Sept. 15, 1970 J. E. BLONSKY 3,528,468

TREE-HARVESTING APPARATUS

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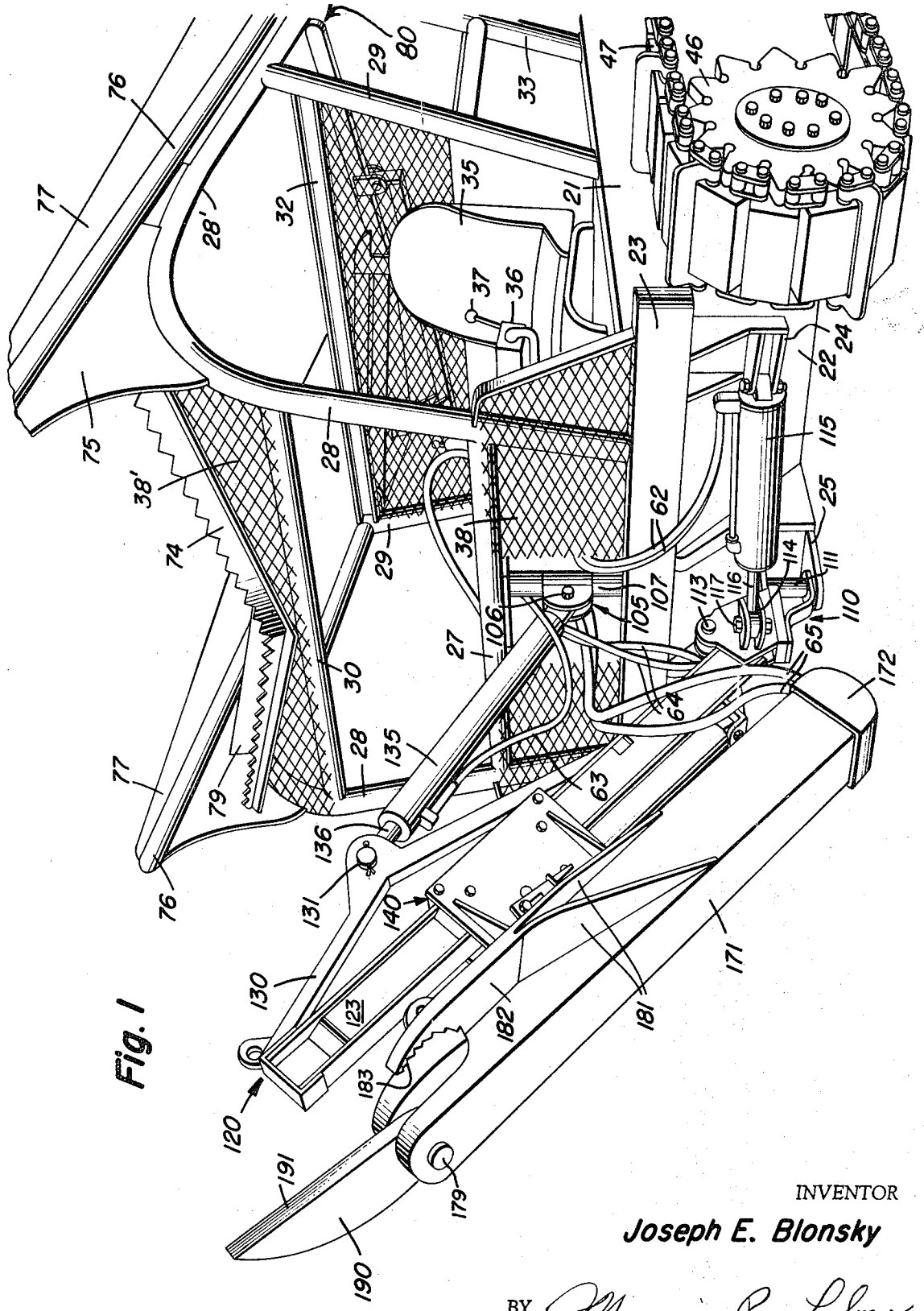


Fig. 1

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Sept. 15, 1970 J. E. BLONSKY 3,528,468

TREE-HARVESTING APPARATUS

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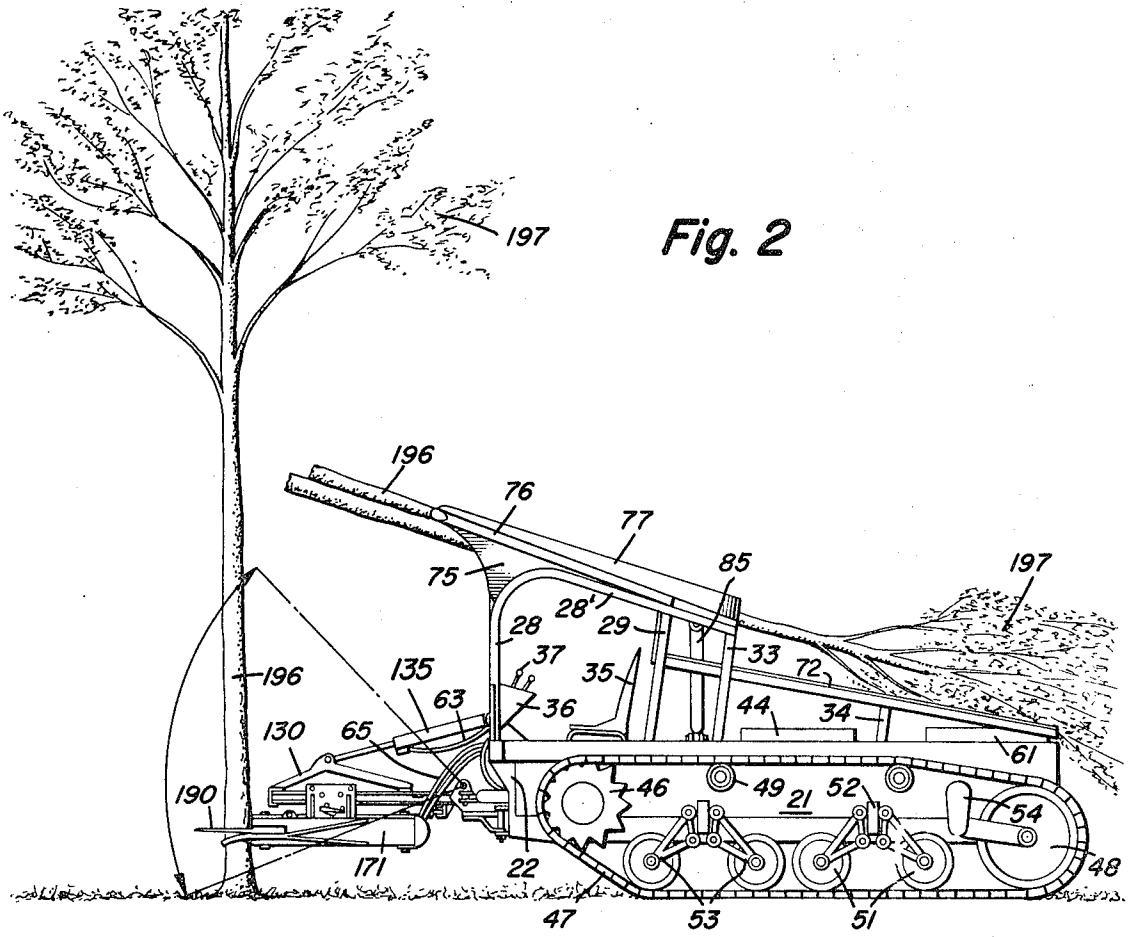


