

April 26, 1955

Filed June 8, 1953

H. SHUFF
WRAP-AROUND CHAIN-DRIVEN CUTTERS
FOR REMOVING BARK FROM TREES

2,707,007

6 Sheets-Sheet 1

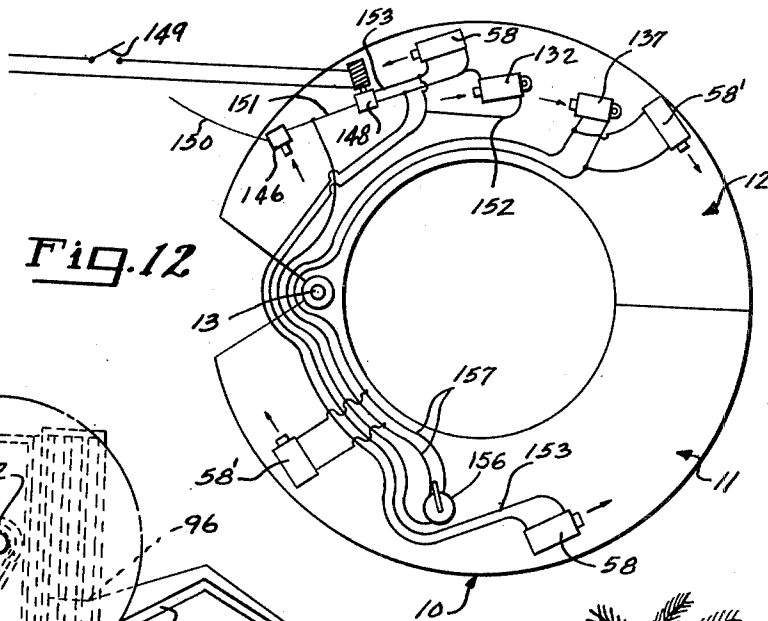


Fig. 12

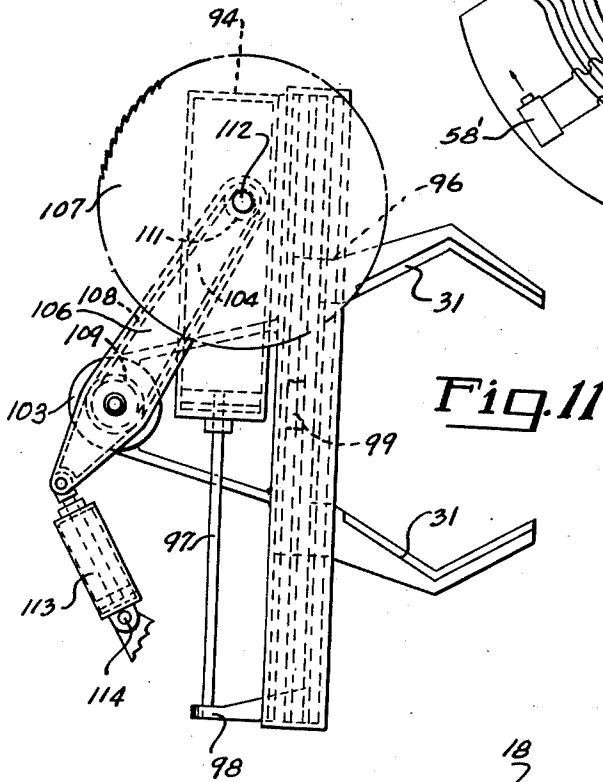


Fig. 11

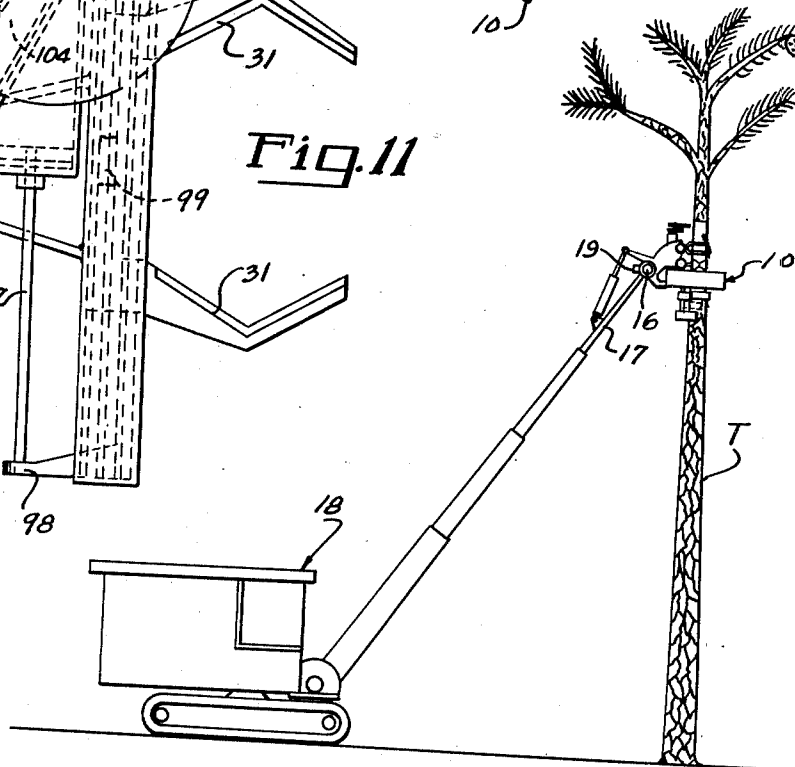


Fig. 1

