June 12, 1956 M. S. LEAGUE 2,749,952

LOG DEBARKER HAVING REVOLVING KNIVES SIMULTANEOUSLY SWINGABLE BY DIFFERENTIAL-TYPE PLANETARY-GEAR-TRAIN

Filed Aug. 31, 1954 2 Sheets-Sheet 1

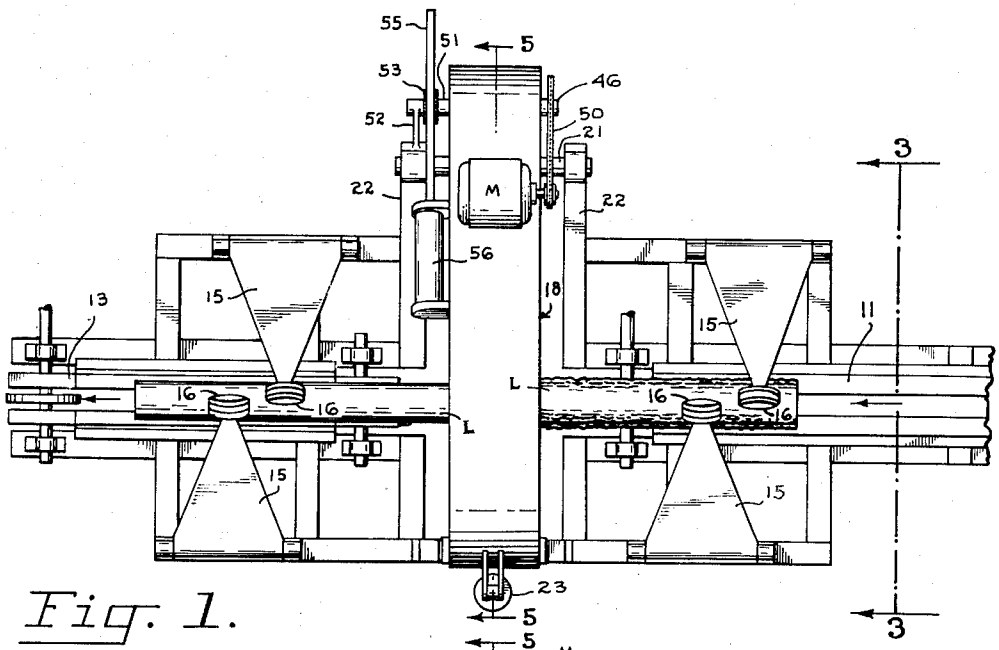

Fig. 1.

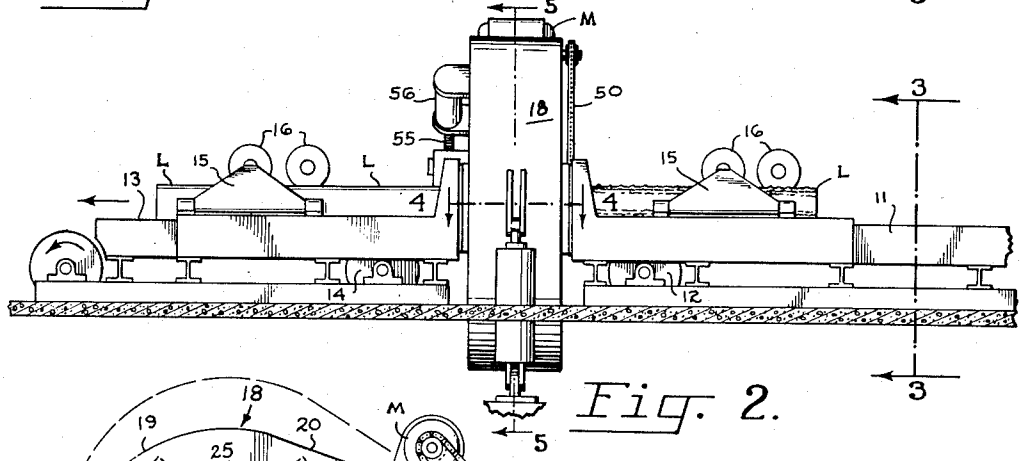

Fig. 2.