Fig. 2

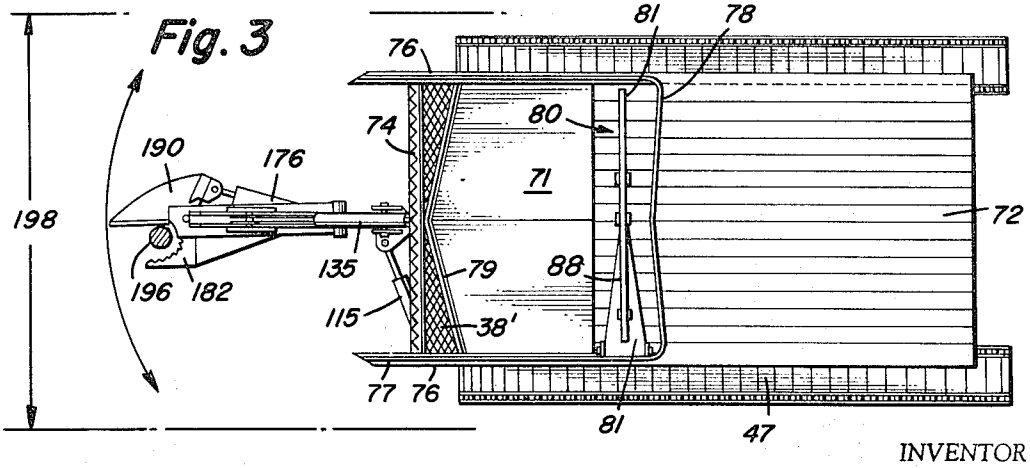


Fig. 3

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TREE-HARVESTING APPARATUS

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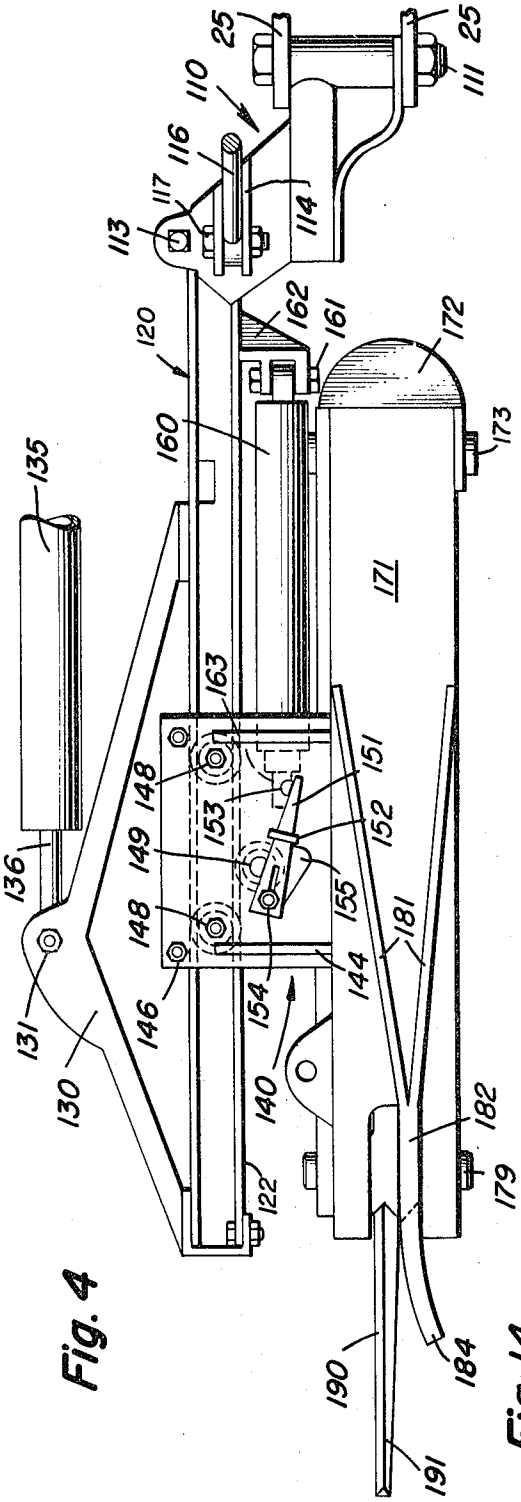


Fig. 4

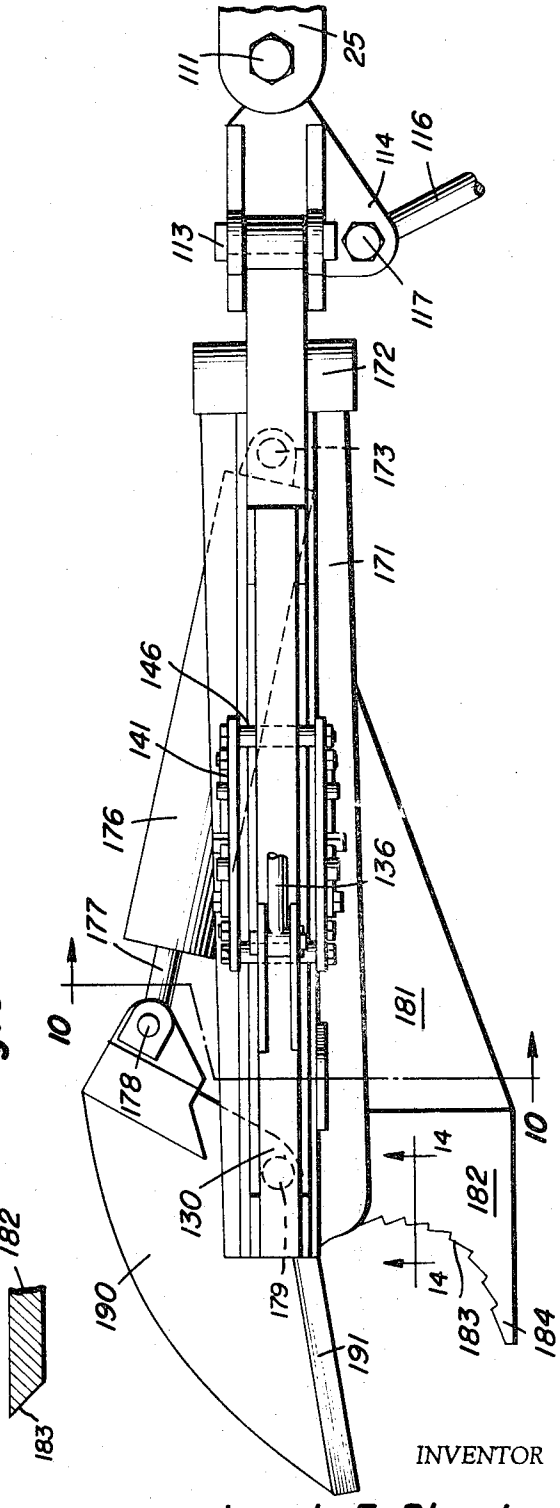


Fig. 5

Fig. 14

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TREE-HARVESTING APPARATUS

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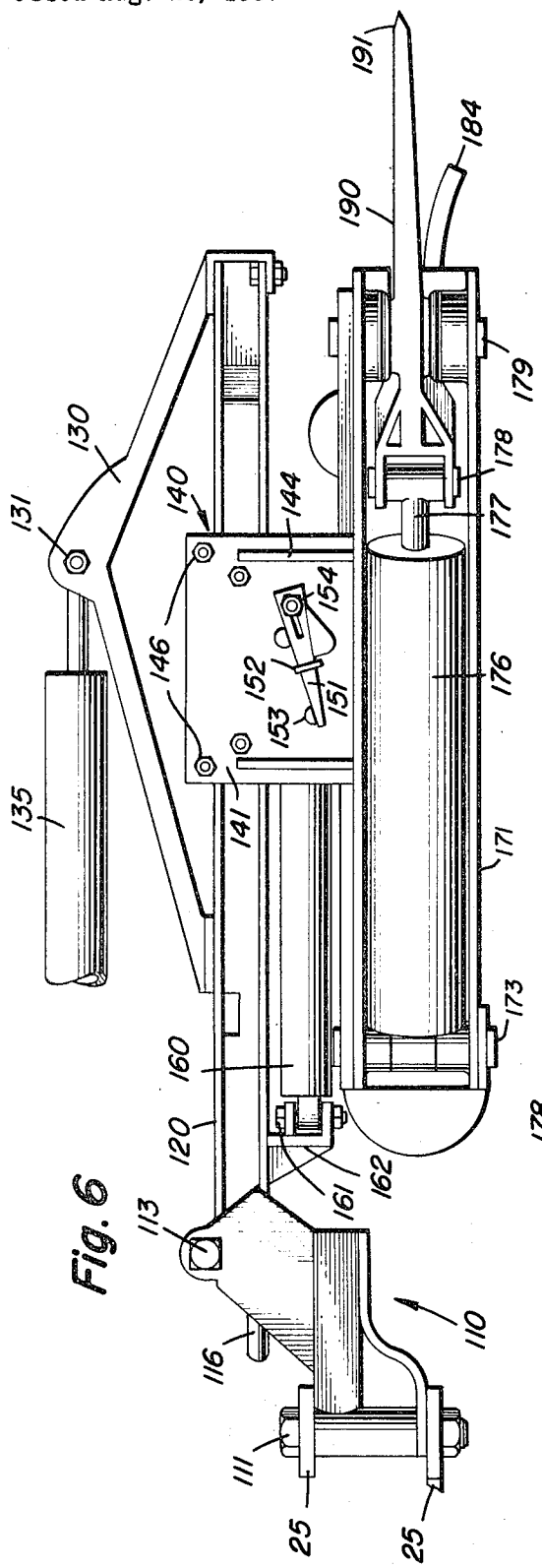