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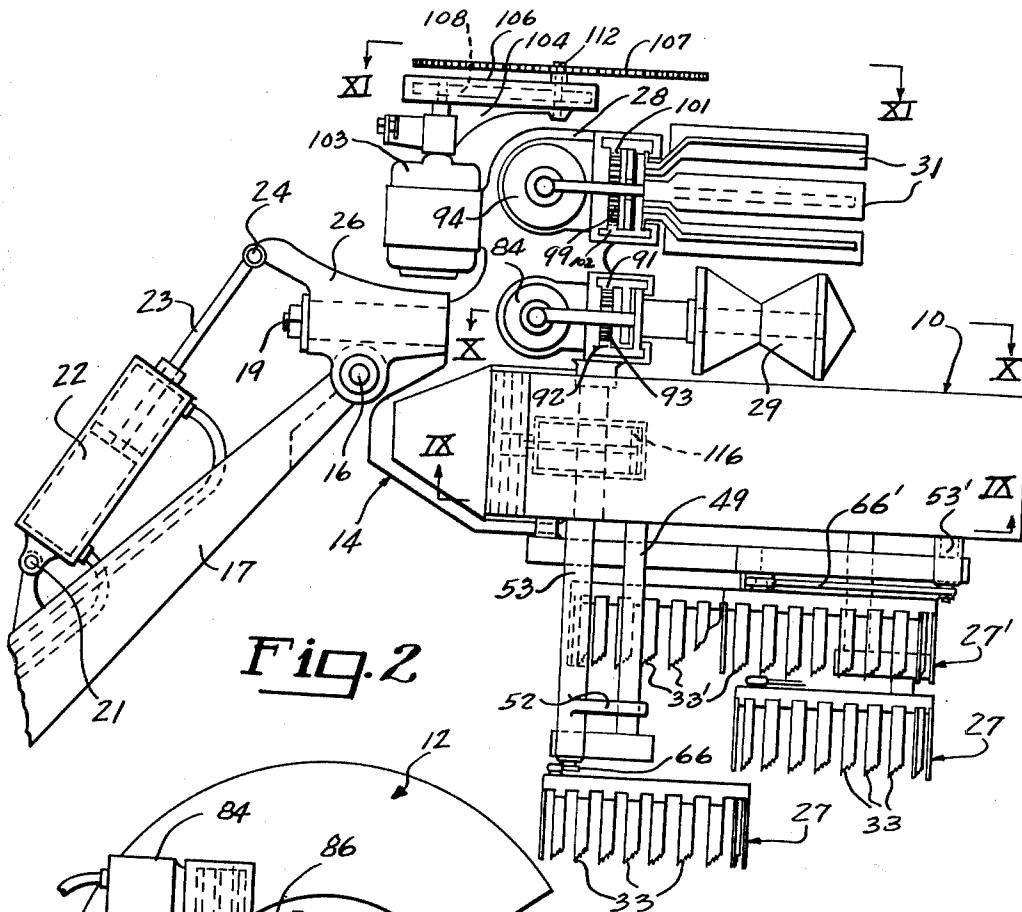


Fig. 2

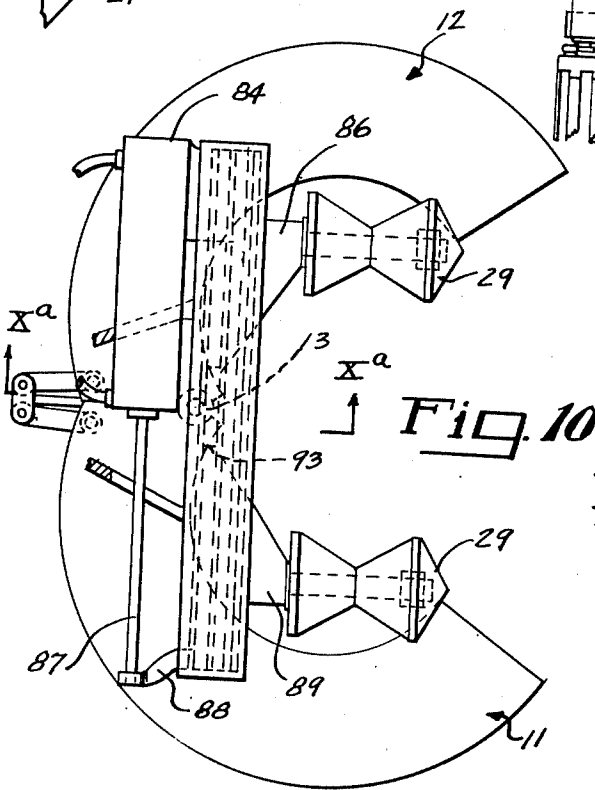


Fig. 10

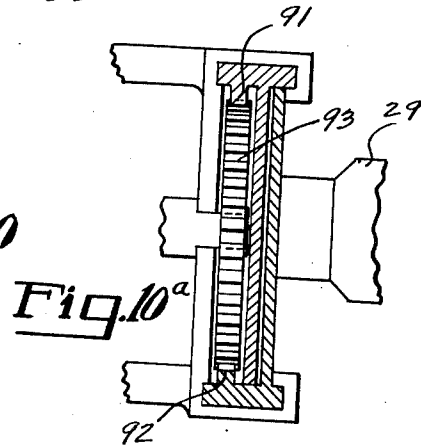


Fig. 10^a

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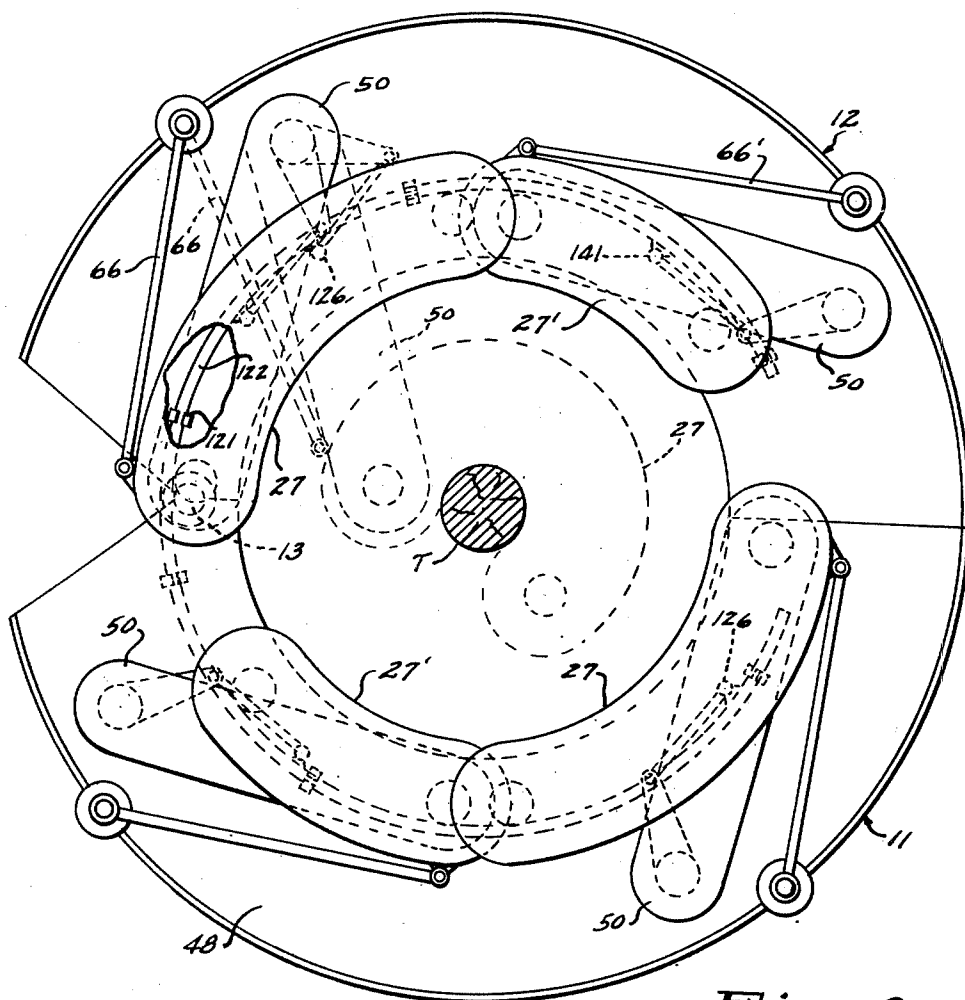


