see Fig. 9) having electric-current-carrying cable pairs 148 and 149, respectively, extending therefrom and connected to solenoids 150 and 151, respectively. These solenoids control the supply to, and the release of, hydraulic fluid from the feed-element-control actuator 103, previously mentioned, in a manner to be presently described.

Each switch unit includes a horizontal arm 152 pivoted at 152a on a switch-unit box 152b, said arm carrying a roller 153. The arms are biased by springs (not shown) contained within boxes 152b to normally hold the rollers 153 in engagement with the ends of an arcuate cam 155 fixed to the interior of the cylindrical housing member 121. The arrangement is such that when the rollers 153 are against the ends of the cam, the switch units are in open condition, but when an arm is forced inwardly, as when its roller rides onto the inner periphery of the cam, the associated switch is closed.

The solenoids 150 and 151 are connected to a movable valve member 157 of a hydraulic-fluid control valve 159, which is only schematically shown. Conduits 161 and 162 extend from the opposite ends of the valve cylinder to the opposite ends of the actuator cylinder 103. A solenoid is operable, when energized, to apply thrust to the valve member 157 and push it toward the opposite end of the valve cylinder. An inlet conduit 163 leads from the high-pressure side of a hydraulic-fluid pump 164 to the center of the valve cylinder. An outlet conduit 165 extends from the center of the valve cylinder to the low-pressure side of the pump 164.

The valve member 157 has two inlet passages 166 and 167, the inlet ends of which are spaced to provide a land facing and closing the conduit 163 when the valve member is centrally positioned in the valve cylinder. The inlet passages communicate with the adjacent ends of the valve cylinder. The valve member has two outlet

passages 168 and 169, the outlet ends of which are spaced to provide a land facing and closing the outlet conduit 165 when the valve member is centrally positioned in the valve cylinder. The outlet passages communicate at all times with the remote ends of the valve cylinder.

The solenoids are of conventional construction and thus have been only schematically shown. Each has a built-in spring (not shown), said spring functioning to urge the valve member to assume a position centrally of the valve cylinder.

The operation of the feed-element angle-control system is as follows. Fig. 9 shows the parts in neutral position with the feed elements 29 rotating about axes parallel to the longitudinal axis of the machine. Assume that it is desired to feed a log forwardly, that is, from left to right in both Figs. 2 and 9. The lever arm 125 is swung clockwise to cause the end of the cam 155, adjacent the roller 153 associated with the switch unit 145, to force said roller to swing inwardly and close the associated switch, while the end of the cam 155 adjacent the roller of the switch 147 retreats from said roller, which merely swings outwardly into engagement with the housing member 121, and thus the switch remains open. Closing of the switch 145 energizes the solenoid 150 to force the movable valve member 157 to the left, as the parts are shown in Fig. 9, to bring the passage 166 into communication with the inlet conduit 163 to supply hydraulic fluid under pressure to the right-hand end of the actuator cylinder 103, and to bring the passage 169 into communication with the outlet conduit 165 to communicate the left-hand end of the actuator cylinder 103 with the low-pressure side of the pump 164. The actuator piston is thus forced to the left, which acts through the disk 95, the slotted links 75 and the control links 71 to shift the axes of rotation of both rows of feed elements clockwise from the positions shown in full lines in Fig. 6 to the dotted-line positions. In these positions, a log will be fed forwardly through the machine.

Movement of the upper slotted link 75 to the left allows the weight 119a on the cable 118 to turn the lever 89 (and thus the plate 141 and the switch units) clockwise only to such an extent that the roller for the switch unit 145 rides off the inner periphery of the cam 155, and onto the adjacent end of the cam, whereupon said switch opens and deenergizes the solenoid 150. When this occurs, the built-in springs for the solenoids, before mentioned, force the valve member 157 back to its central position and thus cut off the supply of fluid to the actuator 103, and also the discharge of fluid from said actuator. The fluid trapped in the actuator 103 and the conduits 161 and 162, and within the valve cylinder and movable valve member, holds the control links 71, and thus the feed elements 29, in their adjusted positions.

In order to determine the extent of angular adjustment of the feed elements 29, the cover plate 123 (see Fig. 7) is provided with an arcuate slot 171 within which is disposed a fixed indicator 173 secured to the base plate 111. The indicator has a mark 175 adapted to cooperate with marks 177 provided on the cover plate 123 adjacent the slot 171 to indicate the extent of angular adjustment of the feed elements 29, preferably in terms of the rate of longitudinal feed of the log.

*Means to vary the lateral spacing of the rows of log-rotating elements*

As previously indicated, the feed elements 29 are adapted to be bodily shifted inwardly and outwardly along the guides 23 to accommodate different-sized, that is, diameter, logs. The two feed-element assemblies of each frame section are connected for movement in unison. This arrangement will now be explained, and thereafter the manner of controlling the bodily move-

ment of the feed-element assemblies from the control booth will be set forth.

Referring to Fig. 10, depending from each left-hand feed-element-supporting plate 25 is a pair of lugs 181, and depending from each right-hand feed-element-supporting plate is a single lug 182, the lugs 181 being pivotally connected at 183 to a link 185, whereas the lug 182 is disposed between and pivotally connected at 187 to a double link 189. The link 185 and double link 189 are pivotally connected together at 191.

Extending through all of the double links 189 of the opposed sets of feed elements intermediate the ends thereof is a common shaft 193 (see Fig. 1) which is preferably keyed to said links. There is a link 195 for each double link, pivotally connected at one end to the common shaft 193 and at its opposite end at 197 to the adjacent leg of the associated frame section.