Fig. 6

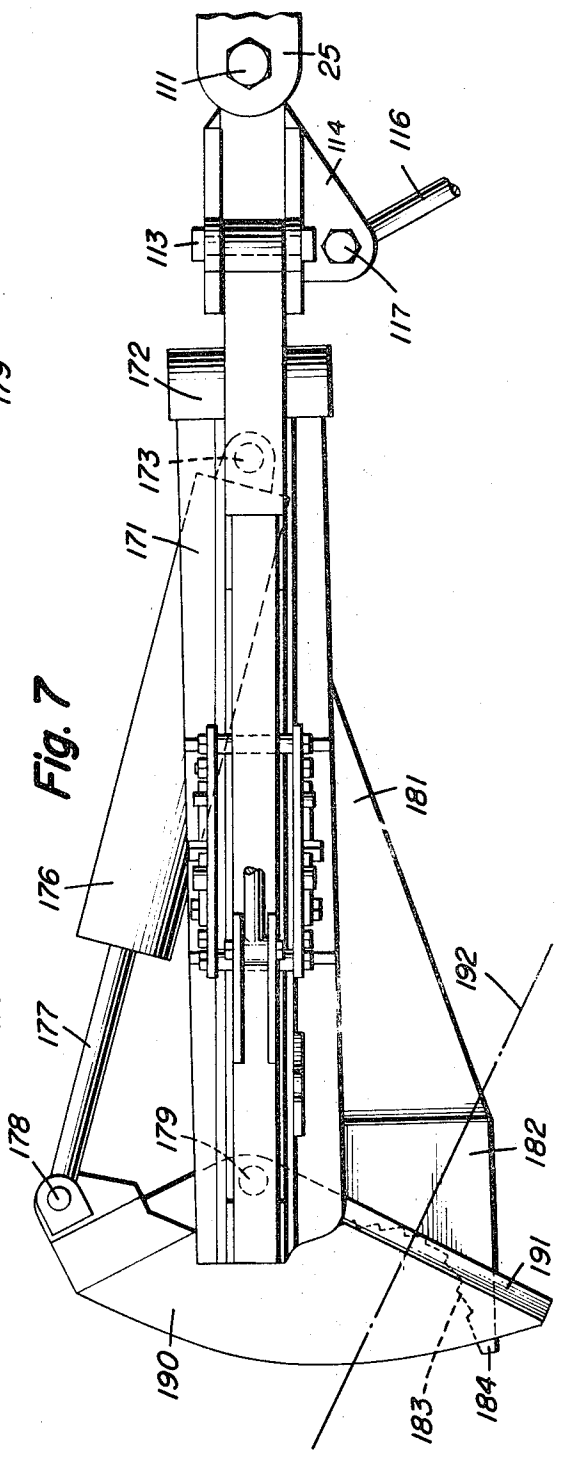


Fig. 7

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TREE-HARVESTING APPARATUS

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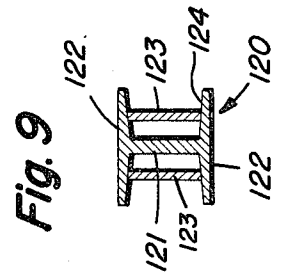