Fig. 8

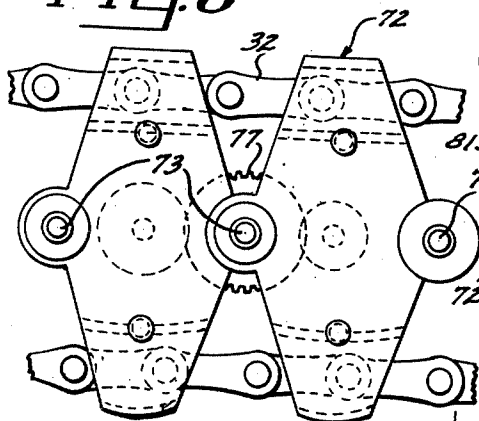
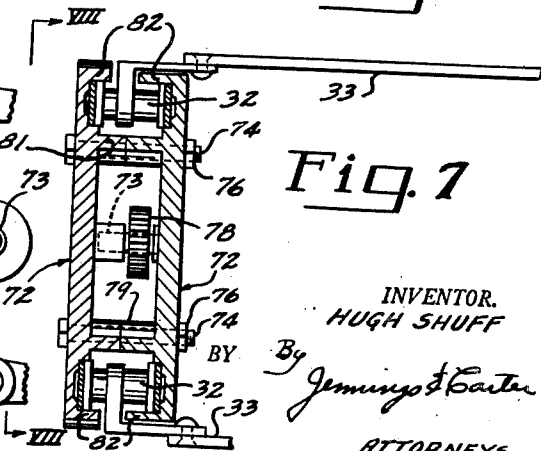