Referring to Figs. 1, 2, 10 and 11, a hydraulic actuator 201 is provided for bodily shifting the sets of feed elements, said actuator including a cylinder 203 pivoted at 205 to a tubular crosspiece 207, the latter member being supported in part intermediate its ends by a pair of angular brackets 209 (compare Figs. 1 and 10) fixed to the right-hand side plate 22 of the frame section 15, as the parts are depicted in Fig. 10. The cylinder 203 has therewithin a piston 210 (see Fig. 11) having a piston rod 211 extending from the cylinder and connected by a clevis connection 213 (Fig. 10) to the plate 25 of the right-hand feed element 29.

Counterbalancing each of the feed-element assemblies of the frame sections 11 and 19, and the upper feed-element assemblies of the sections 13 and 17, as the parts are depicted in Fig. 2, is a counterweight 221 (see Figs. 2 and 3) which is suspended by a rope or cable 223, said cable being trained over a sheave 225 and connected to the outer margin of the adjacent feed-element-supporting plate 25 of the adjacent feed element. Each sheave 225 is rotatably supported by a bracket 229 from the associated frame section.

Referring to Figs. 10 and 11, when the actuator 201 is actuated in a manner such as to force inwardly the feed-element assemblies of the right-hand row, as the parts are depicted in Fig. 10, against the resistance of the weights 221, the links 189, 195 and 185, through the common shaft 193, force the feed-element assemblies of the opposite row inwardly the same amount, the links being dimensioned to achieve this result.

The manner of controlling the spacing of the rows of the feed-element assemblies will now be explained. Mounted on the frame section 15 adjacent the actuator 201 (in a manner not shown) is a hydraulic fluid-control valve 232 (see Fig. 11), the construction of which duplicates the valve 159 previously described, and hence similar reference numerals have been applied to corresponding parts of the valve 232, prime marks being added to the numerals to differentiate such corresponding parts. Conduits 233 and 234 connect the valve 232 to the cylinder of the actuator 201. Solenoids 235 and 236 control the operation of the valve 232 and are in turn controlled through current lines 243 and 244 by a control box 245 mounted on the table or shelf 113 of the control booth.

Referring particularly to Figs. 12 through 16, the control box 245 includes a housing having a horizontal face plate 249, an inclined face plate 251, end plates 253, an angularly bent back plate 255, and a base plate 257, the latter being secured to the shelf or table 113 of the control booth. A control arrangement for the bark-cutting-and-removing instrumentalities to be described hereinafter is in part mounted beneath the horizontal face plate 249, but of present concern is the control arrangement for the actuator 201, which control arrangement is in part located beneath the inclined face plate 251.

The latter control arrangement includes a movable indicator carriage 261 (see Fig. 14) slidably mounted by means of depending ears 263 on a pair of spaced, parallel

rods 265 secured to the end plates 253. The carriage 261 is of generally open, rectangular configuration, as is apparent from Fig. 15, and has mounted on the left side thereof, as the parts are depicted in Fig. 15, a handle 267 protruding through an elongated slot 269 (Fig. 12) formed in the inclined face plate 251. The handle 267 is adapted to have significance of position by virtue of markings 271 provided on the face plate 251 adjacent the slot, the markings being calibrated in terms of log size or diameter.

Mounted in spaced relation on the carriage 261 are two switch units 275 and 277 having depending, pivotally mounted arms 279 and 281, respectively, carrying rollers 283 and 285, respectively (see Fig. 16). Operatively associated with the roller 283 is a strip cam 287, and operatively associated with the roller 285 is a strip cam 289, said cams being laterally and longitudinally spaced with respect to one another, but being parallel to one another, and extending in opposite directions from the rollers and presenting beveled ends to their respective rollers.

The strip cams are mounted on a carriage 291 (Fig. 14) slidably supported by depending ears 292 on a pair of spaced parallel rods 293 connected to the end plates 253. The arms 279 and 281 are biased by springs (not shown) to positions against stops (not shown) disposed within the boxes of the switch units. When the arms are against the stops the switches are open. The switch units are of conventional construction, and therefore the detailed construction thereof need not be shown. The current-supply lines 243 and 244, previously mentioned, are connected respectively to the switch units 275 and 277.

Connected to the right-hand end of the carriage 291, as the parts are depicted in Fig. 15, is a cable 301 which is trained over a sheave 303 and suspends at its opposite end a weight 305 (see the corresponding left-hand end of the carriage 291 in Fig. 11).

Thus, the carriage 291 is constantly urged to the left, as the parts are depicted in Figs. 2 and 11. Connected to the left-hand end of the carriage 291, as the parts are depicted in Fig. 15, is one end of a response cable 307, the cable then being trained over a sheave 309 mounted on the control box, then extending through an opening in the shelf or table 113, and then being trained over a sheave 311 (see Fig. 10), the latter sheave being mounted on the control booth. The other end of the cable 307 is trained about a sheave 317 and is connected at 319 to the double link 189 associated with the frame section 15.

The operation of the control arrangement described above is as follows. For clarification, it will be pointed out that in Figs. 2 and 11 the directions are unavoidably opposite or contrary from those depicted in Figs. 12, 14, 15 and 16. It may be assumed that the handle 267 on the control box 245 is moved to the right from the position shown in Figs. 2 and 11 (to the left as the parts are shown in Figs. 12, 14 and 15) to accommodate a log of larger size. This action causes the switch-actuating roller 283 associated with the switch unit 275 to ride up and onto the associated strip 287 and pivots the arm 279 carrying the roller to close the switch incorporated in the switch unit 275 to energize the solenoid 235 to supply fluid under pressure to the inner end of the cylinder of the actuator 201. This forces the two rows of feed elements to move in unison outwardly, such movement being transmitted through the double link 189 associated with the frame section 15, and cable 307 to the carriage 291 within the control box 245, thus moving the carriage 291 and strip 287 against the pull of weights 305 and toward the right, as the parts are depicted in Fig. 11, so as to bring the beveled end of the strip cam 287 associated with the switch unit 275 back under the associated switch-control roller 283. This action opens the switch incorporated in the switch unit 275 and stops the operation of the actuator 201 by deenergizing the solenoid 235. The solenoids have built-in springs (not shown) which

function to bring the movable valve element of the valve 232 back to its central position whenever the solenoids are deenergized, this action functioning to trap the hydraulic fluid in the actuator 201 to hold the rows of the feed elements 29 in their adjusted position.