Fig. 9

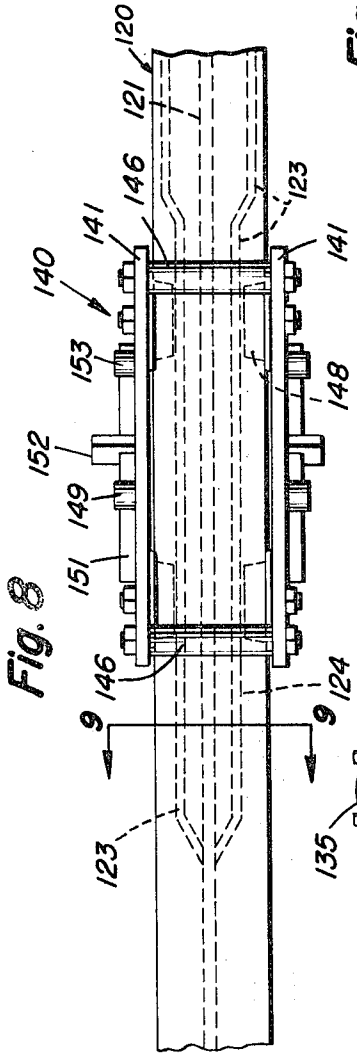


Fig. 8

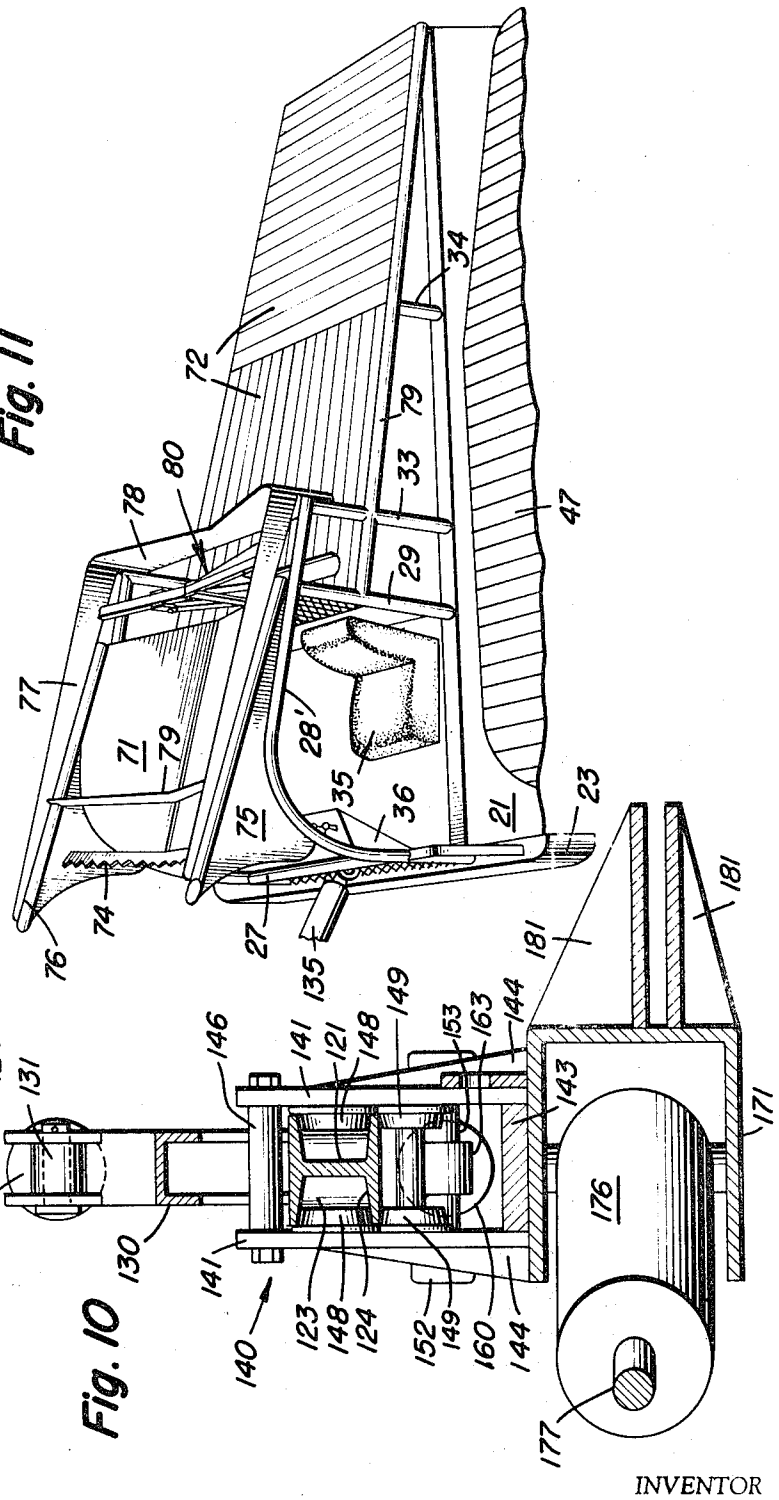


Fig. 11

Fig. 10

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TREE-HARVESTING APPARATUS

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Fig. 12

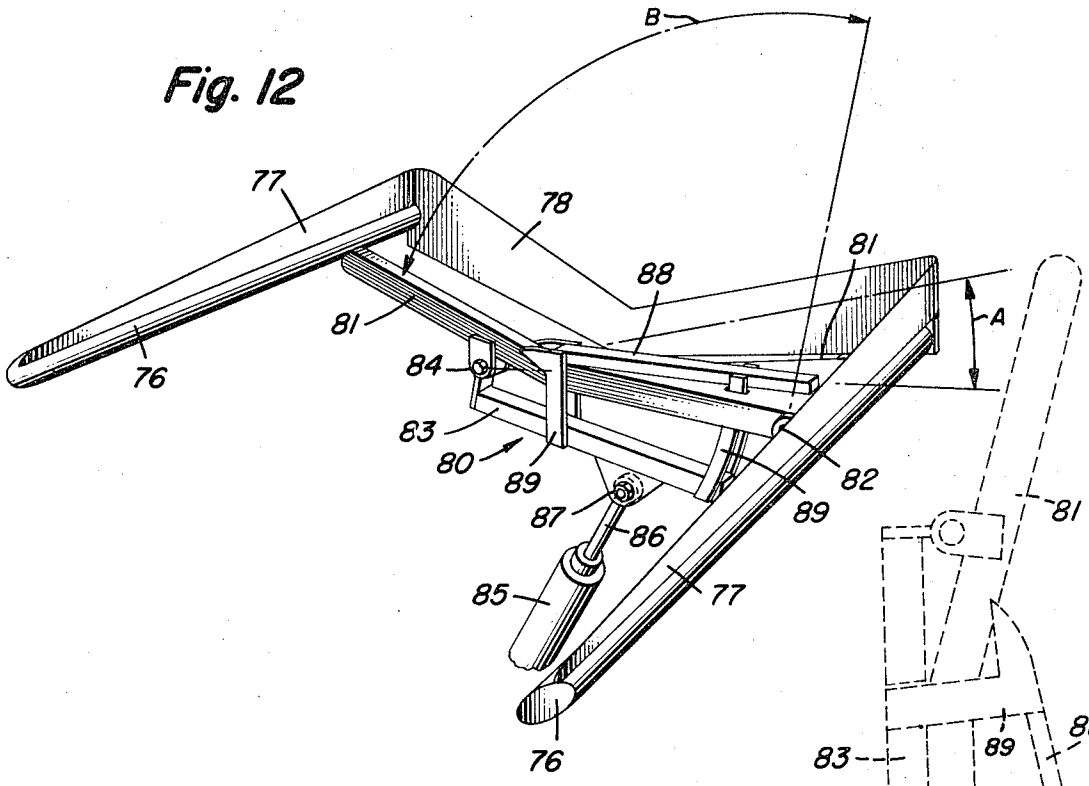
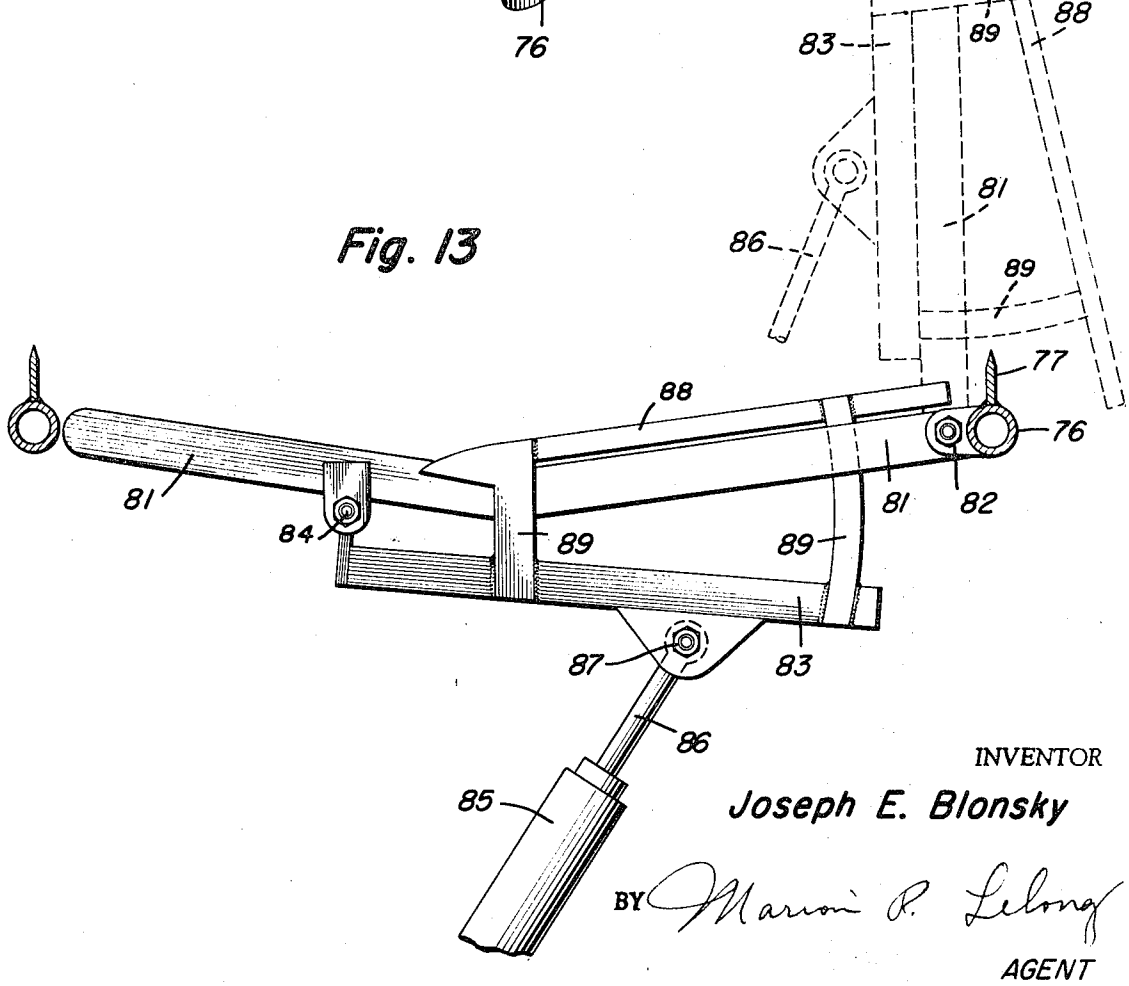


Fig. 13



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TREE-HARVESTING APPARATUS

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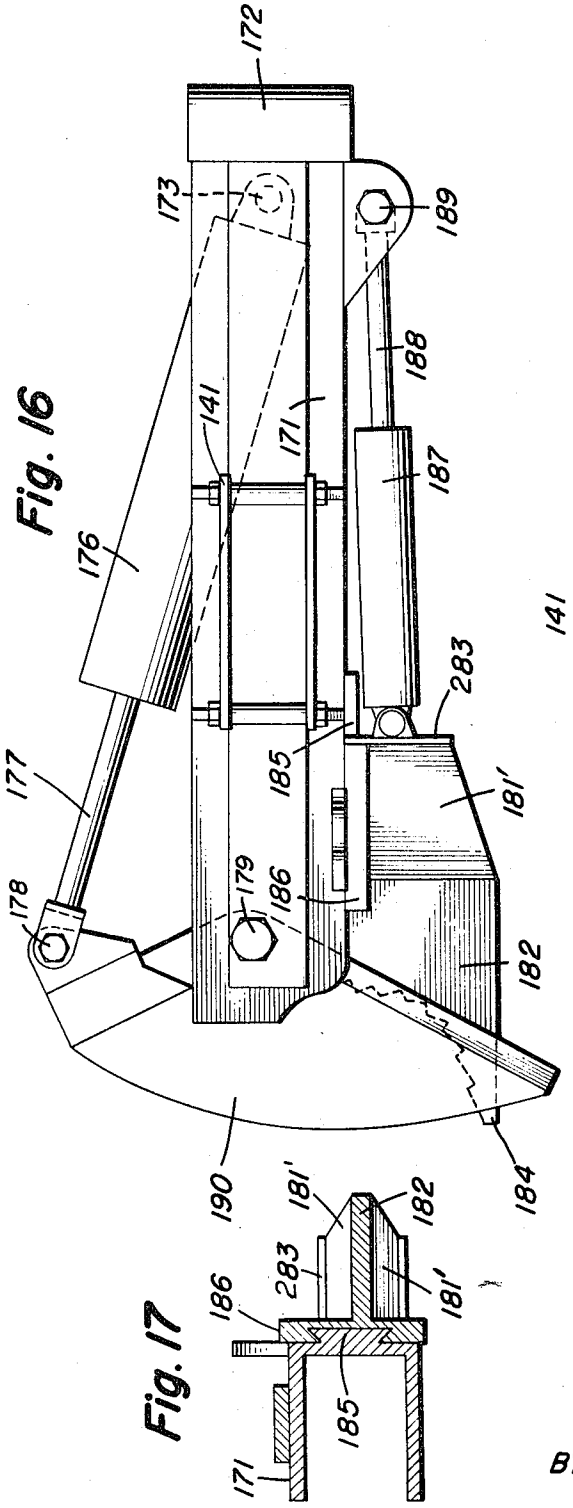