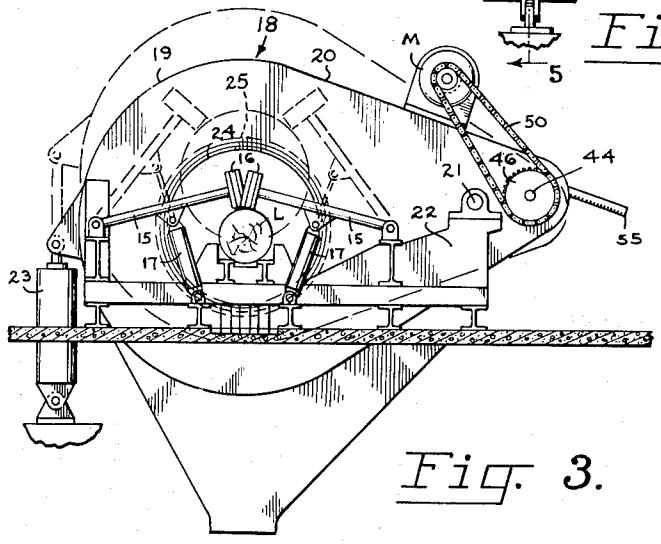

Fig. 3.

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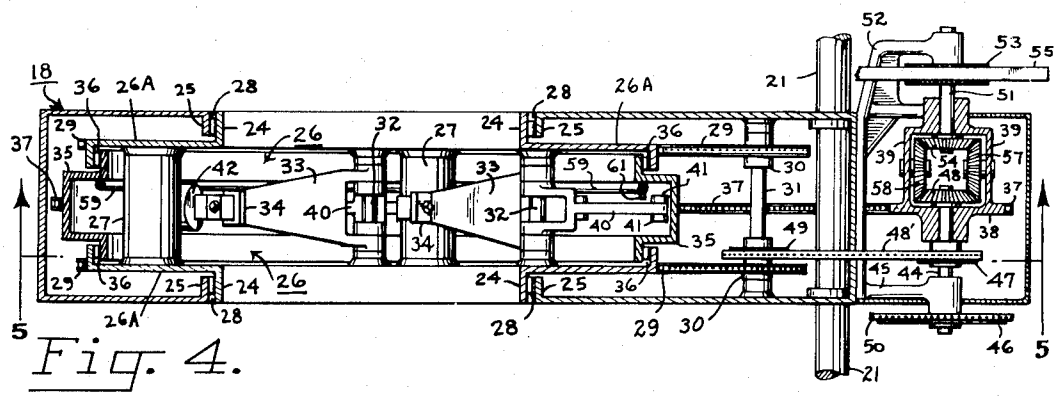

Fig. 4.