Fig. 3

Fig. 7



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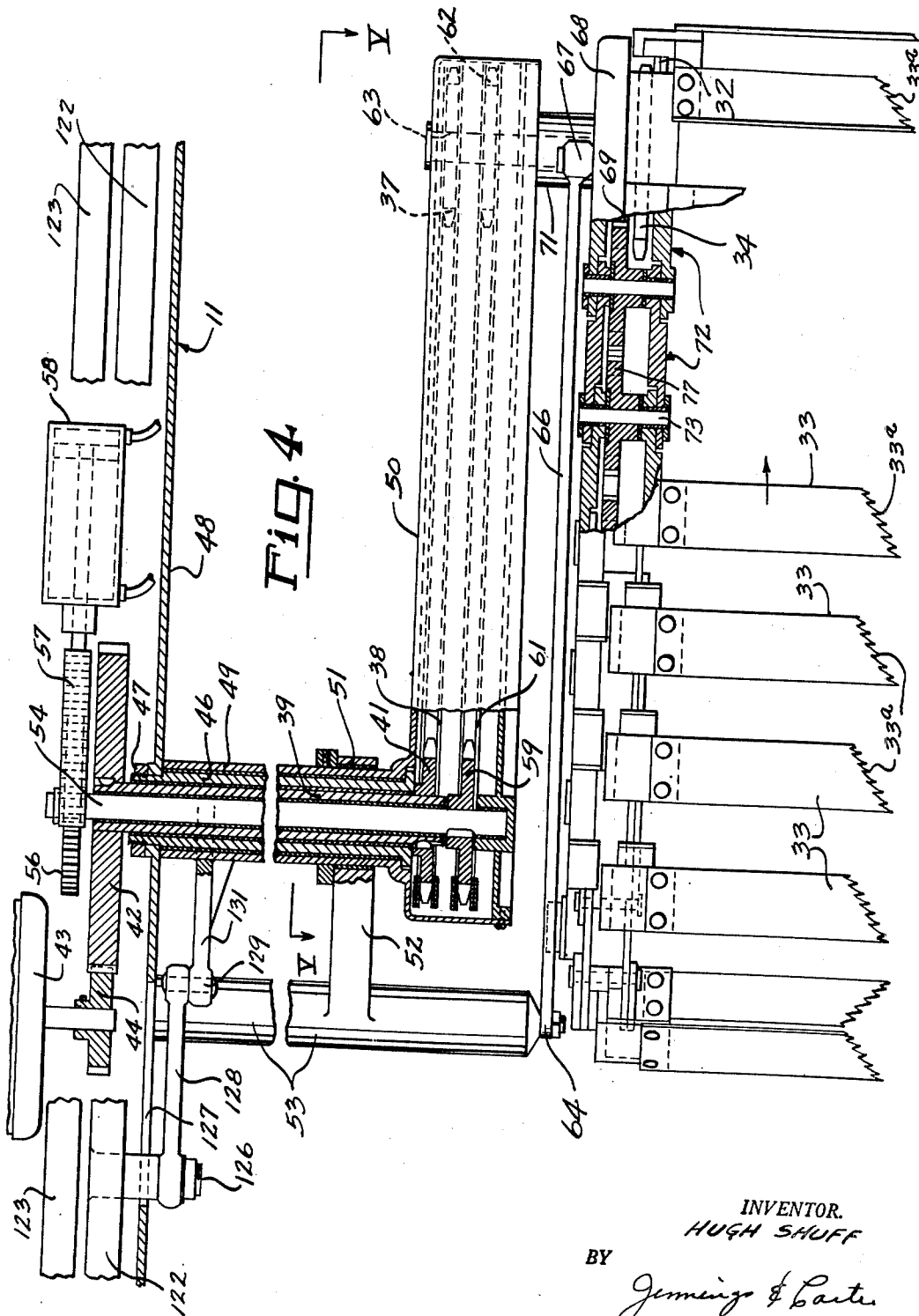
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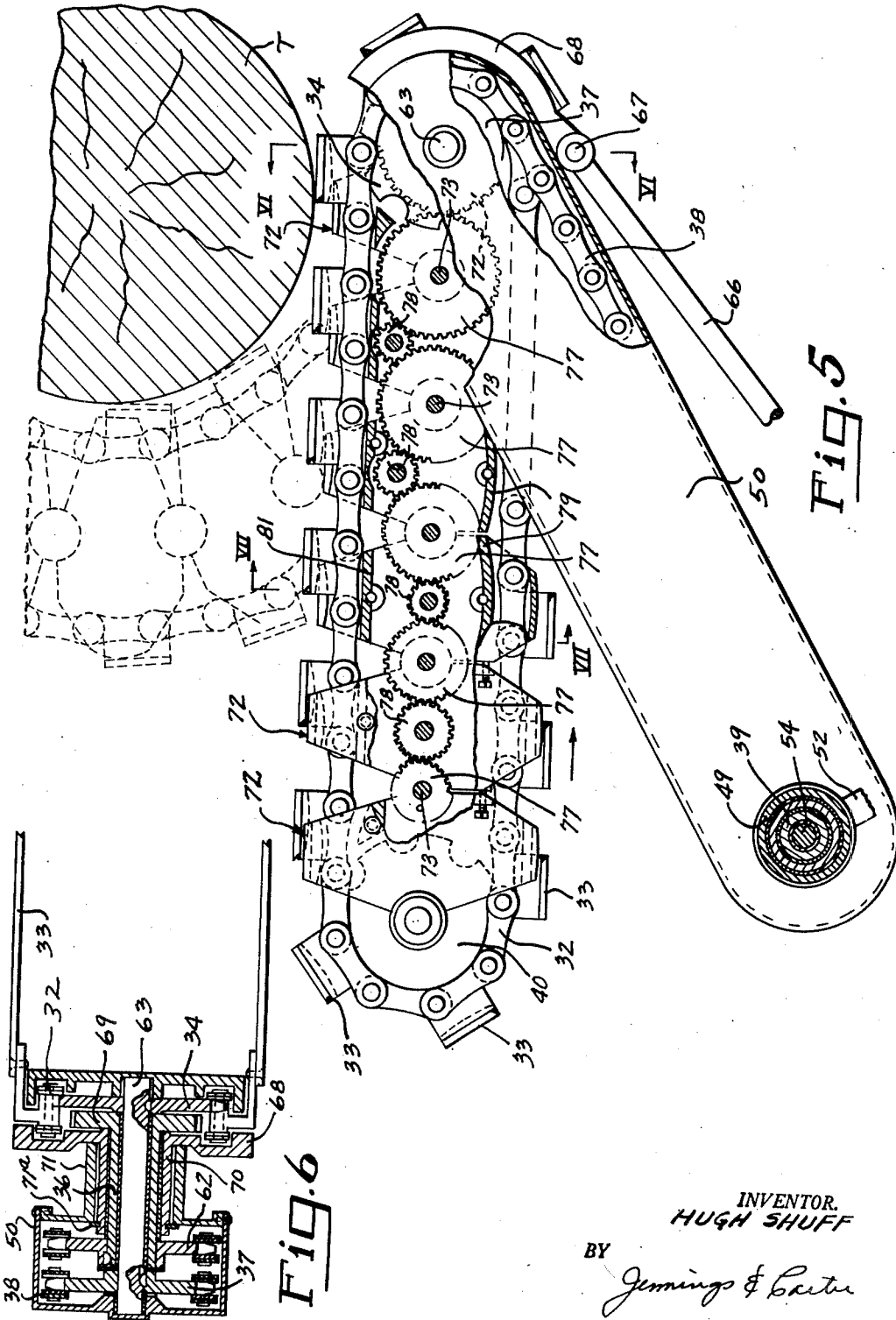
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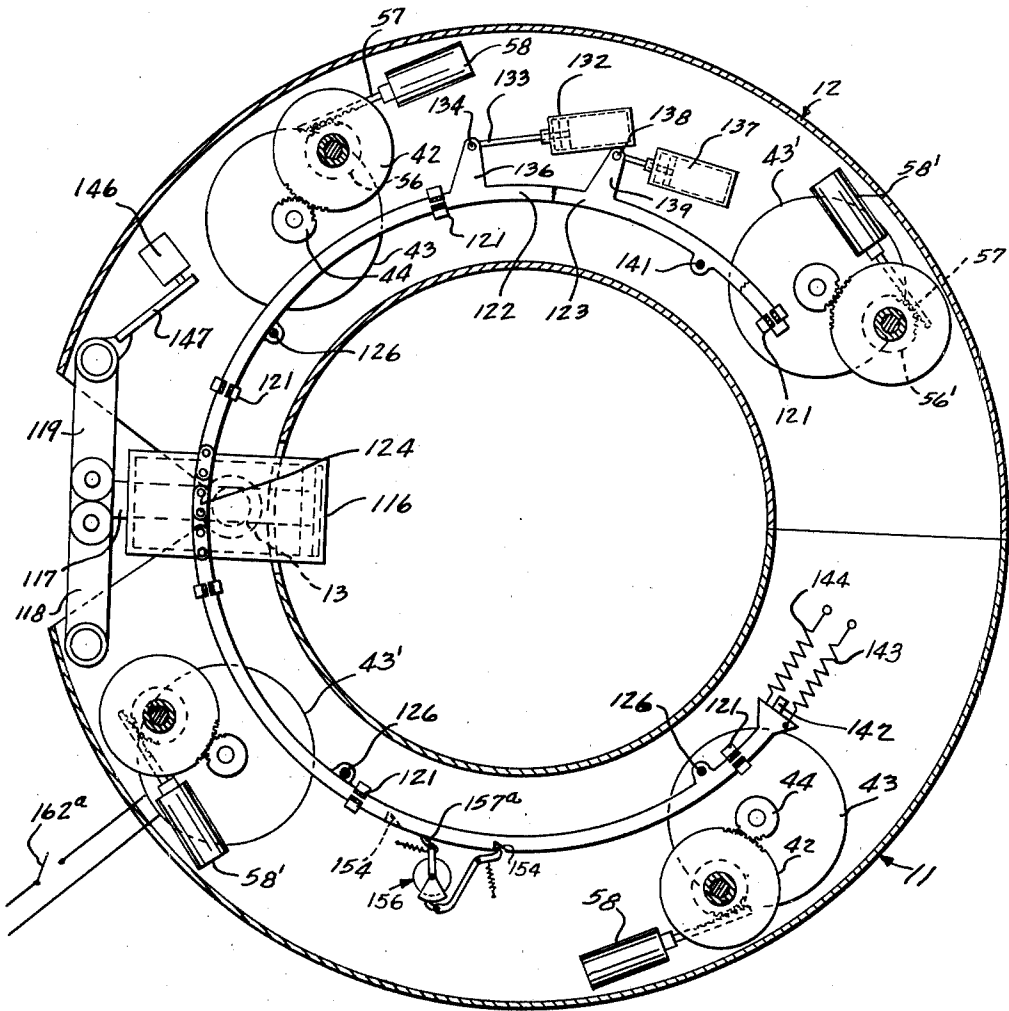