Fig. 16

Fig. 17

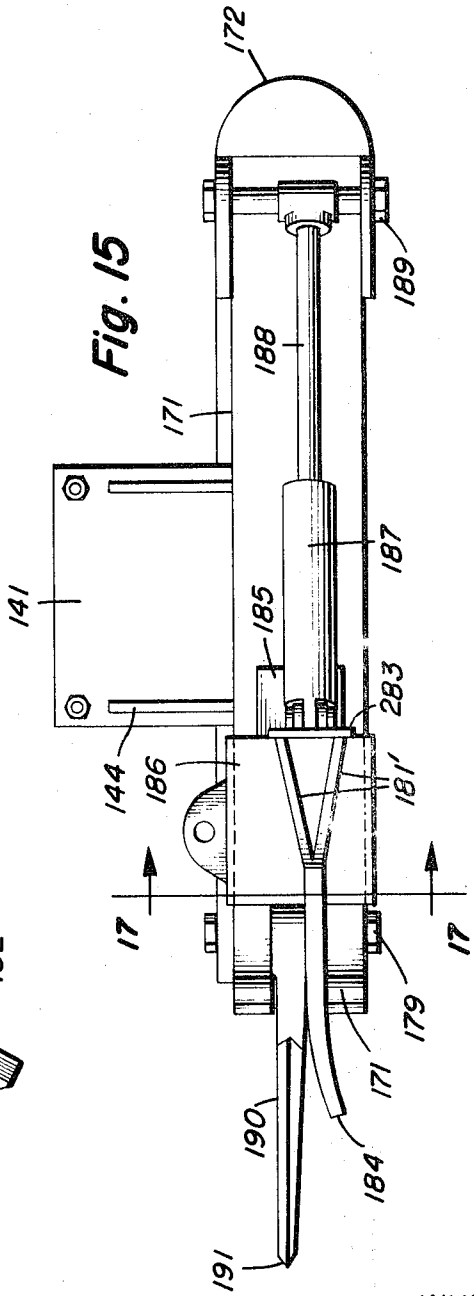


Fig. 15

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TREE-HARVESTING APPARATUS

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Fig. 18

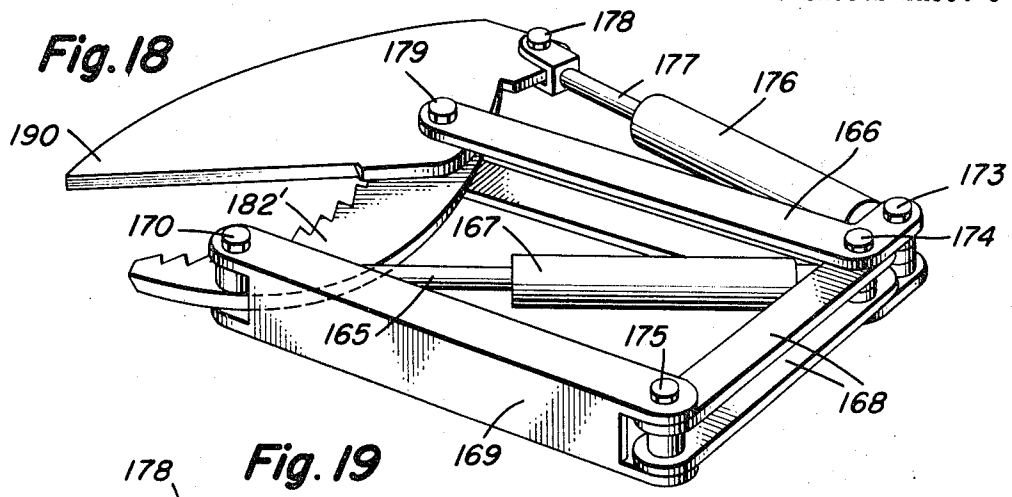


Fig. 19

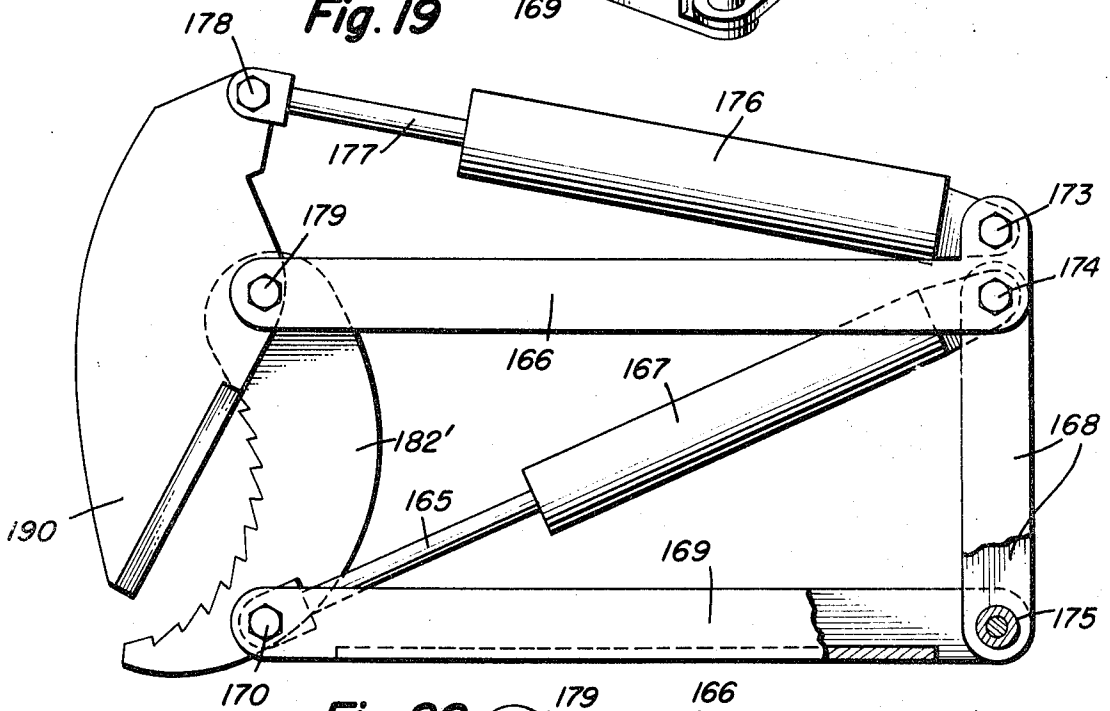


Fig. 20

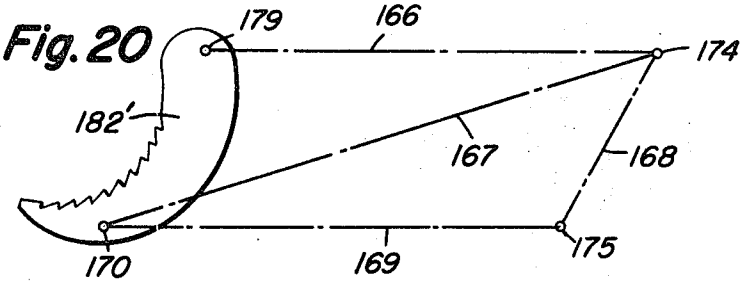
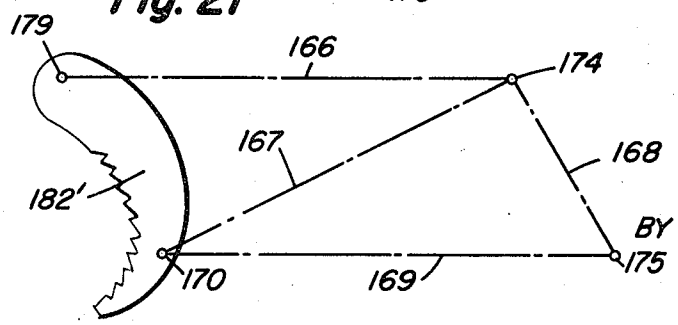


Fig. 21



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United States Patent Office 3,528,468 Patented Sept. 15, 1970

3,528,468

TREE-HARVESTING APPARATUS

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Continuation-in-part of application Ser. No. 606,104, Dec. 30, 1966. This application Aug. 28, 1967, Ser. No. 668,282

Int. Cl. A01g 23/02

U.S. Cl. 144—309 13 Claims

ABSTRACT OF THE DISCLOSURE

Tree-harvesting apparatus embodying the invention comprises a vehicle having tree-felling means mounted thereon. The tree-felling means may be moved in several directions so as to selectively engage and fell trees. Means and methods also are provided for preventing entanglement of the falling trees with adjacent trees and for catching them upon the vehicle as they are felled. Means also may be provided to bunch, transport, and unload trees which rest on the vehicle.

This application is a continuation-in-part of copending application Ser. No. 606,104, filed Dec. 30, 1966, and now abandoned, for Tree Shearing and Assembly Vehicle.

FIELD OF THE INVENTION

This invention relates to apparatus for harvesting trees. More specificaly, it relates to motor-driven vehicles having attachments which fell standing trees, successively receive the felled trees, transport the trees to a selected location, and unload them. Tree-harvesting machines known theretofore have been intended mainly for clear-cutting and for thinning or selective cutting of thinly populated stands. If existing machines are compact enough for thinning purposes, they usualy lack maneuverability and means for selectively positioning their cutting devices when operated in crowded stands. Because of increasing costs and scarcity of labor, there is a need to provide tree-harvesting machines which are versatile, efficient, and economical.

For mechanical thinning, it is desirable to employ a mobile vehicle which will fell trees in such manner as to clear a roadway of greater width than the width of the machine. It is also important that such a vehicle be one which will fell trees near to the vehicle without shifting the position of the vehicle with respect to each tree to be felled.

In wood procurement operations, felled trees usually are "bunched"; that is, they are aligned and brought together in a compact group in order to facilitate handling them subsequently. Thus, it is desirable to provide tree-harvesting apparatus with means to bunch felled trees. Other desirable features are capabilities for transporting and selectively unloading felled trees. It is also desirable to provide means for ensuring that falling trees which have just been cut do not become entangled in surrounding trees.

DESCRIPTION OF THE PRIOR ART

Heretofore, large motor vehicles have been provided to harvest standing trees. Such vehicles may have means for cutting a tree, lowering it into horizontal position, removing its limbs, cutting the bole of the tree into sections, and stacking the sections upon retaining means. Other known machines are directed primarily to delimbing standing trees before shearing the tops and bottoms of the trees. Another type of machine successively cuts a plurality of standing trees, picks them up, loads them upon

the vehicle, and transports them to another location for further operations thereon.

SUMMARY OF THE INVENTION

A tree-harvesting apparatus embodying the invention comprises a vehicle having shearing means mounted thereon to fell trees, means for positioning the shearing means in engagement with the bole of a tree, and means for actuating the shearing means to sever the bole. In addition, means are provided to elevate a tree at the instant it is severed so that it will not become entangled with adjacent standing trees. Additional means may be provided to successively receive the felled trees, transport them to a selected location, and unload them.