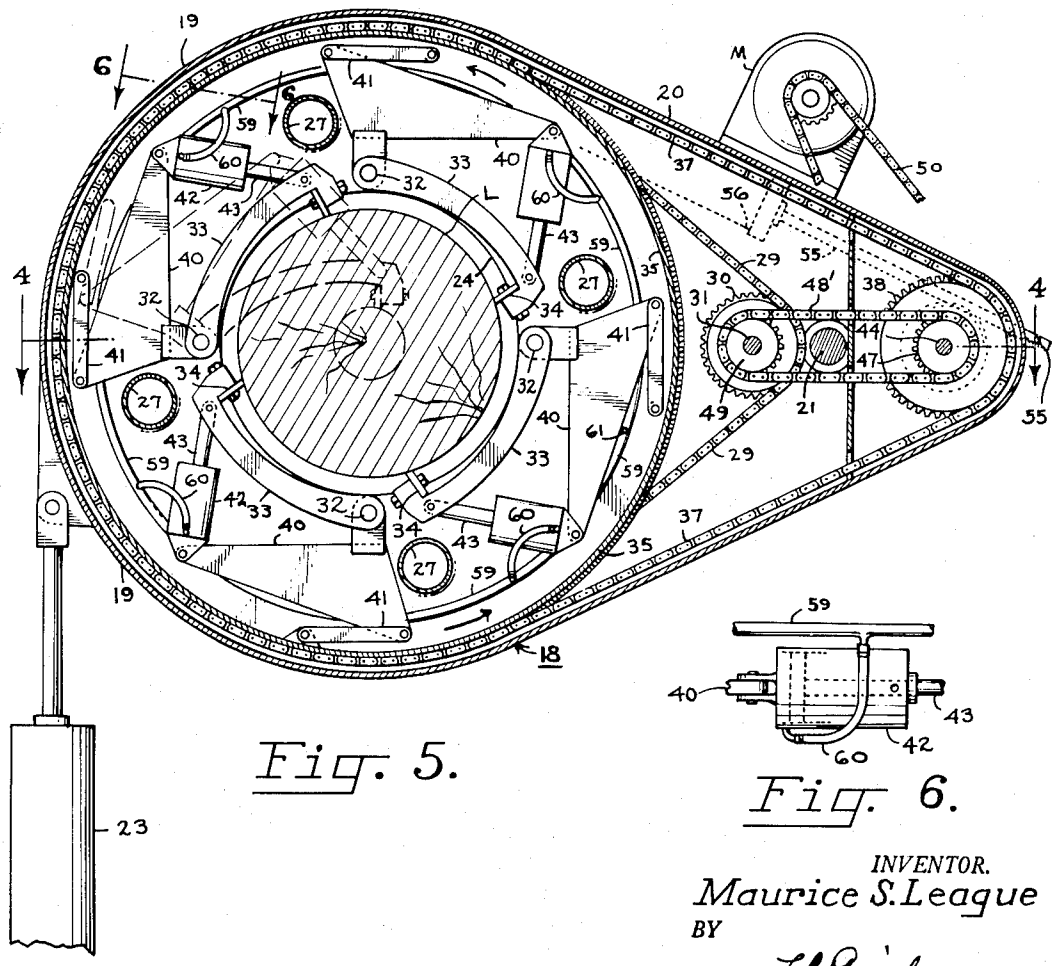

Fig. 5.

Fig. 6.

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United States Patent Office 2,749,952 Patented June 12, 1956

2,749,952

LOG DEBARKER HAVING REVOLVING KNIVES SIMULTANEOUSLY SWINGABLE BY DIFFERENTIAL-TYPE PLANETARY-GEAR-TRAIN

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Application August 31, 1954, Serial No. 453,330

5 Claims. (Cl. 144—208)

This invention relates to the removal of bark from logs, commonly referred to as the debarking of logs, and relates more specifically to the mechanical debarking of logs as distinguished from the removal of bark from logs by hydraulic means.

In most log-debarking devices, and this is true in most hydraulic debarking devices as well as in most mechanical debarkers, the log is required to be rotated during the debarking operation and also the log at the same time must either be moved longitudinally through the debarking apparatus or else the debarking means must travel longitudinally with respect to the rotating log. The requirement of rotating the log while the log is being debarked not only necessitates special means for centering and gripping the ends of the log and then using such means for supporting and rotating the log, but it also necessitates special care and attention and loss of time in order to secure proper positioning of the log in such supporting and rotating means. Furthermore, when logs are bowed instead of being straight, or when they are extremely irregular in shape and surface, the rotating of the log may add to the difficulty of obtaining thorough and satisfactory removal of all the bark.

An important object of the present invention is to provide an improved log-debarking machine in which no rotation of the log will be required.

A related object of the invention is to provide such a log-debarking machine in which the log will be moved longitudinally in a convenient manner through the debarking means without requiring any special care for handling or positioning the log in the course of the debarking operation.

