United States Patent

[11] **3,587,681**

[72] Inventors **Georg Wehr;**
Gotthold Goetze; Hans Heesch, Rotenburg
An Der Fulda, Germany

[21] Appl. No. **735,222**
[22] Filed **June 7, 1968**
[45] Patented **June 28, 1971**
[73] Assignee **Rotenburger Metallwerke GmbH**
Fulda, Germany
[32] Priority **June 9, 1967**
[33] **Germany**
[31] **R46219**

[54] **APPARATUS FOR DEBRANCHING AND/OR DEBARKING FELLED TREES**
23 Claims, 18 Drawing Figs.

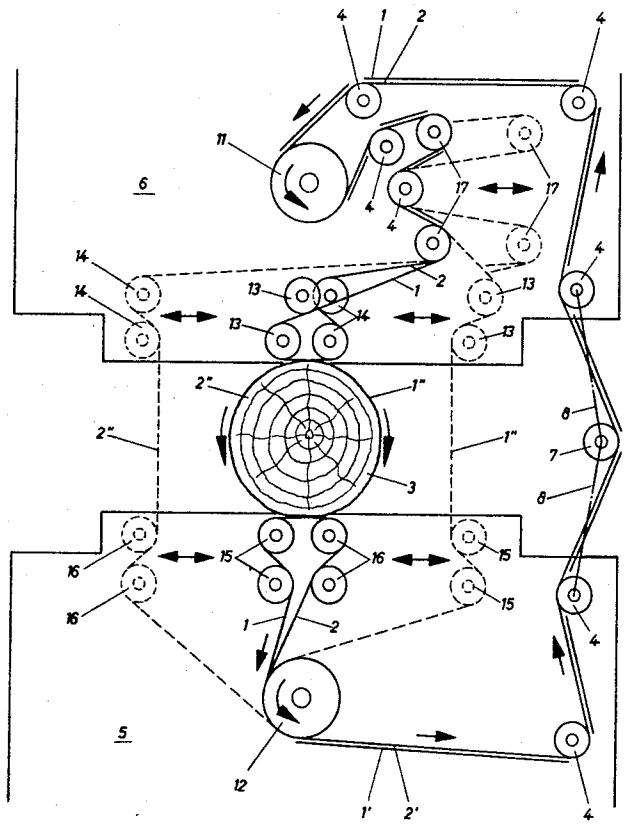
[52] **U.S. Cl.** **144/2,** 144/208
[51] **Int. Cl.** **B27l 1/00**
[50] **Field of Search** 144/208, 208-9, 2-21, 3-4

[56] **References Cited**
UNITED STATES PATENTS

2,625,968	1/1953	Eklund et al.	144/208-9
2,642,904	6/1953	Pearce	144/208-9
2,989,097	6/1961	Bombardier	144/208-9
3,093,170	6/1963	Thayer	144/208-9

Primary Examiner—Gil Weidenfeld
Attorney—Stevens, Davis, Miller & Mosher

ABSTRACT: An apparatus for debranching and/or debarking felled trees comprising upper and lower vertically displaceable supports each having stationary, rotatably mounted guide pinions, input pinions and output pinions for each of at least two endless chain cutters passing between the supports. Two motors are operatively connected to each chain to drive it in traction and thrust. The input and output pinions are arranged tangentially to the periphery of the trunk so that the cutters run in opposite directions along overlapping, opposed peripheral portions of the trunk. Tensioning means are also included to apply tension to the chain cutters so that they will follow the profile of the trunk during processing.