DESCRIPTION OF THE DRAWINGS

The invention may be understood by referring to the accompanying drawings, in which:

FIG. 1 is a fragmentary, left-front, perspective view of a tree-harvesting apparatus embodying the invention;

FIG. 2 is a left-side view of the apparatus;

FIG. 3 is a top plan view of the apparatus;

FIG. 4 is a left-side view of a tree-felling assembly forming part of the apparatus;

FIG. 5 is a top plan view of the felling assembly shown in FIG. 4, with the shear blade in open position;

FIG. 6 is a right-side view of the felling assembly;

FIG. 7 is a top plan view of the felling assembly, with the shear blade completely closed;

FIG. 8 is an enlarged, fragmentary, top plan view of a trolley boom incorporated in the felling assembly, with the boom construction shown in phantom view;

FIG. 9 is a cross section of the trolley boom taken along line **9—9** in FIG. 8;

FIG. 10 is a cross section of the felling assembly taken along line **10—10** in FIG. 5;

FIG. 11 is a perspective view, looking downwardly and rearwardly, of the roof structure of the vehicle;

FIG. 12 is a perspective view of a tree-unloading means and associated elements;

FIG. 13 is a front elevation of the tree-unloading means, with parts thereof shown in dump position by phantom lines;

FIG. 14 is a fragmentary cross section taken along line **14—14** in FIG. 5;

FIG. 15 is a left-side view of a felling assembly of the adjustable-anvil type;

FIG. 16 is a top plan view of the felling assembly shown in FIG. 15;

FIG. 17 is a cross section taken along line **17—17** in FIG. 15;

FIG. 18 is a perspective view of an alternate design of shear assembly having a pivotable anvil;

FIG. 19 is a top plan view of the pivotable anvil shear assembly shown in FIG. 18; and

FIGS. 20 and 21 are diagrammatic representations of parallelogram movements of the pivotable-anvil shear assembly in FIGS. 18 and 19, with the elements thereof in fully extended and fully retracted positions, respectively.

TREE-HARVESTING VEHICLE WITH FIXED ANVIL

FIGS. 1 to 11 of the drawings illustrate an embodiment of the invention which includes a motor vehicle having a roof on top thereof and a felling assembly which operates in front thereof. The vehicle has an endless track assembly on each side for propelling the vehicle, but wheeled propulsion is entirely satisfactory. This embodiment has an operating cab section in front and a power-plant section at the rear which is provided with a foliage-supporting roof at a lower elevation than a bole-supporting roof over the cab section.

As shown in FIG. 1, this embodiment of the invention includes a unitary frame comprising longitudinal frame members **21** attached to transverse frame members **22** to form a strong, rigid base for the vehicle. A transverse bumper bar **23** is attached to the front ends of longitudinal frame members **21**. Swinging cylinder brackets **24** and felling assembly brackets **25** are attached to the front transverse frame member **22**.

The roof supports comprise lower guard rail **27**, outwardly inclined front corner posts **28** which are bent to form downwardly sloping roof beams **28'**, operator station posts **29**, upper guard rail **30**, rear brace **32**, posts **33**, and intermediate posts **34**, as shown in FIGS. 1 and 2. The operator station comprises operator seat **35**, operating console **36**, hydraulic control **37**, lower mesh barrier **38**, and upper mesh barrier **38'**, as shown in FIGS. 1 and 2. Engine **44**, in the middle of the unitary motor vehicle, as shown in FIG. 2, supplies power to sprocket drive wheels **46**, which move endless tracks **47** and main idler wheels **48** of a conventional design. Tracks **47** are held in alignment by slack rolls **49**. The motor vehicle is supported mainly by dual bogie clusters having two bogie rollers **51** resiliently attached to frame brackets **52** with triangular bogie arms **53**. Tension on tracks **47** is maintained by track-tightening arms **54**. Engine **44** also supplies power to a conventional hydraulic pump (not shown) which is connected to hydraulic fluid reserve tank **61** in the rear of the motor vehicle (FIG. 2). The hydraulic pump is connected by fluid lines to the operating console **36** and thus supplies hydraulic fluid under pressure to swinging cylinder lines **62** (FIG. 1), lifting cylinder lines **63**, thrusting cylinder lines **64**, shearing cylinder lines **65**, and unloading cylinder lines (not shown).

The roof structure of the vehicle, as shown in FIGS. 2, 3, and 11, comprises a roof **71** of V-shaped cross-section, which protects the operator's cab and receives and positions trees falling on the roof. A sloping lower foliage roof **72** (FIG. 3) protects engine **44** and hydraulic tank **61**, while supporting the branch and foliage parts **197** of felled trees (FIG. 2). Foliage roof **72** has several hinged sections for access to the engine and hydraulic means and is attached to rearwardly-sloping foliage support beams **79** (FIG. 11), attached to posts **29, 33** and **34**.

Bulkheads **75** located above the operator's cab are attached to the tops of roof beams **28'** (FIG. 2). Catch rails **76** are attached to the top edges of bulkheads **75**, and knife-edged tree guides **77** are attached to the tops of catch rail **76**. A catch rail **76** and a knife-edged tree guide **77** may be combined into a solid, rigid plate having a top knife edge; this plate may be hinged for ease in unloading. As shown in FIGS. 3 and 11, a V-shaped, saw-toothed impact bar **74** is attached to bulkheads **75** across the front of the motor vehicle. A V-shaped tree-rocking bar **79** is attached to bulkheads **75** across the vehicle rearwardly of impact bar **74**, and a V-shaped, knife-edged tree-holding bar **78** is attached transversely, near the rear of the operating cab and rearwardly of tree-rocking bar **79** and tree-unloading means **80**. Because impact bar **74**, tree-rocking bar **79** and tree-holding bar **78** are all V-shaped with the points of the V's extending downwardly, when the boles of trees fall on the forward part of the vehicle, the inclined sides of these bars direct the boles downwardly and inwardly of the bars so that the boles are bunched together and aligned.

Parts of tree-rocking bar **79** project upwardly beyond the planes defined by the top edges of impact bar **74** and tree-holding bar **78**. By virtue of this arrangement, falling trees successively strike and rock over the roof and then come to rest on the roof. As a result, the kinetic energy of a falling tree is transmitted to the vehicle in successive increments, and no part of the vehicle sustains the shock of the entire weight of the tree.

If a felled tree is small, a large part of the kinetic energy is also absorbed by bending and breaking of

branches as foliage parts **197** strike foliage roof **72**. If the vehicle is designed to receive trees of average size, large trees may rock completely over the vehicle and impart most of their kinetic energy to the ground, without foliage parts **197** coming substantially into contact with foliage roof **72**. The weight of bole **196** of a large tree may then rest entirely upon tree-holding bar **78**, and consequently tree-holding bar **78** must have a sharp upper edge, sharp teeth, or other bole-penetrating means whereby it can bite deeply enough into the bark and wood of a bole to withstand dragging forces from foliage parts **197**.

UNLOADING MEANS

The tree-harvesting vehicle includes means for unloading trees which are resting on the roof of the vehicle with bole portions **196** of the trees extending forwardly, as shown in FIG. 2. The unloading means is designed to raise tree boles **196** from the roof of the vehicle and to carry them up and over catch rail **76** and tree guide **77** on one side of the vehicle, so that the trees fall to the ground alongside the vehicle.

A preferred form of unloading means, indicated generally by the numeral **80**, is attached hingeably to catch rail **76** on the left side of the vehicle, as shown in FIGS. 3, 11, 12 and 13. This unloading means is a double-acting device which comprises unloading arm **81**, lifting riser **83**, cylinder **85** and piston rod **86**. Cylinder **85** is connected in a conventional manner by fluid lines (not shown) to the hydraulic system which actuates various other operating elements of the apparatus. Conventional control means (not shown) are provided to cause piston rod **86** to advance, retract, or be at rest, as desired.

One upwardly-angled end of unloading arm **81** is connected hingeably to left-hand catch rail **76** by hinge pin **82**. Unloading arm **81** is Y-shaped in plan view (FIG. 3) and V-shaped in front view (FIG. 13), and it spans substantially the entire distance between catch rails **76**. Piston rod **86** is connected hingeably to lifting riser **83** by piston hinge pin **87**. Lifting riser **83** is beneath unloading arm **81** and is attached hingeably to arm **81** by hinge pin **84**. Riser guides **89** connect lifting riser **83** to top riser **88** and keep both risers **83** and **88** aligned longitudinally with the right-hand half of unloading arm **81** (FIG. 13). Top riser **88** is parallel to, and rests upon, the widened side of unloading arm **81** when piston rod **86** is retracted.

Upward extension of piston rod **86** raises lifting riser **83** and top riser **88** pivotably about hinge pin **84** in a counter-clockwise direction through arc "A," as seen from the front of the vehicle in FIGS. 11, 12 and 13, until the top of lifting riser **83** and the bottom of the right-hand side of unloading arm **81** become parallel and into contact with each other, as seen in phantom lines in FIG. 13. As piston rod **86** is extended further, unloading arm **81** is pivoted clockwise about hinge pin **82** through arc "B" of about 90°, as indicated in FIG. 12, until the entire double-acting sweep unloader **80** is generally vertical. Boles **196** of felled trees, which rest upon top riser **88** as unloading arm **81** is pivoted, are carried up, over and well beyond the outside edge of left-hand catch rail **76**. Boles **196** of bunched trees resting on the bole-supporting means thus are impelled upwardly over catch rail **76** and outwardly of the vehicle so that the trees fall clear of the tracks and side structure of the vehicle.

The vehicle shown in the drawings has a tree-unloading means positioned only on one side thereof. However, tree-harvesting vehicles embodying the invention may have similar unloading means installed on both sides of the vehicle so that assembled trees can be unloaded selectively from either side of the vehicle.