Inasmuch as the logs will vary in size and diameter, and also since there may be considerable diameter variation and surface variation, or surface irregularities, in an individual log, a further object of this invention is to provide an improved log-debarking device which will be adjustable for logs of any diameter within a reasonable range, and which also will automatically adjust itself to accommodate any irregularities in the log surface.

In the debarking of logs, it is desirable, of course, to remove the bark without removing any excessive amount of surface wood beneath the bark. Since the thickness and toughness of the bark may vary with different logs as well as with different types of logs, an additional object of the present invention is to provide an apparatus employing mechanical debarking knives or members in which the engaging pressure of such debarking knives against the log surface can be easily regulated and adjusted in order to prevent excessive penetration into the log beyond the depth to which the bark layer extends.

A still further object of this invention is to provide an apparatus capable of debarking logs mechanically which will not be excessively complicated in construction or expensive to produce and operate, and the operation of which will not call for the exercise of unusual care or skill.

The way in which these objects and other incidental advantages are achieved with the present invention, and the manner in which my improved debarking apparatus may be constructed, and its method of operation, will be explained in the course of the following brief description with reference to the accompanying drawings.

In the drawings, which are more or less diagrammatic:

Figure 1 is a top plan view of my debarking machine showing a log in the process of having the bark removed;

Figure 2 is a corresponding side elevation of the same machine;

Figure 3 is an end elevation of the machine taken on line 3—3 of Figures 1 and 2;

Figure 4 is an enlarged plan section taken on line 4—4 of Figure 2, the section line 4—4 being indicated also in Figure 5;

Figure 5 is an enlarged sectional elevation taken on line 5—5 of Figures 1 and 2, the section line 5—5 being indicated also in Figure 4; and

Figure 6 is a fragmentary enlarged section on line 6—6 of Figure 5.

Referring first to Figures 1, 2 and 3, each log L to be debarked is delivered to the debarking machine by being moved longitudinally along a trough of guideway 11. The guideway has an open slot along the bottom and driven, log-engaging wheels, one of which is shown at 12 in Figure 2, having teeth on their peripheries and so positioned as to contact the underside of a log through the slot in the guideway, move the log into the bark-removing section of the machine. A second guideway 13, similar to and in longitudinal alignment with the guideway 11, is located on the opposite side of the bark-removing section and similarly toothed, log-engaging wheels 14, cooperate in moving the log L through the bark-removing section and thence on and away from the machine.

In order to hold the log L steady in the guideways 11 and 13 as it is moved longitudinally through the bark-removing section of the machine, pairs of hinged arms 15, alternately hinged to the opposite sides of the machine frame, as shown in Figure 1, extend to the top of the log and carry rotatable log-engaging wheels 16 which bear down on the top of the log. Each hinged arm 15 is adjustably controlled by an air piston and cylinder, diagrammatically indicated at 17 in Figure 3, so that the arms can accommodate logs of different diameters and at the same time exert desired downward holding pressure on the logs as the logs are moved successively through the debarking section of the machine.

The bark-removing section of the machine is located within a housing which is indicated in general by the reference character 18. This housing has a peripheral wall, one half 19 of which is semicircular and a half portion 20 of which (see also Figure 5) is elongated or extended laterally toward the opposite side of the machine. The housing 18 is hingedly mounted for limited up and down vertical adjustment and is hinged on a shaft 21 (Figures 1 and 3). The hinge shaft 21 is supported at its ends on stationary brackets 22 constituting part of the machine frame.