Fig. 9

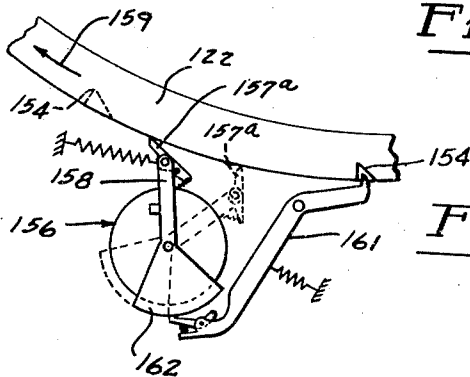


Fig. 9a

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WRAP-AROUND CHAIN-DRIVEN CUTTERS FOR REMOVING BARK FROM TREES

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Application June 8, 1953, Serial No. 360,233

8 Claims. (Cl. 144-208)

My invention relates to apparatus for removing bark and limbs from trees, especially standing trees, whereby when the trees are felled and sawed into lumber the bark-free slabs without further treatment may be used for making paper and the like.

The prime object of my invention is to provide apparatus of the character designated embodying a flexible member carrying bark-engaging cutters together with means to wrap the flexible member at least partially about the tree and to rotate the member while so wrapped about the tree, thus causing the cutters to remove the bark.

Another object is to provide means for holding the flexible member in an arc representing a portion of a circle and to hold the same yieldably in this position, thus accommodating the device to the varying diameter of the tree as it is moved along the trunk of the same.

Another object is to provide apparatus of the character designated which embodies means for centering the apparatus as a whole about the tree trunk and which also has clamp members disposed to engage and clamp the tree when desired.

A more general object is to provide apparatus for barking trees, especially standing trees, which shall be simple of construction and operation and which shall embody electric and hydraulic drive and control means easily controlled by the operator, particularly when the machine is operated from the end of a boom of a crane or the like.

My invention consists essentially of one or a plurality of cutter assemblies which may be in the form of chains mounted on a supporting, articulated, guiding frame so as to wrap partially about the tree, thus to hug the tree, the chains carrying cutters which engage the bark and remove the same. My improved apparatus includes means for driving the chains and controlling the arcuate position of the cutter assemblies. The chains and remaining mechanism may be mounted on a two-part housing, pivoted together, which has associated therewith means for opening and closing the same, thus permitting the apparatus to be placed about a tree. In order to guide the apparatus and hold the same centered, I provide guide rollers which steady the device on the tree as it is moved therealong together with means to engage and disengage the rollers. My invention further embodies a clamp on the device for tightly clamping the trunk of the tree and a cut-off saw for topping the tree. Likewise, I provide means for mounting the device on a crane boom and means for tilting the position of the entire device with respect to the crane boom, thus accommodating the same accurately to the trunk of the tree being operated upon. The chains preferably are driven by electric motors and I preferably employ a plurality of the cutter-carrying chains vertically disposed relative to each other so as to assure that the complete periphery of the tree is operated upon at one pass of the machine.

Apparatus illustrating features of my invention is shown in the accompanying drawings forming a part of this application in which:

Fig. 1 is a wholly diagrammatic side elevational view showing my invention mounted on the upper end of the boom of a crane and operating upon the trunk of a tree;

Fig. 2 is an enlarged side elevational view of the apparatus on the upper end of the boom of the crane;

Fig. 3 is a wholly diagrammatic bottom view and illustrating the relative disposition of the cutters at the various levels, one of the longer cutters being shown in full lines in tree engaging position;

Fig. 4 is a fragmental, enlarged side elevational view of

the upper portion of the apparatus, certain of the parts being broken away and in section for the sake of clarity;

Fig. 5 is an enlarged fragmental plan view taken generally along the line V—V of Fig. 4;

Fig. 6 is a detail sectional view taken along lines VI—VI of Fig. 5;

Fig. 7 is a detail sectional view taken generally along the line VII—VII of Fig. 5;

Fig. 8 is a fragmental plan view looking in the direction of arrows VIII—VIII of Fig. 7;

Fig. 9 is a somewhat diagrammatic detail bottom view looking upwardly from a plane indicated by the line IX—IX of Fig. 2;

Fig. 9a represents an enlargement of a portion of Fig. 9;

Fig. 10 is a plan view taken generally along the line X—X of Fig. 2;

Fig. 10a is a detail sectional elevation taken generally along the line Xa—Xa of Fig. 10;

Fig. 11 is a plan view of the topping saw as viewed along arrows XI—XI of Fig. 2; and,

Fig. 12 is a wholly diagrammatic bottom view of the wiring and piping.

Referring now to the drawings for a better understanding of my invention and more particularly to Fig. 1 my improved apparatus embodies a frame indicated generally at 10. The frame 10 has two parts, 11 and 12, pivoted together as at 13 for a purpose later to appear. The frame halves 11 and 12 are mounted in a yoke-like supporting frame member indicated generally by the numeral 14.