This type of unloading means is also useful for unloading many other types of articles, such as logs, telephone poles, pipe, lumber, cylinders, containers and the like. It is particularly useful for unloading trees and other elongated articles from a vehicle by raising them up and over

barriers, such as bulkheads **75** and catch rails **76** or side boards of a truck or other vehicle, and depositing the articles alongside the vehicle.

TREE-FELLING ASSEMBLY

A swing-type, tree-felling assembly provided with a fixed anvil is shown in FIGS. 1, 4, 5, 6, and 7. This assembly comprises a two-part joint having hinge components, swing sidling means, lifting means, thrusting means, a single-boom assembly, and a shear assembly.

The two-part joint has upper and lower parts, of which the upper part is lift joint **105**, of knuckle-and-bracket construction. The lower part is boom joint **110**, of double-bracket construction. The vertical hinge components of both lift joint **105** and boom joint **110** are attached to the motor vehicle. Vertical pin **107** of lift joint **105** is fastened to transverse bumper bar **23** and to lower guard rail **27**. Horizontal lift hinge pin **106** permits pivoting of the lifting means in a vertical plane.

Boom joint **110** pivots about a vertical boom hinge pin **111** attached to felling assembly brackets **25**. Hinge pin **111** is aligned vertically with vertical pin **107** of lift joint **105**. Thus, lift joint **105** and boom joint **110** function like the hinges of a gate. Boom joint **110** includes a horizontal hinge pin **113**, which permits pivoting of the trolley boom **120** in a vertical plane, and also includes a swing bracket **114** attached to the swing sidling means and to the side of boom joint **110**. As shown in FIG. 1, the swing sidling means comprises a hydraulic swing cylinder **115**, piston rod **116**, and swing hinge pin **117**.

Trolley boom **120** is of generally H-shaped construction and is attached at its lower inner end to hinge pin **113**. A trolley clearance bracket **130** is attached to the upper surface of trolley boom **120** with one arm close to the upper, forward end of trolley boom **120**. Bracket hinge pin **131**, located at the midpoint of trolley clearance bracket **130**, is attached to the lifting means. In the embodiment shown in FIGS. 1 to 7, the lifting means comprises a hydraulic lifting cylinder **135**, attached to lift joint **105** by lift hinge pin **106**, and piston rod **136**, which is attached to hinge pin **131** at the apex of trolley clearance bracket **130**.

Trolley boom **120**, as shown in FIGS. 8 and 9, has web **121**, horizontal flanges **122**, and vertical reinforcing plates **123** welded to horizontal flanges **122** to form a reinforced box structure for the rearward portion of trolley boom **120**, a narrowed triple web structure (FIG. 9) for the middle portion of trolley boom **120**, and a conventional beam structure for the forward end of the trolley boom. Trolley raceways **124** are thereby defined on the upper edges of lower flanges **122**, outside of reinforcing plates **123** and along the middle portion of trolley boom **120**, as shown in FIGS. 8 and 9.

As shown in FIGS. 4 and 6, the thrusting means in this embodiment is thrust cylinder **160** attached by thrust pin **161** to bracket **162**. Bracket **162** is attached to bottom flange **122** of trolley boom **120** near its rearward end. The end of thrust piston rod **163** is shown in FIG. 10 and in phantom view in FIG. 4.

As shown in FIGS. 4, 6, 8, and 10, trolley **140** comprises parallel housing plates **141**, bottom plate **143**, buttresses **144** (omitted in FIG. 8), load rollers **146**, raceway rollers **148**, bottom rollers **149**, trolley take-up wedges **151**, wedge guides **152**, trolley thrust pin **153**, wedge set pins **154**, and wedge strips **155**. Bottom plate **143** (FIG. 10) and buttresses **144** are attached to housing plates **141** and to the top member of the shear beam therebeneath. Trolley thrust pin **153** passes through thrust piston rod end **163**. Trolley take-up wedges **151** keep bottom roller **149** in close contact with bottom horizontal flange **122** by exerting strong upward pressure on the shaft of bottom roller **149**, as shown in FIGS. 4 and 6.

The shear assembly (FIGS. 4 and 5) comprises trolley **140**, channel-shaped shear beam **171**, anchor pin **173**, shear cylinder **176** (FIGS. 5 and 7), shear piston rod **177**, fulcrum pin **179**, blade pin **178**, anvil backup plates **181**, anvil **182**, anvil arm **184**, and shear blade **190**. Shear beam **171** is attached to and hangs from trolley **140**. Cap **172** protects the rearward end of shear beam **171** and has openings therethrough (not shown) for shear-cylinder hydraulic fluid lines **65** to pass to shear cylinder **176**. Anchor pin **173** receives the compressive force of shear cylinder **176** at the rearward end of shear beam **171**. Blade pin **178** hingeably connects shear piston rod **177** and blade **190**. Blade **190** is a flat plate of substantial thickness and of generally sectorial shape. The leading edge, opposite to blade pin **178**, forms a double-beveled cutting edge **191** (FIG. 15).

Anvil **182** and anvil back-up plates **181** are attached to the side of shear beam **171** opposite to shear cylinder **176**. The forward-facing holding edge of anvil **182** is concave, with concavity most pronounced near shear beam **171**, and is provided with anvil teeth **183** which face generally toward fulcrum pin **179** whereby a tree bole tends to become cradled close to shear beam **171**. Anvil **182** has a downwardly bent anvil arm **184** at its outer end, which provides a cam surface for positioning blade **190** as it moves through a tree bole **196** toward the closed position shown in FIG. 7. As shown in cross section in FIG. 14, anvil teeth **183** are beveled upward to form a series of sharp holding edges which, in combination with cutting edge **191**, creates a positive couple of equal parallel forces having a minimum moment arm.

OPERATION OF SWING-TYPE TREE-FELLING ASSEMBLY

In the operation of the swing-type tree-felling assembly shown in FIGS. 1 through 7, the tree-harvesting vehicle is driven to a position near enough to a tree for shear blade **190** and anvil **182** to be placed horizontally on opposite sides of the tree, as shown in FIGS. 1 and 3. The tree-felling assembly is actuated so as to position anvil **182** and blade **190** near to the ground and on opposite sides of bole **196**. Hydraulic fluid is introduced under pressure into shear cylinder **176**, whereupon blade **190** is caused to turn in a counterclockwise direction, as seen in FIG. 3, and to sever bole **196**.

During the tree-shearing operation, the upper beveled surface of cutting edge **191** exerts an upward force upon the sheared butt of bole **196**, and its lower beveled surface exerts an equal downward force upon the sheared top of the tree stump. With transverse forces thus in balance, cutting edge **191** shears straight across the bole of the tree. With the downward force opposed by the unyielding ground and with the upward force resisted by the weight of the tree, cutting edge **191** initially crushes the adjacent wood fibers on both sides of the hole. Then, when cutting edge **191** is nearly to its closed position, blade **190** acts like a wedge and the upward force it exerts lifts the cut face of the sheared tree bole **196** upwardly in a felling plane **192** (FIG. 7), which is normal to cutting edge **191**.

The most powerful and effective wedging action takes place at the point of closure, as shown in FIG. 7, whereby a strong tilting impetus is imparted to sheared bole **196** as the last fibers are cut. If no adjacent trees entangle the foliage and limbs of a sheared tree, the tree drops in free fall onto impact bar **74** along felling plane **192**, which forms an acute angle with shear beam **171**.

BOLE POSITIONING

As pointed out previously, it is desirable to bunch boles **196** of trees which are resting on the roof means, in order that they may be handled easily in subsequent operations. By means of the felling assembly shown in FIGS. 2 and 3, it is possible to reach almost any overhead position that a bole **196** could assume on the roof means and grasp it between cutting edge **191** and anvil teeth **183**. By proper movement thereof, the felling assembly can be caused to move laterally any boles **196** that are

positioned improperly on the roof means and to bunch the boles in a desired compact alignment.

TREE-TOSSING MEANS

Frequently, limbs of trees are entwined to some extent with limbs of adjacent trees. When the bole of a tree is cut, the limbs of the adjacent standing trees may catch the falling tree and impede its fall, alter its direction of fall, or even prevent it from falling. However, if a tree is lifted quickly above surrounding foliage as soon as its bole is sheared, the fall of the tree is impeded by the foliage of adjacent trees to a much lesser extent than would be the case if the felled tree were permitted to fall without being lifted. In accordance with the invention, means are provided to lift a sheared tree as soon as its bole **196** is severed and before the falling tree has lifted appreciably from its vertical position. This means can be called a "tree-tossing" means, and can be described most readily in terms of operational procedure. This procedure is as follows:

At the very moment that blade **190** is fully closed, as shown in FIG. 7, or slightly sooner, the operator energizes hydraulic lifting cylinder **135**. Since the sheared butt of bole **196** rests upon blade **190** and anvil **182**, the entire tree is tossed upwards while its foliage parts **197** fall along felling plane **192** toward impact bar **74**. At the upward limit of travel of the felling assembly, the sheared butt of bole **196** is disengaged from blade **190**, and the entire tree pivots about its center of gravity. As a result, foliage parts **197** strike surrounding foliage while moving relatively rapidly and downwardly, instead of slowly sideways as is usual in tree-felling conditions.