The semicircular or opposite end of the housing 18 is supported by a hydraulic piston and cylinder 23 which enable the position of the housing 18 to be adjusted vertically. This housing is completed by a pair of identical vertical side walls or flanges which have central circular aligned openings concentric with axially aligned annular flanges 24 of an interior rotating element 26, these openings also being concentric with the circular portion 19 of the housing periphery. These annular flanges 24 in the circular openings in the side walls of the housing 18 are larger in diameter than the diameter of the largest logs which will be debarked and thus are large enough to enable any logs to pass through the interior rotating element 26 and thus through the housing 18. The housing

18 is so positioned that the center of the circular portion 19 and the center of the annular flanges 24 will coincide with the axis of the average-sized log to be debarked. Then, for larger or smaller logs, the housing 18 is raised or lowered a short distance through the intermediary of the hydraulic piston and cylinder 23 so as to bring the center line of the openings approximately close to the axis of such larger or smaller logs.

An inturned annular flange 25 (Figure 4) extends around each of the circular openings in the side walls of the housing 18. The annular flanges 24 are formed on a pair of duplicate rings 26A, 26A, which are secured together in spaced relationship by connecting members 27 to which they are rigidly welded, and constitute the interior integral rotating element 26 which is rotatably mounted within the housing 18 on two sets of suitable bearings indicated at 28, 28 in Figure 4.

The outer peripheries of the companion flanged rings 26A, 26A, are formed with teeth for engagement with a pair of identical endless sprocket chains 29, 29, which chains pass around identical sprocket wheels 30, 30 secured on a driven shaft 31 (Figures 4 and 5). The ends of this driven shaft 31 are supported in suitable bearings in the side walls of the housing 18. The shaft 31, and with it the sprocket wheels 30, 30, is driven through the intermediary of means which will be explained later and this driving of the shaft 31 produces rotation of the rotating elements 26 within the housing 18.

The rotating element 26 carries a plurality of symmetrically arranged cross shafts 32 (Figures 4 and 5). In the machine as illustrated, there are four such cross shafts 32 and consequently these are spaced 90° from each other in the rotating element 26. Corresponding knife-carrying arms 33 are pivoted on these cross shafts 32 respectively. Bark-removing cutters or scraper knives 34 are carried on the free ends of these arms 33.

An inner ring member 35, formed with an annular radially-extending channel and with an annular outwardly-extending flange on each side, as shown in Figure 4, is rotatably supported within the rotating elements 26 on two similar sets of bearings indicated at 36, 36. The outer periphery of this ring member 35 carries teeth for engagement with an endless sprocket chain 37. This sprocket chain passes around an external sprocket 38 formed on a rotated gear cage 39 as later explained.

A triangular-shaped lever 40 (Figure 5) is also pivotally supported on each cross shaft 32, such pivotal mounting serving as the fulcrum point for the lever. One end of each lever 40 is connected by a link 41 with the inner ring member 35. The other end of each lever 40 is connected with the movable end of the corresponding knife-carrying arm 33 through the intermediary of an air-cushioning cylinder 42 and piston 43. From Figure 5 it will now be apparent that a slightly partial rotation of the inner ring member 35 with respect to the rotating element 26 (thus, a slight rotation clockwise as viewed in Figure 5) will cause the ends of the knife-carrying arms 33 and their cutter knives 34 to move inwardly and thus to engage logs of smaller diameter, while relative opposite rotation of the inner ring member 35 with respect to the rotating element 26 will produce opposite adjustment of the knife-carrying arms and cutter knives.

The means by which the position of the inner ring member 35 with respect to the rotating element 26 is changed, and the means by which both are rotated ordinarily in unison, will now be described. On a shaft 44, which is rotatably supported in a suitable bracket 45 (Figure 4) carried by the housing 18, an outer drive sprocket 46, an inner sprocket 47 and a bevel gear 48 are keyed. The sprocket 47 is connected by an endless chain 48' with a sprocket 49 of identical size which is keyed on the shaft 31. The outer drive sprocket 46 is driven by an electric motor M through the intermediary of sprocket chain 50. (See also Figures 1 and 2.)