Movement of the handle 267 in the opposite direction, so as to accommodate a log of smaller size, will cause hydraulic fluid, through the actuation of the switch in the switch unit 277 and the energization of the solenoid 236, to be supplied under pressure to the outer end of the cylinder of the actuator 201 and will release hydraulic fluid from the inner end of the cylinder of said actuator, the resulting approaching movement of the two rows of feed elements tending to slacken the cable 307. The response mechanism will then be operable through the pull maintained by the weight 305 on the cable 301 to slide the carriage 291 to the left (assuming the orientation of Figs. 2 and 11) to bring the beveled end of the strip cam 289 back under the switch roller 285 and thus open the switch unit 277.

In use, a series of live rolls forming a conveyor will be employed to feed logs into the machine, and a considerable advantage of providing an adjustable cradle lies in the fact that logs of different sizes may be fed from a fixed-level conveyor into the machine.

A review of the structure so far explained shows that each row of the feed elements 29 is rotated in the same direction (in a counterclockwise direction as the parts are depicted in Fig. 3) so as to rotate a log cradled thereby, and that provision is made for bodily shifting the rows of feed elements inwardly or outwardly along inclined planes to accommodate different-sized logs. Provision is also made for simultaneously adjusting the angular positions of the axes of rotation of the feed elements from neutral positions either way so as to selectively feed a log from left to right (as the parts are depicted in Fig. 1), which is the normal direction of travel, or to stop the log at any place along the machine, or to reverse the direction of feeding movement of the log, and then to feed the log forwardly again, at the option of the operator. Thus, the operator has full control over the movement of the log, and by stopping the log at a debarking station to be presently described, or by reversing the direction of travel of the log at the debarking station, a log of irregular or unusual shape or size may be entirely debarked despite its shape.

#### Log hold-down units

Operating in conjunction with the feed elements 29, are two hold-down units 331 and 333 mounted respectively on the frame sections 13 and 17. Referring particularly to Figs. 1, 2, 3 and 18, each hold-down unit includes a pair of bracket plates 334 fixed to the adjacent side plate 22 of the associated frame section. A horizontal shaft 337 is journaled in each pair of brackets adjacent the upper end thereof and has fixed thereto spaced arms 341, the latter carrying intermediate their lengths a pin 343. Pivotally connected at its opposite ends to the pin 343 and a double lug 345 carried by the plate 25 of the adjacent feed-element assembly is a link 347.

It follows from the above structure that when the rows of feed elements are shifted inwardly or outwardly, the arms 341, through the links 347, are likewise shifted in a direction corresponding to the direction in which the feed elements are moved. That is, if the rows are shifted apart, the arms are swung outwardly, and if the rows of feed elements are moved toward one another, the arms 341 are swung inwardly. This action adjusts the position of the hold-down units relative to the size of the log being processed.

The arms 341 have a shaft 349 journaled on their upper ends. A pair of bell-crank members 353 are fixed intermediate their ends to the shaft 349. The inner ends of the bell-crank members have fastened thereto a plate 354 (compare Figs. 3 and 18), and pivotally carried by said plate is a caster assembly including a hold-down roller

355 adapted to engage a log. The outer ends of the bell-crank members are curved toward one another (see Fig. 2) and journaled therein is a pin shaft 356 which is connected to a piston rod 357 of a pneumatic actuator 359.

The caster assembly above mentioned includes a plate 360 swiveled by a pivot 361 on the plate 354. The plate 360 carries downwardly curved arms 362 rotatably supporting the hold-down roller 355. By this caster arrangement the hold-down roller will adjust itself to the helical path of movement of the surface of the log which it engages, and thus not interfere with forward movement or reverse movement of the log through the machine.

The actuator 359 has a cylinder 363 pivotally connected at 364 to arms 341 (compare Figs. 2 and 3). A counterweight arm 365, carrying a counterweight 367, is fixed to the shaft 337, previously mentioned.

In Figs. 2 and 3 the hold-down rollers 355 are shown engaging the log generally indicated at A, this position being caused by the supply of air under pressure to the inner ends of the pneumatic actuators 359, this action causing the bell-crank arms to pivot from the broken-line position shown in Fig. 3 to the full-line position. When a log is to be fed into the region of the hold-down arms, the hold-down rollers are arranged in their more outwardly disposed positions by the supply of air to the outer ends of the pneumatic actuators 359, and thereafter air under pressure is supplied to the inner ends of said actuators to bring the hold-down rollers 355, independently or simultaneously, into yielding engagement with the top of a log.

The supply of air under pressure to the pneumatic actuators 359 is controlled from the control booth in a manner to be indicated hereinafter.

Arranged between the hold-down units 331 and 333 (considered longitudinally of the machine) are three pairs of bark-and-cambium-layer-removing instrumentalities, the instrumentalities of each pair being disposed one on either side of the path of travel of a log.

#### *Swingable bark-removing cutters*

The first set of bark-removing instrumentalities or tools comprises two cutterhead units 381 and 383 (see Figs. 2 and 17), the primary purpose of which is to remove bark. Each unit includes a swinging tubular arm 385 affixed adjacent its lower end to a sleeve 386 journaled on a shaft 387, the latter being fixed to a pair of brackets 389 which in turn are fixed to the side plates 22 of the frame sections 13 and 15 (compare Figs. 1 and 17). At its opposite end, each swinging arm 385 has fixed thereto in offset relation a clevis member 391 (see Fig. 19), rotatably supporting a shift 393, the latter having fixedly secured thereto a rotary toothed-cutter 395. The teeth of the cutter are helical as shown, the helix preferably being arranged so as to assist forward feeding movement of the log through the machine.