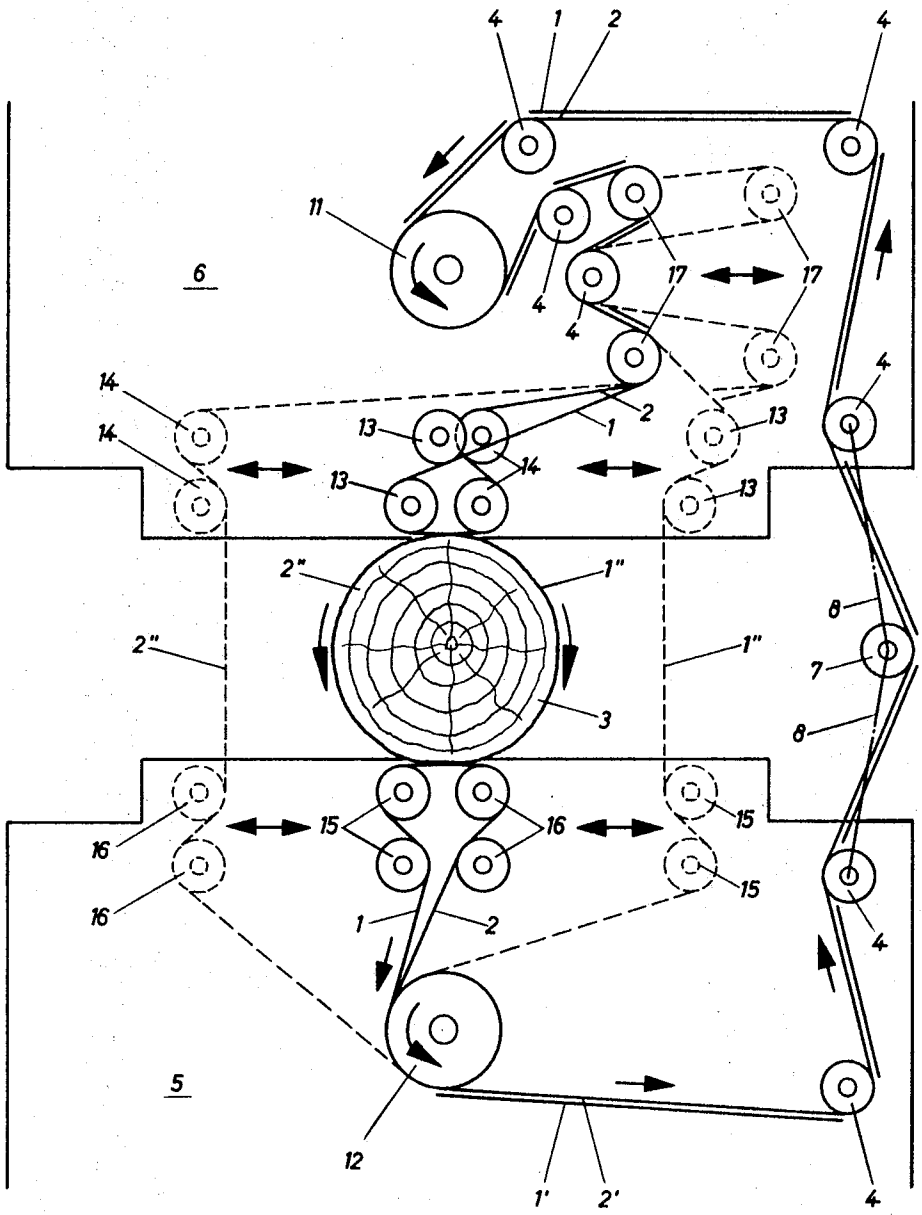

4
1
2
4
11
6
17
17
4
4
14
14
2
1
13
13
14
13
13
13
4
2"
1"
2"
1"
8
7
8
3
16
16
15
16
15
15
1
2
4
5
12
1'
2'
4