A second shaft 51 (Figure 4) is rotatably mounted in a suitable bracket support 52 in axial alignment with the shaft 44. A pinion 53 and an inner bevel gear 54 are keyed on the second shaft 51. A pinion rack bar 55, connected to a piston in a hydraulic cylinder 56 (Figure 1) engages the pinion 53 and acts to prevent rotation of the pinion 53, shaft 51 and bevel gear 54 except momentarily when the pinion rack bar 55 is adjusted through the intermediary of the hydraulic piston and cylinder.

The gear cage 39 (Figure 4) is rotatably supported on the aligned shafts 44 and 51 and carries the oppositely-positioned bevel gears 57 and 58 which are in mesh with the gears 48 and 54 at all times. The gears 48, 54, 57 and 58 are identical.

It will be evident from Figures 4 and 5 that the rotation of the shaft 44, driven by the motor M through the medium of sprocket chain 50 and sprocket wheel 46, will cause rotation of the rotating element 26, since the shaft 31 is connected with the shaft 44 through the intermediary of the sprockets 47 and 49 and the sprocket chain 48'. Since the sprockets 47 and 49 are identical in size the shafts 44 and 31 are driven in unison. The gear ratios between the sprockets 30 on the shaft 31 and the external sprockets on the rotating element 26, to which the sprocket chains 29 are connected, are half the size of the gear ratio between the external sprocket 38 on the gear cage 39 and the external sprocket on the inner ring member 35, to which the sprocket chain 37 is connected. Rotation of the shaft 44 and bevel gear 48, while the shaft 51 and bevel gear 54 are held against rotation, will result in rotation of the gear cage 39, and in a differential-type of planetary-gear-train such as this, such rotation will always be at half the speed of the bevel gear 48 and shaft 44. Consequently the inner ring member 35, which is driven from the sprocket 38 by the chain 37, will rotate at the same speed as the rotating element 26 driven by the chains 29 from the sprockets 30. Thus, as long as the position of the pinion rack bar 55 is not changed during such rotation, the inner ring member 35 and the rotating element 26 rotate in unison, and in a counterclockwise direction, as indicated by the arrows in Figure 5, but any change of position of the rack bar, causing momentary movement of the pinion 54, will adjust the position of the inner ring member 35 with respect to the rotating element 26 and move the cutter knives either inwardly or outwardly depending upon the direction in which the rack bar 55 is adjusted. Such adjustment of the rack bar can be made at any time regardless of whether the rotating element 26 and the ring member 35 are rotating or not.

The air cylinders 42 and pistons 43, by which the working ends of the knife-carrying arms 33 are connected with the adjusting levers 40, serve as cushioning or resilient connecting elements for the purpose of enabling the cutter knives 34 to accommodate themselves to irregularities in the surface of the log which is being debarked. It will be appreciated that, if no provision were made for any such cushioning or resilient accommodation of the knives to surface irregularities in a log, considerable excess of wood would have to be removed in the course of the debarking operation and there would also be increased strain and vibration imposed on the entire debarking machine.

A pipe ring 59 has flexible hose connections 60 with the cylinders 42. The pipe ring 59 is provided with a charging valve 61, similar to an automobile tire valve, which enables the pipe ring, and therewith the cylinders 42, to be charged with air from any suitable source at a desired pressure, thus for example at a pressure of 30 lbs. per square inch. A gauge (not shown) can, if desired, be mounted on the pipe ring 59 as a convenience in having a desired air pressure maintained in the cylinders 42.

I claim:

1. In a log-debarking machine of the character described, a rotatable assembly, means for rotating said

assembly, a plurality of corresponding arms pivotally mounted in said assembly for pivotal movement towards and away from an axis of rotation of said assembly, bark-removing elements on said arms, a ring member rotatably carried by said assembly and rotatable with said assembly on said axis of rotation, means normally rotating said ring member in unison with said assembly, linkage connecting said arms to said ring member for positioning the bark-removing elements at desired radial distances from said axis of rotation, means in said ring-member-rotating means for momentarily causing said ring member to rotate at a different speed from said assembly, whereby said linkage will move said arms on their pivotal mountings and thereby change the radial distances of said bark-removing elements from said axis of rotation of said assembly and said ring, and means for moving a log longitudinally through said assembly.