The yoke is pivotally mounted as at 16 to the upper end of the boom 17 of the crane 18. The connection 16 pivotally mounts the entire apparatus for movement about a horizontal axis. The apparatus is mounted for movement about an axis at right angles to the horizontal axis of pivot 16 on a bolt 19 which projects rearwardly from the yoke frame 14.

Pivotally mounted as at 21 on the boom 17 is a pneumatic cylinder 22. The piston rod 23 of the cylinder is pivotally connected as at 24 to an extension of a member 26 in which the bolt 19 fits and which also is pivoted at 16 to the boom. It will be apparent that when air is admitted to the ends of the cylinder 22 at the connections indicated the entire mechanism is pivoted up and down about the pivot point 16.

With reference more particularly to Fig. 2 of the drawing it will be seen that the apparatus comprises vertically staggered sets of cutters indicated generally by the numerals 27 and 27'. The two lowermost cutter assemblies 27 are relatively long as shown in Fig. 3 and are vertically staggered as shown in Fig. 2. The uppermost cutter assemblies 27' are shorter in length than the lower ones and are in the same horizontal plane. The cutters are mounted 90° from each other as shown in Fig. 3.

While there are slight differences with respect to the method of mounting the several cutter assemblies 27 and 27', for all practical purposes they are substantially the same and except to show the overall relation of the apparatus a description of one of the cutter assemblies will suffice for all. Above the frame 10, mounted on an upward extension 28 of the yoke frame 14, in a manner disposed to engage the trunk of the tree between them when the same are brought together in the manner later to appear.

Above the rollers 29 are a pair of gripper or clamp elements 31 disposed when brought together, as will be explained, to grip the tree trunk.

As best shown in Figs. 4 to 8, inclusive, the cutter assemblies 27 each embody a chain 32 carrying vertically elongated bark cutting blades or knives 33. The lowermost cutter assembly 27, that is, one of the two located furthest from the housing 10 will be described in detail, only sufficient additional detail description being given to identify the other cutters.

The chain 32 is mounted at a wrap-around end of the cutter assembly 27 on an idler sprocket 40, and at a suspended end of the cutter assembly 27, on a driven sprocket 34 mounted on a vertically disposed shaft 63. The shaft 63 extends upwardly and carries a sprocket 37 about which passes a sprocket chain 38. The sprocket chain 38 is driven by a vertically disposed, hollow shaft

39 which has keyed thereto a sprocket 41 over which the chain 38 passes. The shaft 39 projects upwardly and carries a gear 42 on the upper end thereof which is driven by an electric motor 43 through a pinion 44. The hollow shaft 39 is mounted in a suitable bearing 46 in turn mounted by means of a nut 47 into the lower wall 48 of the housing section 11. Surrounding the bearing 46 is an outer sleeve 49, secured to the top of a housing 50 enclosing the chain 38 and which is mounted for rotation in a bearing 51 carried on the end of a bracket 52. The bracket 52 in turn is supported by a depending column member 53 welded to the underside 48 of the housing section 11.

Inside the hollow shaft 39 is a shaft 54 which carries at its upper end a pinion 56 in mesh with a rack 57 operated by the piston rod of a pneumatic cylinder 58. On the lower end of shaft 54 is keyed a sprocket 59 over which passes a sprocket chain 61. The sprocket chain in turn passes over a sprocket 62 which is mounted on a shaft 36 which surrounds the shaft 63.

Pivotaly mounted to the column 53 as at 64 is a radius rod 66 in turn pivotaly mounted at 67 to a member 68 disposed just above the sprocket 34. Upstanding from the member 68 is a tubular member 70. Depending from the housing 50 which surrounds the chains 38 and 61 is a column member 71 through which telescopes the member 70 and through which pass the hollow shaft 36 and shaft 63. A locking washer 71a holds the parts rotatably assembled, see Fig. 6. The shaft 63 has secured at its lower end the sprocket 34 for driving chain 32, whereas shaft 36 has secured at its lower end a gear 69.

The supporting and guiding frame members for the chain 32 comprise vertically spaced frame members 72 having successive inner and outer overlapping knuckles which are pivoted together as at 73 to adjacent similar members. These frame members are held together in vertically aligned pairs by bolts 74 and nuts 76 therefor (see Fig. 7). However, each of said pairs is free to pivot as a unit relative to the next pair about the pivot points 73.

Starting with the sprocket 34 and gear 69, the members 72 are provided with gears 77 which decrease progressively in diameter outward toward the idling sprocket 40. It will be noted that the gear 69 is in mesh with the first gear 77 and that the first gear 77 drives the following gear 77 through a pinion 78. This arrangement continues, the gears 77 driving the subsequent gears through the pinions 78 until, between the last two members 72 the gear and pinion are substantially the same diameter. The members 72 may be provided with inward curved guide portions 79 over which the chain 32 slides when the cutter assembly 27 is partially wrapped or curved about the trunk of the tree as will later appear. Also, there may be flat guide portions 81 at the opposite side. To further guide the chain, the opposite ends of the members 72 may have spaced intumed flanges 82. It will be noted from Fig. 4 that the gears 77 are each mounted between and made fast to the inner knuckles of the pivot portions 73 of the successive frame members 72. That is to say, gear 69 is carried by the shaft 36 and driven by the sprocket 62, chain 61, sprocket 59, shaft 54, pinion 56 and rack 57. Rotation of gear 69 therefore rotates gears 77 in mesh therewith, causing the successive frame members 72 and hence the chain 32 to wrap about the tree T as indicated in dotted lines, Fig. 5.

Due to the decrease in diameter of the gears 77 a small rotative movement of the gear 69 at the suspended or right hand end of the assembly as viewed in Fig. 5, causes an increasing rotative movement of the gears 77 toward the wrap-around or left end, thus causing the apparatus to assume an arcuate form, wrapping about the tree trunk. In this position, power from the motor 43 drives the chain 32, causing the cutters 33 to engage the bark of the tree. It will be noted that the cutters may be provided with serrated lower ends 33a to facilitate the removal of limbs from the trunk of the tree as the apparatus is moved down the tree. The radius rod 66 holds the assembly against rotating bodily, permitting the chain to wrap the trunk of the tree as indicated. While the elements of only one of the two lower cutter assemblies 27, and its associated supporting means and operating mechanism, have been described, it should be noted that corresponding elements of either of the upper cutter assemblies 27' have been identified in the drawing by corresponding numerals to which a prime has

been added. (For example, in Fig. 9, note elements 43', 56', 57', and 58'.)