Fig 1

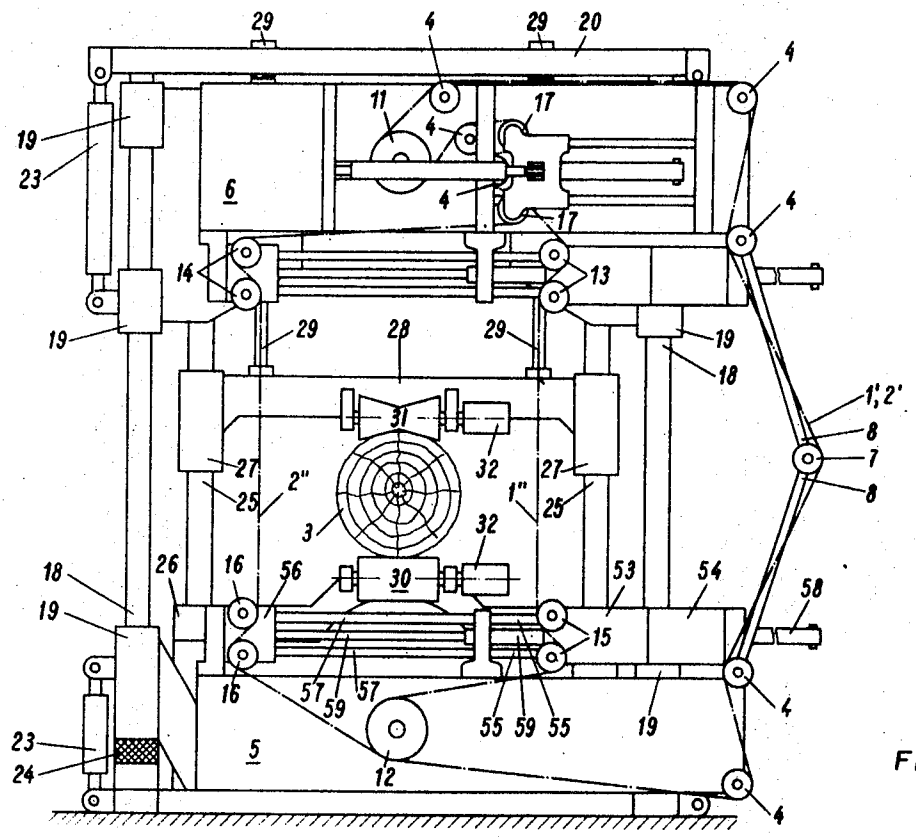

29
4
29
20
4
11
17
4
19
23
6
4
17
4
14
13
19
29
28
29
19
18
1', 2'
31
8
7
32
27
27
8
2"
25
1"
25
3
32
18
26
16
56
30
53
54
58
19
15
16
57
59
57
55
59
55
19
4
23
24
5
12
4