2. In a log-debarking machine of the character described, a rotatable assembly, means for rotating said assembly, a plurality of corresponding arms pivotally mounted in said assembly for limited pivotal movement in paths containing a substantially vertical plane, bark-removing elements on inner ends of said arms, an inner ring member rotatably carried by said assembly and rotatable with said assembly on a common axis, means normally rotating said ring member in unison with said assembly, linkage connecting said arms to said ring member for positioning the bark-removing elements at desired radial distances from said common axis, means in said ring-member-rotating means for momentarily causing said ring member to rotate at a different speed from said assembly, whereby said linkage will move said arms on their pivotal mountings and thereby change the radial distances of said bark-removing elements from said common axis of rotation of said assembly and said ring, and means for moving a log longitudinally through said assembly.

3. In a log-debarking machine, a housing, a rotatable assembly supported in said housing, means for rotating said assembly, a plurality of corresponding arms pivotally mounted in said assembly for pivotal movement towards and away from an axis of rotation of said assembly, bark-removing knives on said arms, a ring member rotatably carried by said assembly and rotatable with said assembly on said axis of rotation, means normally rotating said ring member in unison with said assembly, linkage connecting said arms to said ring member for positioning the bark-removing knives at desired radial distances from said axis of rotation, means in said ring-member-rotating means for momentarily causing said ring member to rotate at a different speed from said assembly, whereby said linkage will move said arms on their pivotal mountings and thereby change the radial distances of said bark-removing knives from said axis of rotation of said assembly and said ring, means for moving a log longitudinally through said assembly, and resilient means included in said linkage to enable said arms and bark-removing knives to accommodate themselves to log-surface irregularities while a log is being moved through said assembly.

4. In a log-debarking machine, a housing, a rotatable assembly supported in said housing, means for positioning said housing along a substantially vertical path, means

for rotating said assembly, a plurality of corresponding arms pivotally mounted in said assembly for limited pivotal movement in paths containing a substantially vertical plane, bark-removing knives on inner ends of said arms, an inner ring member rotatably carried by said assembly and rotatable with said assembly on a common axis, means connected to said assembly-rotating means for normally rotating said ring member in unison with said assembly, linkage connecting said arms to said ring member for positioning the bark-removing knives at desired radial distances from said common axis, means in said ring-member-rotating means for momentarily causing said ring member to rotate at a different speed from said assembly, whereby said linkage will move said arms on their pivotal mountings and thereby change the radial distances of said bark-removing knives from said common axis of rotation of said assembly and said ring, means for moving a log longitudinally through said assembly, and air cylinders and pistons included in said linkage to enable said arms and bark-removing knives to accommodate themselves to log-surface irregularities while a log is being moved through said assembly.

5. A log-debarking machine, including a housing, a rotatable assembly supported in said housing, means for positioning said housing along a substantially vertical path, means for rotating said assembly, a plurality of corresponding arms pivotally mounted in said assembly for limited pivotal movement in paths containing a substantially vertical plane, bark-removing elements on said arms, a ring member rotatably carried by said assembly and rotatable with said assembly on a common axis, means connected to said assembly-rotating means for normally rotating said ring member in unison with said assembly, linkage connecting said arms to said ring member for positioning the bark-removing elements at desired radial distances from said common axis, means in said ring-member-rotating means for momentarily causing said ring member to rotate at a different speed from said assembly, whereby said linkage will move said arms on their pivotal mountings and thereby change the radial distances of said bark-removing elements from said common axis of rotation of said assembly and said ring, means for moving a log longitudinally through said assembly, and resilient means included in said linkage to enable said arms and bark-removing elements to accommodate themselves to log-surface irregularities while a log is being moved through said assembly.

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