Each cutter 395 is adapted to be rotated in a counter-clockwise direction (as the parts are depicted in Fig. 17) by a motor 401 mounted on the lower end of the associated swinging arm and driving the cutter through a chain-and-sprocket drive 403. The cutter is driven at a higher rate of speed than that of the feed elements 29, but in the same direction, so that there is relative movement between the rotating cutters and the log to enable the cutters to perform their bark-removing operations without retarding the rotary movement imparted to the log by the feed elements 29.

For urging the cutters into yielding engagement with a log, there is provided a pneumatic actuator 405 for each cutterhead unit. A cylinder 407 of each actuator 405 is pivoted at 409 on the associated cross member 207. A piston rod 410 of each actuator 405 is pivotally connected by a clevis 410a to a lug 411 fastened to the associated swinging arm 385 intermediate the length of said arm. The control of air under pressure to and from the pneumatic actuator 405 will be indicated hereinafter along with

the description of the operation of other bark-removing instrumentalities.

The right-hand cross member 207, as the parts are depicted in Fig. 24, is supported at its ends by a pair of plates 412 fixed to the outer edges of the two most adjacent plates 334 (compare Figs. 1, 2 and 3). The left-hand cross member 207 is supported at its ends by another pair of angle brackets 209.

#### *Swingable and rockable bark-removing cutters*

The second pair of bark-and-cambium-layer-removing instrumentalities or tools, labeled 415 and 416, is best shown in Figs. 2, 17, and 20 through 23. The two mechanisms are similar in construction and thus the construction of only one unit, unit 415, will be explained in detail. The unit 415 includes a tubular support 417 having fixed adjacent its lower end a sleeve 418 journaled on the shaft 387 (see Fig. 17). Fixed on the upper end of the support 417 is a forked member 419 (see Fig. 20) having a first pair of forked arms 420 and a second pair of forked arms 421, there being a bearing sleeve 423 extending through and fixed to the four forked arms and protruding beyond the two outermost arms. Straddling the arms 420, and pivotally mounted on the sleeve 423, are depending arms 424 of a forked member having upwardly extending arms 425, and straddling the arms 421, and pivotally mounted on the sleeve 423, are depending arms 426 of a forked member having upwardly extending arms 427. The two forked members just mentioned are thus mounted for independent pivotal movement. Rotatably mounted on the arms 425 by a shaft 428 is a cutter 429 having helical teeth, and rotatably mounted on the arms 427 by a shaft 430 is a cutter 431 having helical teeth.

Each of the shafts 428 and 430 has reduced end portions (see Figs. 20 and 22) rotatably received by the associated arms, and a clamp 433 mounted on each outer associated arm fixes each shaft in any position to which it has been rotatably adjusted, said clamp engaging a flange 434 fixed to the outer end of each shaft. Formed on each of the shafts 428 and 430 intermediate its ends is an eccentric portion 435 (see Fig. 22) on which is rotatably mounted the associated cutter. By rotatably adjusting each of the shafts, the distance between the axis of rotation of the associated cutter and the axis of sleeve 423 may be varied for a purpose to presently appear.

Up to this point, it is apparent that, if the tubular support 417 were swung inwardly toward a log, the two cutters would merely pivot rearwardly about the sleeve 423, and hence no forcible engagement of the cutters and the log could be achieved.

However, there is provided an equalizing bar 439 (see particularly Fig. 23) having its ends loosely received through apertures 440a (see Fig. 21) formed in a pair of rearwardly extending lugs 440 fixed to the outer cutter-supporting fork arms. Heavy cotter pins 441 are provided on the ends of the equalizing bar. Formed centrally in the bar 439 is an opening 439a (Fig. 23) through which loosely extends the upper end of a pivot element 442 fixed at its lower end to the support 417 (see Fig. 21). The upper end of the element 442 has a heavy cotter pin 443 provided thereon. The opening 439a in bar 439 is sufficient to allow the equalizing bar not only to pivot in its own plane but also to wobble or rock when the cutters pivot back and forth on the sleeve 423.

It is evident from the above description that the cutters are self-adjusting and that one cutter may ride upon a knot or branch stub, such motion being transmitted through the equalizing bar 439 to the other cutter to thrust it inwardly into engagement with the side of the knot or branch stub, or the area immediately surrounding the knot or branch stub, to remove the bark and at least some of the cambium layer therefrom.

For rotating the cutters 429 and 431, there is provided an electric motor 451 (see Fig. 17) mounted on the lower end of the support 417 and driving through a chain 453 a sprocket 455 (see Fig. 20) fixed to a shaft 457, the latter

extending through and being journaled in the sleeve 423. Also fixed to the shaft 457 are sprockets 459 and 461, which drive respectively sprockets 463 and 465 through chains 467 and 469, respectively, the latter-named sprockets being respectively rotatably mounted on the eccentric portions of the shafts 428 and 430. The sprockets 463 and 465 are fixed to the cutters 429 and 431, respectively. The cutters are thus driven in the same direction at the same speed.

To obtain the correct tension in the chains 467 and 469, the shafts 428 and 430 may be rotatably adjusted upon loosening the clamps 433 to vary the distances between the axes of the upper and lower pairs of sprockets, as the parts are shown in Fig. 20.

For swinging the cutters inwardly and outwardly with respect to a log supported by the feed elements 29, there is provided a pneumatic actuator 471 for each tubular support 417. The outer end of the actuator cylinder is pivotally mounted at 473 to the crosspiece 207 (see Fig. 17), and the actuator piston rod 475 is pivotally connected at 477 to the support 417 at a place between the shaft 387 and the cutters. The manner of supplying air to and discharging air from the actuator will be indicated hereinafter.