Fig 2

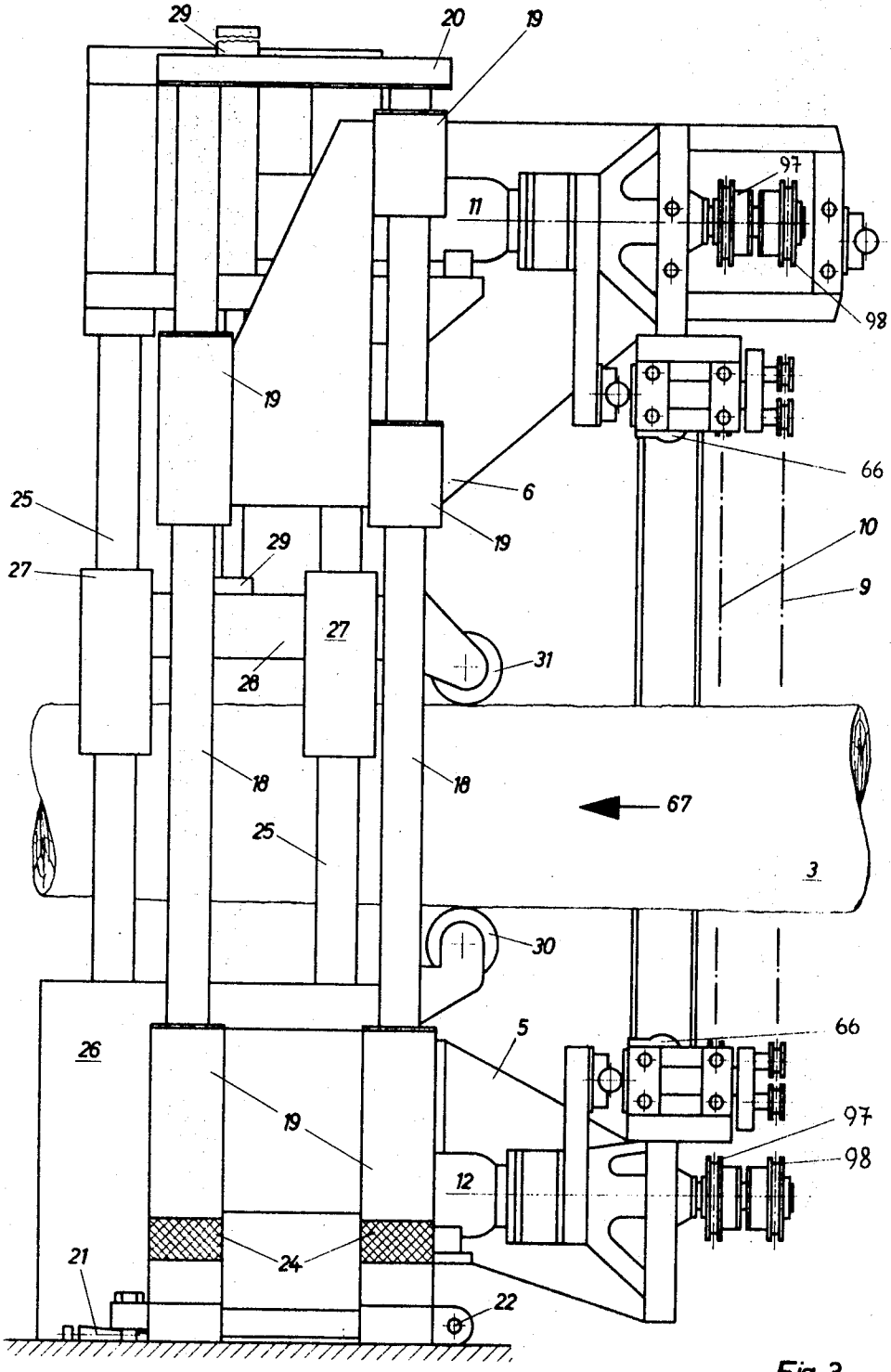

29
20
19
97
11
98
19
66
6
19
25
10
29
27
9
27
28
31
18
18
67
25
3
30
66
5
26
19
97
98
12
21
24
22