ADJUSTABLE ANVIL SHEAR

Instead of using the fixed-anvil shearing assembly described previously, an adjustable anvil shear assembly like that shown in FIGS. 15, 16 and 17 may be employed. With this type of shear, anvil body **182** may be moved selectively to shift the terminal position of cutting edge **191** around fulcrum pin **179** so that felling plane **192** is shifted equally with respect to shear beam **171**.

This embodiment has a longitudinal dovetail gib **185** (FIG. 17) attached to the side of shear beam **171** (near to fulcrum pin **179** and opposite to shear cylinder **176**), and a matching dovetail slide **186** having anvil body **182** and truncated anvil back-up plates **181'** attached thereto. A flat anvil cylinder plate **283** has plates **181'** attached to its forward side and a bracket and anvil pin attached to its rearward side. Attached to the anvil pin is shift cylinder **187** which moves shift piston rod **188**. Cylinder pin **189** is attached by a lug to the rearward part of shear beam **171** (near to anchor pin **173**) and is also attached to shift piston rod **188**. Hydraulic lines (not shown in the drawings) connect shift cylinder **187** to the hydraulic pump so that cylinder **187** connected thereto may be moved along its axis to cause dovetail slide **186** to slide forward or backward, as desired, on dovetail gib **185** to shift the position of anvil **182**.

By shifting anvil **182** backward or forward, cutting edge **191** is selectively pivotable through approximately 45° before reaching a fully closed position as shown in FIG. 7, whereby felling plane **192** is also varied through approximately 45° relative to shear beam **171**. An operator of this type of tree-harvesting machine is able, by selectively positioning anvil **182** relative to fulcrum pin **179**, to vary felling plane **192** and thereby control the direction of fall of a tree without moving the motor vehicle itself.

PIVOTABLE ANVIL SHEAR

Another method and mechanism for varying felling plane **192**, shown in FIGS. 18, 19, 20 and 21, involves the use of a parallelogram mechanism which pivots sickle-shaped anvil **182'** about pin **179** by movement of piston rod **165**. This piston rod **165** is attached pivotably to pin **170** near the outer end of anvil **182'**. Piston rod **165** is attached to a piston of conventional design (not shown) which slides within anvil cylinder **167**. Also attached pivotably to anvil pin **170** is anvil beam **169**, which always remains parallel to fulcrum plates **166**. Fulcrum plates **166** are attached at their forward end to fulcrum pin **179** and at their rearward end to a cylinder pivoting pin **174**, to which cylinder **167** is also attached.

Adjacent to pin **174** is anchor pin **173** to which shear cylinder **176** is attached. Shear piston rod **177** is actuated by shear cylinder **176** and is attached to shear cylinder **176** and to blade pin **178** on shear blade **190** which is attached to and pivots around fulcrum pin **179**. Anvil beam **169** is attached pivotably to anvil parallel plates **168** by pin **175**, and plates **168** are also attached to cylinder pivoting pin **174**. Compressive stresses are resisted by cylinders **167** and **176**, and tensile stresses are withstood by fulcrum plates **166**. As illustrated schematically in FIGS. 20 and 21, when piston rod **165** is drawn into the cylinder **167**, anvil **182'** is pivoted backwardly so that blade **190** must be pivoted accordingly to reach its fully closed position, whereby felling plane **192** (FIG. 7) is necessarily moved through an equal angle.

The adjustable-anvil and pivotable-anvil embodiments are two types of movable-anvil shears. Other means of moving the anvil so that felling plane **192** is selectively shifted are within the scope of the invention. With either embodiment, shear piston rod **177** must be long enough to permit blade **190** to pivot as far as desired. Either of these movable-anvil embodiments of the shear assembly can be combined with a suitable positioning means and boom assembly to form a versatile swing-type felling assembly or a useful rack-type felling assembly. With capability at his finger-tip to select the proper felling angle for each tree, the operator may fell trees in the desired directions without leaving the cab of the tree-harvesting vehicle.

It is readily understood from the foregoing description that various changes may be made in details of structure and arrangement of the tree-felling assembly, the roof means, and the unloading means wtihout departing from the scope of this invention. The appended claims are consequently intended to cover all such modifications and alterations as may fall within the true spirit and scope of the invention.

What I claim is:

1. A mobile tree-harvesting apparatus comprising a self-propelled vehicle having a tree-shearing means mounted on the vehicle operable upon actuation by driving means to sever the bole of a tree and initiate free fall of said tree in a direction to fall onto the vehicle and means carried by the vehicle for receiving a tree in free fall.

2. The mobile tree-harvesting apparatus of claim **1** wherein said tree-shearing means is movable laterally, longitudinally, and vertically with respect to the vehicle so as to selectively engage the bole of a tree to be severed.

3. The mobile tree-harvesting apparatus of claim **1** wherein said means carried by the vehicle for receiving a tree in free fall is a roof comprising bole-receiving means, bole-holding means and bole-unloading means.

4. A mobile tree-harvesting apparatus comprising; a self-propelled vehicle, tree-shearing means mounted on the vehicle and movable laterally, longitudinally and vertically with respect to the vehicle so as to selectively engage the bole of a tree to be felled, means for actuating the tree-shearing means to sever a bole thereby, said vehicle having a roof comprising a bole-receiving means, bole-holding means and bole-unloading means,

said bole-receiving means comprising a pair of elevated rails attached to said roof along the sides thereof, a transverse impact bar attached to the roof at the front end thereof, a transverse tree-rocking bar attached to the roof rearwardly of and higher than the transverse impact bar, and a transverse tree-holding

bar attached to the roof rearwardly of and lower than the tree-rocking bar, whereby the bole of a tree falling on the vehicle lengthwise thereof imparts its kinetic energy successively to the impact bar, the tree-rocking bar and the tree-holding bar and no part of the vehicle receives the entire impact of the falling bole.

5. The mobile tree-harvesting apparatus of claim 4 wherein each of the impact bar, the tree-rocking bar and tree-holding bar is V-shaped so as to receive, bunch and align trees falling on the vehicle.

6. The mobile tree-harvesting apparatus of claim 4 wherein said transverse impact bar comprises a top edge surfaced with arresting means designed to penetrate the bark of felled trees and prevent sliding thereof.

7. The mobile tree-harvesting apparatus of claim 4 wherein the bole-unloading means comprises a double-acting frame which first shifts said boles toward the center of the vehicle, and then raises the boles up and over one of said elevated rails to discharge the boles from the vehicle.

8. The mobile tree-harvesting apparatus of claim 7 wherein said double-acting frame comprises an elongated unloading arm hingeably attached at one end to an elevated rail and spanning the transverse distance between said elevated rails, a lifting arm having generally parallel elongated upper and lower members above and beneath said unloading arm, said parallel members being rigidly interconnected and hingeably attached to the unloading arm near the center of said arm, and lifting means attached to said lifting arm, whereby the lifting arm is first pivoted until the lower member contacts said unloading arm and the upper member is higher than said elevated rail, whereupon the unloading arm is pivoted in the opposite direction to discharge the trees.

9. A tree-harvesting apparatus which comprises a vehicle, tree-shearing means, tree-shearing support means movably on said vehicle, means for moving the tree-shearing means into cutting relationship with the bole of a tree and means for actuating the tree-shearing means to sever the bole, said tree-shearing means comprising a pivotable blade having a double-beveled cutting edge and an anvil attached to said tree-shearing support means in a plane parallel to and slightly below that of the blade and is positioned so as to engage the bole of a tree on the side opposite to that engaged by the blade, said anvil and blade is in such relationship to the vehicle that when said blade severs a tree, the tree is caused to be felled toward said vehicle.

10. The tree-harvesting apparatus of claim 9 wherein the edge of said anvil facing the blade is concave and is provided with teeth which face toward the point about which the blade pivots.

11. A tree-harvesting apparatus which comprises a vehicle, tree-shearing means, means for supporting the tree-shearing means movably on the vehicle, means for moving the tree-shearing means into cutting relationship with the bole of a standing tree, and means for actuating the tree-shearing means to sever the bole, said tree-shearing means comprising a pivoted blade having a double beveled cutting edge of such thickness as to exert on the butt of a tree sheared thereby and on the top of the stump of the sheared tree equal and opposite forces of such magnitude that the tree is sheared cleanly across a single substantially horizontal plane, said supporting means comprising an anvil in a plane parallel to and slightly below that of the blade and positioned so as to engage the bole of a tree on the side opposite to that engaged by the blade, whereby the anvil rests beneath the blade when the blade is closed, and means for adjusting the position of the anvil with respect to the blade.

12. The method of harvesting trees with a vehicle having a tree severing means which comprises severing the bole of a tree so that the severed tree is allowed to free fall toward the vehicle, catching said severed tree against said vehicle whereby the momentum of said severed tree in free fall carries it on top of said vehicle.

13. The method of claim 12 wherein said severed tree is tossed upwardly immediately after the bole is severed.

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U.S. Cl. X.R.

144—3, 34

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,528,468 Dated September 15, 1970

Inventor(s) Joseph E. Blonsky

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, line 3, "Joseph E. Bronsky" should read -- Joseph E. Blonsky --.

Signed and sealed this 1st day of December 1970.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

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