#### *Swingable bark-removing brushes*

The third pair of bark-and-cambium-layer-removing instrumentalities is best shown in Figs. 24 to 27. The primary purpose of the third set of instrumentalities is to remove the cambium layer or inner bark on a log, especially around and on a knot, branch stub, and the like; and the secondary purpose of the third set of instrumentalities is to remove any minor portions of bark on the log which have not been previously removed.

As is apparent in Figs. 2 and 24, each of the third pair of instrumentalities comprises a brush unit, one brush unit being indicated at 481 and the other brush unit being indicated at 483. Each brush unit comprises a swinging arm 485 having an offset lower portion journaled by a sleeve 486 on a shaft 487 fixed to a pair of brackets 489 fixed to the side plates 22 (see Fig. 1) on the adjacent legs of the frame sections 15 and 17. Rotatably carried by the upper end of each arm 485 is a shaft 495 having fixed to the inner end thereof a wire brush 497. Fixed to the outer end of each shaft is a sprocket 499, and driving the sprocket is a chain 501 driven by sprocket 503 fixed to the shaft of a motor 505, the latter being mounted on the lower end of the arm 485.

Referring particularly to Figs. 25 and 26, each wire brush comprises a base plate 511 having a plurality of stiff, short, heavy cable sections 513 welded in sockets or holes provided in said plate. As is apparent from Fig. 26, cable sections are not provided on the central portion of the plate, leaving a cavity or recess in the center of the brush. This cavity or recess is very important to the operation of the brushes, as it allows them to fit over and generally conform to the configuration of a knot or branch stub and thus remove the bark and cambium layer on the sides and in the area surrounding the knot or stub, these places being most difficult areas from which to remove bark and cambium layer.

For holding the wire brushes in engagement with the exterior of a log being debarked, there is provided a pneumatic actuator 521 for each wire-brush unit, the cylinder of each pneumatic actuator being pivoted at 523 to the associated cross member 207. The piston rod 525 of each pneumatic actuator is pivotally connected at 527 to the arm 485 intermediate the length thereof.

#### *Hydraulic control for the pneumatically positioned cutters and brushes*

The pneumatic actuators for the first, second, and third bark-and-cambium-layer-removing instrumentalities are adapted to be independently supplied with air under pressure in a substantially duplicate manner to cause the associated bark-and-cambium-layer-removing devices to

yieldingly but forcibly engage a log, by selective operation of a plurality of control handles provided on the control box 245. For convenience in description, the control handles have been given the same reference numerals as the instrumentalities which they control, the subscript *a* being added to distinguish between the parts (compare Figs. 2 and 12).

Referring particularly to Fig. 27, where the control arrangement for the wire-brush assembly 483 is disclosed, a description of the manner and operation of this control system will serve to indicate how the other instrumentalities, as well as the two hold-down devices 331 and 333, are operated.

A control handle 483a has fixed to its lower end a cam 535 pivotally mounted on a pivot rod 537 (see Figs. 12 and 13) fastened in the end plates 253 of the control box 245. There is a lever 539 pivoted on a pivot rod 541 secured at its ends in the end plates of the housing, one end of the lever resting on the cam 535 and the other end resting on the protruding portion of a valve member 545 forming part of a valve 547 fixed to the base 257 of the housing. A hydraulic fluid-supply line 555 (see Fig. 27) communicates with the lower end of the chamber of the valve body of the valve 547, and a hydraulic fluid-discharge conduit 551 communicates with the upper end of said chamber. A supply-and-discharge conduit 559 communicates at one end centrally with the valve chamber, and then branches to provide branch conduits 563 and 565 communicating with valve 567 and 569, respectively, which valves are of conventional construction. A compression spring 549, arranged within the valve 547, constantly urges the valve member 545 upwardly and therefore pivots the lever 539 in a direction to constantly dispose it in engagement with the cam 535.

The valve 567 has a movable valve member 571 biased upwardly by a spring 573, and the valve 569 has a movable valve member 575 constantly biased upwardly by a spring 577. It is apparent that the branch conduits 563 and 565 communicate respectively with the upper ends of the bores within which the valve members 571 and 575 travel. Suitable stops or lugs in each of the valves 567 and 569 limit upward movement of the respective valve members. Also, suitable stops are provided for limiting downward travel of the valve members.

It is evident that when hydraulic fluid is supplied through conduits 559, 563 and 565, the two valve members 571 and 575 are both forced downwardly simultaneously. In order to supply hydraulic fluid to the conduits 563 and 565, the valve member 545 is provided with a passage 581 having an enlarged right-hand portion, as the parts are depicted in Fig. 27, which is in constant communication with the conduit 559, and having an upper passage portion communicating with the conduit 551 when the valve member is in its upper position, but being cut off from communication with said conduit when said valve member is depressed. The passage 581 also has a lower leg portion which is normally out of communication with the conduit 555 but is adapted to communicate with said conduit when the valve member 545 is depressed.

Assuming that the control member 483a is in its upright position, it is apparent that the valve member 545 will be disposed in its upward position, and thus the conduit 559 is in communication with the discharge conduit 551, and thus no pressure is applied to the valve members 571 and 575, and therefore they remain in their upward positions under the influence of the springs 573 and 577, respectively. However, the control member 483a is adapted to be swung counterclockwise, as the parts are depicted in Fig. 13, to the broken-line position, which action through the cam 535 and the lever 539 depresses the valve member 545 and places the conduit 559 in communication with the supply conduit 555 so that hydraulic fluid is simultaneously supplied to the upper ends of the valve members 571 and 575, depressing said valve mem-

bers. The effect of forcing the just-mentioned valve members downwardly will now be explained.