In Fig. 3 of the drawing, I show in diagrammatic manner one of the lower cutter elements 27 wrapped about the tree trunk T while the others have not yet been moved to position. However, when the others are brought into working position it will be seen that substantially the entire periphery of the tree is engaged.

During the operation of the apparatus guide rollers 29 are brought to bear against the sides of the tree trunk. This is accomplished by means of a pneumatic cylinder 84 mounted on an outer extension 86 of the upward extension 28 which carries one of the rollers 29. The piston rod 87 of the cylinder engages an extension 88 of a yoke 89 carrying the other roller 29. When the piston rod moves inwardly the rollers move together equally. This is accomplished by means of racks 91 and 92 on equalizing gear 93 placed therebetween.

Mounted on the yoke frame 14, in very similar manner to the rollers 29 are the clamps 31. A pneumatic cylinder 94 is mounted on an extension 96 carrying one of the clamps 31. The piston rod 97 of the cylinder 94 is secured to an extension 98 of a yoke carrying the other arm 31 of the clamp. When the piston rod moves inwardly the clamps move in together, a centering gear 99 engaging racks 101 and 102 on the yokes on which the clamps 31 are mounted.

Also mounted on the yoke frame 14 is an electric motor 103. Pivotaly mounted on top of the motor is a swing arm 104 which carries a chain housing 106. On the outer end of the arm 104 is a saw 107. A chain 108, driven by a sprocket 109 on the motor drives a sprocket 111 on a vertical shaft 112 carrying the saw 107. The saw may be pivoted by means of a pneumatic cylinder 113, pivotaly mounted as at 114 to a suitable portion of the frame structure. It may be swung into position to cut the top of the tree, or, to top the tree.

As before stated the two uppermost cutter assemblies 27' are shorter in length than the two lowermost ones 27. Further, the cutter assemblies are placed 90° apart as clearly indicated in Fig. 3 of the drawing. Therefore, the housing sections 11 and 12 each carry one of the long band cutter assemblies 27 and one of the upper, shorter ones 27'. It will be noted that if the two upper assemblies 27' are brought to bear against the tree and wrap thereabout when the diameter of the tree is small, they would interfere with each other. However, the lowermost cutter assemblies 27 can be brought to bear at any time without interfering either with each other or with the upper, shorter cutter assemblies 27'.

The housing sections 11 and 12, with respect to opening and closing movement, are under control of a hydraulic cylinder 116 having a piston rod 117 to which is pivotaly connected links 118 and 119, connected to the housing sections 11 and 12 outwardly of the pivot point 13. When air under pressure is admitted to the closed end of the cylinder 116 the outward motion of the links opens the housing sections 11 and 12 whereby the apparatus may be placed about the tree.

The control means for bringing the several cutter assemblies into contact with the tree and for curving the same thereabout will now be described. Mounted on bearings 121 in the split housing, for sliding movement therethrough, are lower and upper control rings 122 and 123, respectively. The rings are connected adjacent their centers by means of lengths of chain 124, permitting the housing to open as already explained. Depending from an offset lug on the ring 122 are pins 126 which project through slots 127 in the lower wall 48 of the housing section, see Figs. 4 and 9. Connected to the lower end of the pins 126 are arms 128 which are pivotaly connected at 129 to an arm 131 fast on the cylindrical upstanding member 49 carried by the housing 50. The pins 126 on the lower ring 122 therefore control the lowermost cutter assemblies 27 and are effective, when the ring 122 shifts as will be explained, to pivot the housing 50 and, through the radius rod 66 and the connection 71, to bring the cutter assemblies into contact with the side of the tree.

The ring 122 is under control of a cylinder 132, the piston rod 133 thereof being pivotaly connected as at 134 to a bracket 136 carried on the side of the lower ring 122.

In quite similar manner the upper ring 123 is controlled by an air cylinder 137 pivotaly connected as at 138 to a bracket 139 on the upper ring 123. Depend-

ing from an offset lug on the upper ring are pins 141, in all respects identical with the pins 126 and which are identically connected through arms similar to 128 and 131 to move the upper pairs of cutters against the side of the tree as will appear.

The lower ring 122 is biased against a stop 142 by means of a spring 143. Similarly, the ring 123 is biased by means of a spring 144 against the same stop. The operation of the pneumatic means is under control of a safety valve 146 located adjacent the pivotal connection of the housings. When the housing is closed an arm 147 mounted on the link 119 opens the valve 146 readying the pneumatic means for operation.

Air under pressure may be supplied through a line 150 (see Fig. 12) through the valve 146, when open, to a solenoid operated valve 148. The valve 148 may be under control of an electric switch 149 located in the cab of the crane or at any other suitable place. As best shown in Fig. 12 air under pressure is supplied, when valve 148 is open, to cylinder 132 through line 151. Likewise, opening of valves 146 and 148 simultaneously supplies air under pressure to the cylinders 58 controlling the wrapping action of the lowermost cutter assemblies. Thus, when both valves 146 and 148 are open, the two lowermost cutter assemblies 27 are brought to bear against the tree trunk and, under the influence of the cylinders 58 connected therewith are wrapped about the tree and held resiliently thereabout. For reverse operation, valve 148 may be actuated so that fluid under pressure from the line 151 may be admitted simultaneously through line 152 to the other end of cylinder 132 and through line 153 to the other end of each of the cylinders 58.

The lowermost ring 122 is provided with a notch 154. Located near the notch 154 is a valve 156 to which is connected air lines 157 (see Fig. 12) which lead to the cylinders 58' and 137 controlling the uppermost cutter assemblies 27'. Disposed to ride against the ring 122 is a spring biased pawl 157a pivotally mounted on the end of an arm 158 which controls the opening and closing movement of the valve 156. In Figs. 9 and 9a, valve 156 is shown closed and when, under the influence of cylinder 132, the notch 154 in the lower ring has traveled in the direction of the arrow 159 to its dotted line position (which corresponds to a relatively small diameter tree trunk), valve 156 remains closed, but as the apparatus moves down the tree trunk, the increasing diameter of the tree trunk causes the swingable end of the housing 50, which represents the cutter-assembly-supporting end, to swing radially outward from the axis of the tree to thus partially rotate sleeve 49 and arm 131 (see Fig. 4), which in turn shoves arm 128 and ring 122 in a direction opposite to the arrow 159, until notch 154 engages pawl 157a to swing the pawl and the arm 158 to their dotted line positions, at which time valve 156 is opened, thereby energizing the cylinders 58' and the cylinder 137 controlling the operation of the two uppermost cutter assemblies 27'. The valve 156 may be provided with a spring-biased holding pawl 161 which operates against a fan-shaped extension 162 of the valve arm 158 thus to hold the valve 156 open until the notch 154 of the control ring 122 moves again to its solid line position, at which time pawl 161 drops into the notch 154 to release the extension 162 so that the spring which biases the pawl 157a can then return the valve arm 158 to its valve-closing position. It will be apparent from what has just been said that in the initial operation of the apparatus the longer, lowermost pairs of cutters 27 are first wrapped about the small diameter top of the tree and the machine is moved downwardly towards the larger bottom trunk portion. At the proper time the valve 156 opens and swings the uppermost cutters into contact with the tree through the cylinder 137 and simultaneously commences the wrapping of the chains of the uppermost cutters about the tree trunk. If desired, suitable delay apparatus may be interposed in the lines so that the cylinders 58 and 58' are slightly delayed in their operation, thus assuring that the cylinders 132 and 137 bring the suspended ends of the cutter chains into contact with the tree prior to commencing of the wrapping action. Once the cutters are engaged the individual motors 43 and 43' may be operated by means of switches 162a which may be located in the cab of the crane or in any other desired position.

If it is desired to load the tree onto a trailer or the

like after the bark is removed and without permitting the tree to fall on the ground, the apparatus is moved substantially to the vertical center of the tree and the clamps 31 are brought together. The tree may now be sawed off at its base and, using the device as a clamping tool, the tree may be loaded onto the trailer without felling the tree.

It will be noted that when the cylinder 116 has moved the links 118 and 119 inwardly to the position shown in Fig. 9 the housings are effectively locked due to the toggle action. Furthermore, in the operation of the apparatus it will be apparent that the two uppermost cutter assemblies 27' are brought into place only after the lowermost cutter assemblies 27, which are the longer ones, thus assuring that substantially all of the periphery of the tree trunk is operated upon by the cutters 33 and 33'.

From the foregoing it will be apparent that I have invented an improved apparatus for operating upon curved surfaces particularly tree trunks and the like. While I have shown and described my improved apparatus as embodied in mechanism for barking standing trees, it will be apparent that the same finds application in other instances. Thus, it may be desired to use the same to operate upon curved metal surfaces, for finishing wood or metal. Various other uses will suggest themselves to those skilled in the art. Therefore, in the appended claims the invention intended to be covered is the construction embodying the flexible members carrying the working tools together with means to cause the flexible members to assume the general shape of the curved surface. It will also be apparent that it is possible that my improved apparatus could operate upon a concave as well as a convex surface.

While I have shown my invention in but one form it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the function thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In apparatus for barking trees and the like, a flexible member, bark-engaging cutters on the flexible member, a series of sequentially pivotally connected members supporting and guiding the flexible member, means to partially rotate said members relative to each other and thereby cause the flexible member to curve about an arcuate portion of a trunk of a tree, and means to drive the flexible member while it is in position about a tree thereby causing the cutters to engage and remove the bark.

2. In apparatus for barking trees and the like, a flexible member, bark-engaging cutters on the flexible member, a series of sequentially pivotally connected members supporting and guiding the flexible member, intermeshing gears on said pivotally connected members, a drive gear adjacent one end of the flexible member and meshing one of said intermeshing gears, means to rotate the drive gear and thereby cause the pivotally connected members and hence the flexible member to wrap about an arcuate portion of a trunk of a tree, and means to drive the flexible member while wrapped about a tree trunk whereby the cutters engage and remove the bark therefrom.

3. Apparatus as defined in claim 2 in which the effective diameters of the intermeshing gears successively decrease from the drive gear outwardly thereof whereby the corresponding frame members pivot through progressively greater arcs outwardly of the drive gear.

4. Apparatus for operating upon the rounded surface of a cylindrical body or the like comprising an endless chain, driving and idling sprockets over which the chain is trained, a series of sequentially pivotally connected frame members extending between the sprockets and on inner and outer ones of which frame members said driving and idling sprockets respectively are supported for rotation, means supporting the innermost of said frame members, means associated with said frame members effective to rotate them relative to each other and thus wrap the chain at least partially about a rounded surface, and means to rotate the drive sprocket thereby causing the working tools to engage a rounded surface.

5. In apparatus for working upon a curved surface, an endless chain, working tools on the periphery of the chain, a series of sequentially pivotally connected frame

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members supporting the chain for travel, gears between the pivoted frame members for controlling the relative angular relationship therebetween, means to rotate one of said gears thereby to conform the chain to the general curvature of a curved surface, and means to drive the chain while in said curved position.

6. In apparatus for removing bark from tree trunks and similar objects, a two-part annular frame pivoted together for placement about a tree trunk, a plurality of bark-removing cutter units supported from the frame each of which comprises an endless sprocket chain, bark-removing cutters on the periphery of the chain, means mounting the cutter units for partial wrapping about a tree trunk, means holding the chains resiliently wrapped about a tree trunk, means to drive each chain while wrapped about a tree trunk, and means to move the apparatus along a tree trunk.

7. Apparatus as defined in claim 6 embodying guide means engageable with a tree trunk and effective to hold the frame substantially centered relative to a tree trunk as the apparatus moves thereon.

8. Tree-barking apparatus of the character described embodying a two-part annular housing with the parts hinged together, at least a pair of bark-removing assemblies spaced below the housing and spaced vertically relative to each other and each of which comprises an end-

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less sprocket chain, sprockets over which the chain is trained, bark-engaging cutters on the periphery of the chain, a pivotally articulated frame having end and intermediate sections, means mounting the sprockets on the end sections of said articulated frame, gears on said end and intermediate frame sections controlling the angular relationship of the same relative to each other, means to drive one of said sprockets, means to rotate one of said gears and thereby cause the articulated frame sections and hence the frame to wrap about an arcuate portion of a trunk of a tree, and means to move the apparatus along a tree trunk while wrapped thereabout.

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