Air under pressure from a source (not shown) is adapted to be supplied to the valves 567 and 569 through the supply conduits 585 and 587, respectively. As shown in Fig. 27, the conduit 587 normally communicates with a conduit 591 through a passage 593 formed in the valve member 575, whereas the conduit 585 is normally out of communication with a conduit 595, but is adapted to be brought into communication with the conduit 595 by a passage 597 formed in the valve member 571 when the valve member is forced downwardly. The conduit 591 communicates with the right-hand end of the cylinder for the actuator 521, whereas the conduit 595 communicates with the left-hand end of said cylinder. Formed in the valve member 571 is an exhaust passage 599 normally communicating the conduit 595 with the atmosphere through the lower end of the bore within which the valve member 571 travels. The conduit 591 is adapted to be placed in communication with a discharge or exhaust conduit 601 by a passage 603 formed in the valve member 575 when the valve member is depressed.

The operation of the control system for wire-brush unit 483 is as follows. When the machine is entirely at rest and when there is no supply of air under pressure to the valves 567 and 569, the wire-brush unit swings under the influence of gravity clockwise from the position shown in Fig. 27 toward the zone to be occupied by the log. When the air compressor for the system is energized and air is supplied to the valves 567 and 569, air under pressure traveling through the conduit 587, passage 593 and conduit 591 into the actuator will force the wire-brush unit 483 to swing counterclockwise out of the zone to be occupied by the logs. However, when at an appropriate time it is desired to bring the wire brush into forcible but yielding engagement with the log, the control handle 483a is swung counterclockwise to communicate the conduit 591 with the atmosphere and to communicate the conduit 595 with the supply of air under pressure so that the wire-brush unit is forced clockwise to bring the brush 497 into engagement with the log.

By locating the control handles in the arrangement shown in Fig. 12, it is apparent that the operator may with one hand grasp two adjacent control handles and pull them forwardly. The control handles are arranged so that the two wire-brush handles are next to one another, so that handles of the first two bark-removing instrumentalities are next to one another, and so that the handles of the second pair of bark-removing instrumentalities are next to one another. Normally, the operator will desire to bring each pair of bark-removing instrumentalities into substantially simultaneous engagement with a log, and this he may readily accomplish by pulling forward the appropriate adjacent pair of handles.

#### Summary of operation

The operation of the machine has been explained along with the description of the various assemblies and mechanisms and therefore need not be repeated in detail. However, in general, the operator will be apprised of, or will visually estimate, the size of the log to be debarked, and will shift the control handle 267 (Fig. 11) one way or the other to vary the size of the cradle such as to enable the log to move into the cradle from a fixed-level-supply arrangement, and also to provide a cradle to properly support the log. As the forward end of the log is fed into the machine, the operator will swing the control handle 125 clockwise (Fig. 9) to adjust the angular positions of the axes of rotation of the feed elements to feed the log forwardly from left to right as the parts are depicted in Fig. 2. As the forward end of the log reaches the hold-down unit 331, the operator will, normally, pull forwardly on the control handle 331a to bring the associated hold-down roller into engagement with the log.

The hold-down roller, being caster mounted, will automatically adjust itself to the helix angle of the strip of log surface passing therebeneath so as not to interfere with the forward feed of the log and yet yieldably but forcibly retain the log on the cradle. As the forward end of the log reaches the first pair of bark-cutting instrumentalities, the operator will pull forwardly on the control handles for these cutting instrumentalities to bring them into engagement with the surface of the log. The cutting heads of these units are arranged to rotate in the same direction as that of the logs, but at a higher rate of peripheral speed, and thus do not interfere with the rotative movement imparted to the log by the feed elements, and yet have relative movement to the log surface, and thus cut, tear and mutilate the bark surface, and also to some extent remove the underlying cambium layer. Because the bark-cutting-and-removing instrumentalities are all yieldably forced into engagement with the log, they will oscillate back and forth so as to accommodate irregularities in the contour of the log.

When the forward end of the log reaches the second pair of bark-cutting-and-removing instrumentalities 415 and 416, the operator will grasp the adjacent pair of control handles 415a and 416a and bring the cutting heads of the units 415 and 416 into forcible but yielding engagement with the surface of the log. These cutting heads will further cut, tear and mutilate the bark and further remove portions of the cambium layer. The second pair of bark-cutting-and-removing instrumentalities, being self-adjusting to the contour of knots, branch stubs and the like, will account in a considerable degree for the removal of back and portions of the cambium layer around these knots, branch stubs, and other irregularities including recesses in the logs.

As the forward end of the log reaches the wire-brush units, the operator will grasp the adjacent handles 481a and 483a and pull them forwardly to bring the wire brushes into yielding but forcible engagement with the surface of the log, which has now been substantially depleted or cleared of bark, although some portions of bark will remain. The wire-brush units will remove these minor portions of the bark and the cambium layer. As knots, branch stubs and the like are brought into the region of activity of the wire-brush units, the wire-brush units will fit over these knots, branch stubs and the like and completely remove the bark and cambium layer on and around such portions.

The operator will observe the progress of the log through the machine and, whenever he sees that a particular spot has not been cleared of bark and cambium layer, he may bring the control handle 125 to a neutral position to allow the various instrumentalities to operate on the uncleared portion, or may reverse the handle 125 to move the log from right to left, or rearwardly, so as to allow the bark-cutting-and-removing instrumentalities to have a second pass at the uncleared region. Many of the logs to be debarked will be successfully and entirely debarked both of bark and cambium layers on the first pass through the machine. However, one primary advantage of the present machine is that it may entirely remove the bark and underlying cambium layer from all sizes and types and configurations of logs in various conditions, such as logs which are entirely green to those which have been allowed to dry so that the bark and the cambium layer are very difficult to remove in the usual machine. When a particularly difficult log is encountered, the operator, because of the versatility of the present machine, may subject the particular difficult area to a thorough cleaning operation by holding it stationary at a bark-removing station, or by reversing the feed of the log and subjecting the particular region to several passes by particular sets of bark-removing instrumentalities.

It is pointed out that by making the peripheral speed of the cutterheads greater than that of the log, the cutterheads assist in maintaining, rather than retarding, rotation

of a log and also cause the bark to be cut into smaller pieces than would be the case were the peripheral speed slower than that of the log. This is so because at a slower speed the cutterheads would exert a hoeing action on the bark and thus the size of the pieces of bark removed would depend on the strength of the bond between the bark and the cambium layer rather than on the spacing and speed of the cutterhead teeth. By cutting the bark into smaller pieces, the bark is ready for use as fuel without being run through a hogging machine.

A further advantage of the cutterheads is that the helix angle of the cutters is arranged to assist longitudinal movement of a log through the machine. That is, the teeth cut along a diagonal path generally parallel to the spiral path of the bark traveling thereunderneath, rather than across such path. Thus the cutting action is like that of a scythe rather than that of a hoe-type pull and enables the bark to be removed without excessive tearing which would damage the useful wood fibers of the log. The provision of helical cutting teeth also prevents clogging of the heads with bark, because as bark accumulates in the grooves between the teeth, subsequent pressure by engaged bark creates forces acting on the accumulating bark urging it along the grooves and out the ends thereof.

The symmetrical disposition of the barking tools and brushes relative to the log and their engagement with the log at places above the central axis of the log tends to maintain the log on its cradle and also prevents the log from camming itself under a tool or brush and off of the cradle. Also, the working faces of the brushes are wider than the tools so that the brushes sweep across the entire spiral working paths of the tools to effectively remove loose bark and also cambium layer portions.

The advantages of the present machine have been indicated heretofore, but it is believed important to point out that it is the capability of the machine of the present invention for handling all types and kinds of logs which accounts for its success.

Having described the invention in what is considered to be a preferred embodiment thereof, it is desired that it be understood that the specific details shown are illustrative and that the invention may be carried out in other ways within the scope of the appended claims.

I claim:

1. In a log-barking machine, log-supporting means for feeding a log longitudinally along a predetermined path, and rotary wire-brush means arranged adjacent said supporting means for engagement with a log supported by said supporting means, said wire-brush means having the bark-engaging portions thereof arranged for rotation in a plane parallel to the path of travel of such log and being formed with a recess to enable the wire-brush means to conform generally to the contour of a knot or stub on a log and remove any bark and cambium layer located thereon and therearound, the axis of rotation of the rotary wire-brush means extending through a log supported by the log-supporting means whereby the recessed portion of the rotary wire-brush means may surround a knot or stub on such log.

2. In a log-barking machine, means for rotating a log, means arranged adjacent said rotating means operable to remove bark from such log, and including a pair of rotary toothed cutters, means mounting the cutters for bodily movement relative to one another and for movement toward and away from such log, and means for imparting the movement of one cutter toward and away from such log oppositely to the other cutter whereby, when one cutter rides upon a knot or stub, the other cutter is thrust inwardly to engage such log in the area surrounding such knot or stub to remove bark-and-cambium-layer material therefrom.

3. In a log-barking machine, means for supporting and rotating a log about its longitudinal axis, a self-adjusting cutter device for removing bark from such log, said device including a pair of cutters mounted for bodily movement

relative to one another and for swinging movement toward and away from such log supported by said means, and an equalizing bar articulately connected at its ends to the cutters and pivotally mounted intermediate its ends whereby movement of one cutter will be imparted oppositely to the other.

4. A log-barking machine including means for supporting a log to be debarked and feeding a log longitudinally along a predetermined path of travel, toothed bark-removing means arranged adjacent the supporting means and engageable with a log supported by said supporting means for removing at least a portion of its bark and exposing and removing part of its underlying cambium layer, and wire-brush means arranged adjacent said supporting means beyond said toothed bark-removing means, in the direction of travel of such log, and engageable with such log for removing any unremoved bark portions and cambium layer, said rotary wire-brush means being formed with a concavity to enable it to fit onto a knot or stub on a log so as to remove any bark and cambium layer located on and surrounding such knot or stub, said toothed bark-removing means including a pair of rotary toothed cutters, each being mounted for movement toward and away from a log, and means for imparting the movement of one cutter toward and away from a log oppositely to the other cutter whereby, when one cutter rides upon a knot or stub, the other cutter is thrust inwardly to engage such log in an area surrounding such knot or stub to remove bark-and-cambium-layer material therefrom.

5. In a log-barking machine, a rotary, toothed barking tool, means supporting said tool, a rotary wire brush having the bristles thereof extending generally parallel to an axis of rotation of the brush, means for supporting said brush adjacent said barking tool, means for supporting a log adjacent said toothed barking tool and said wire brush with a longitudinal axis of such log extending parallel to the axis of rotation of said toothed barking tool and normal to the axis of rotation of said wire brush, and means for independently, yiedingly urging said barking tool and said wire brush toward said log, said barking tool having a plurality of independent, separate, circumferentially spaced barking teeth.

6. In a log-barking machine, a barking-tool support, a pair of rotary log-barking tools, means mounting the tools on said support for relative bodily swinging movement about a common axis, means interconnecting said tools with said support and being operable positively to cause the swinging movement of one tool about said axis to be transmitted oppositely to the other tool, means for supporting a log adjacent said barking tools, and means for forcing said tools toward such log.

7. In a log-barking machine, a barking-tool support, a pair of rotary log-barking tools, means mounting the tools on said support for relative bodily swinging movement about a common axis, means interconnecting said tools with said support and being operable positively to cause the swinging movement of one tool about said axis to be transmitted oppositely to the other tool, means for supporting a log adjacent said barking tools, means for forcing said tools toward such log, and power means for driving said tools including elements mounted for rotation about said axis and being drivingly connected with said tools.

8. In a log-barking machine, a barking-tool support, a pair of rotary log-barking tools, means mounting the tools on said support for relative bodily swinging movement about a common axis, means interconnecting said tools with said support and being operable positively to cause the swinging movement of one tool about said axis to be transmitted oppositely to the other tool, means for supporting a log adjacent said barking tools, means for forcing said tools toward such log, said barking tools having teeth therearound, said log-supporting means supporting such log with its longitudinal axis extending

parallel to the axis about which the tools swing, a rotary wire brush having the bristles thereof extending generally parallel to the axis of rotation of the brush, means for supporting said brush adjacent said barking tools with the axis of rotation of the brush arranged normal to such axis of such log, said brush having a central recess of a relatively small size compared to diameters of logs to be debarked whereby the recessed portion of the brush will approximately fit over knots and stubs on such logs, and means for feeding a log in a direction so that the barking tools first engage such log whereby the barking tools perform a preliminary barking operation on and around any such stubs and knots and said wire brush finishes such barking operation.

9. In a log-barking machine, a stationary elongated horizontal frame, a pair of horizontal parallel feeding means supported by and extending lengthwise of said frame, said feeding means being spaced from one another by distance less than the diameter of a log to be debarked so as to engage the underside of such log and form a cradle for supporting such log, said feeding means being operable to rotate such log and to feed such log in lengthwise fashion longitudinally of said frame along a predetermined path, a pair of power-driven rotary barking tools mounted on said frame on the opposite sides of and in symmetrical relation to said path for independent movement toward and away from such log for engagement with opposite sides of such log to remove bark and a portion of cambium layer from such log, yieldable means for independently yieldingly pressing said tools against such log so that if one of said tools engages a knot or stub it may yield so as to lessen the tendency of the tool to dislodge such log from its cradled position on said feeding means, said tools being positioned to engage opposite sides of such log at places above the central axis thereof and said yieldable means applying equal force to said tools so as to tend to maintain such log on said feeding means and to hold such log down against said feeding means, a pair of wire-brush means mounted and positioned on said frame in a fashion similar to that of said tools and located beyond said tools, in the direction in which such log is advanced along said path, for removing loose bark and cambium layer portions from such log while tending to maintain such log in its cradled position on said feeding means.

10. In a log-barking machine as specified in claim 9 in which said tools are rotatable about axes parallel to said path so as to engage such log along spiral paths, and in which said wire-brush means are rotatable about axes extending toward said path and have bristles extending

in the same direction so that said wire-brush means operate and sweep across the spiral working paths of said tools and effectively remove loose bark and cambium layer.

11. In a log-barking machine as specified in claim 10 in which the diameter of the working face of each wire-brush means is larger than the width of a tool so as to make certain that the edges as well as the central portions of the spiral working paths of the tools are operated on and swept across by the working faces of the wire-brush means.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|    |            |               |                |
|----|------------|---------------|----------------|
| 15 | Re. 23,765 | Pauley et al. | Jan. 5, 1954   |
|    | 675,282    | Kline         | May 28, 1901   |
|    | 735,793    | Moreau        | Aug. 11, 1903  |
|    | 1,300,748  | Lombard       | Apr. 15, 1919  |
|    | 1,379,768  | Larson        | May 31, 1921   |
| 20 | 1,456,328  | Moravec       | May 22, 1923   |
|    | 1,855,577  | Kirkland      | Apr. 26, 1932  |
|    | 1,887,908  | Tidblad       | Nov. 15, 1932  |
|    | 1,986,707  | Bezner        | Jan. 1, 1935   |
|    | 1,986,708  | Bezner        | Jan. 1, 1935   |
| 25 | 2,165,097  | Fuller        | July 4, 1939   |
|    | 2,230,336  | Taylor et al. | Feb. 4, 1941   |
|    | 2,305,281  | Taylor et al. | Dec. 15, 1942  |
|    | 2,401,500  | Ockfen        | June 4, 1946   |
|    | 2,505,168  | Augustin      | Apr. 25, 1950  |
| 30 | 2,540,994  | Rogers        | Feb. 6, 1951   |
|    | 2,576,127  | Leffler       | Nov. 27, 1951  |
|    | 2,601,261  | Carpenter     | June 24, 1952  |
|    | 2,626,717  | Kraner        | Jan. 27, 1953  |
|    | 2,630,848  | Edwards       | Mar. 10, 1953  |
| 35 | 2,641,289  | Merrifield    | June 9, 1953   |
|    | 2,646,092  | Kolpe et al.  | July 21, 1953  |
|    | 2,652,867  | Boswell       | Sept. 22, 1953 |
|    | 2,667,978  | Pridy         | Feb. 2, 1954   |
|    | 2,669,266  | Bouchard      | Feb. 16, 1954  |
| 40 | 2,671,480  | Efurd et al.  | Mar. 9, 1954   |
|    | 2,675,035  | Carpenter     | Apr. 13, 1954  |
|    | 2,688,349  | Nicholson     | Sept. 7, 1954  |

##### FOREIGN PATENTS

|    |         |         |               |
|----|---------|---------|---------------|
| 45 | 108,230 | Germany | Jan. 20, 1900 |
|    | 136,210 | Germany | Nov. 22, 1902 |
|    | 13,472  | Norway  | Nov. 7, 1904  |
|    | 293,461 | Germany | Aug. 12, 1916 |
|    | 121,038 | Sweden  | Mar. 2, 1948  |
| 50 | 475,928 | Italy   | Nov. 22, 1952 |