Fig 3

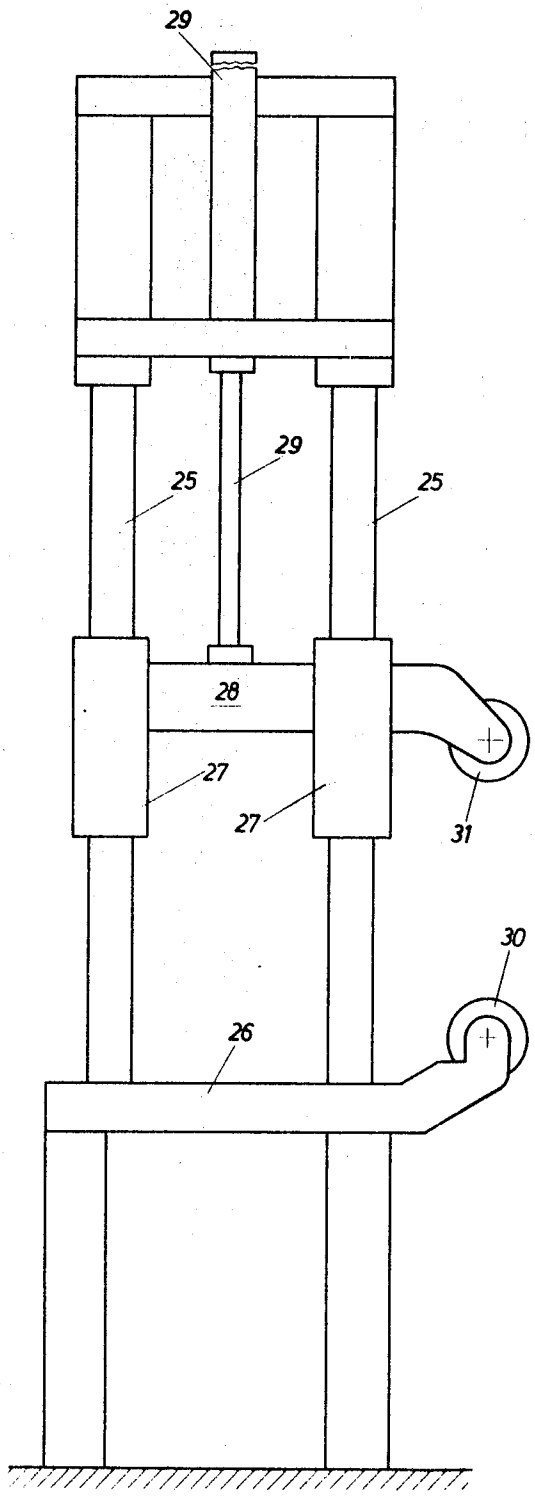


Fig 4

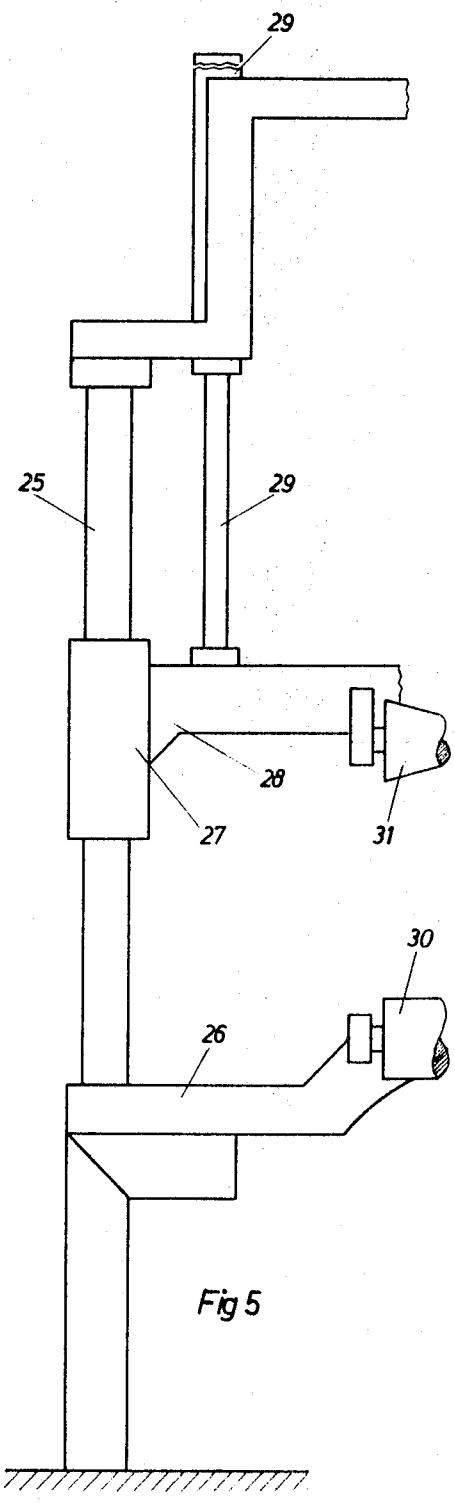


Fig 5

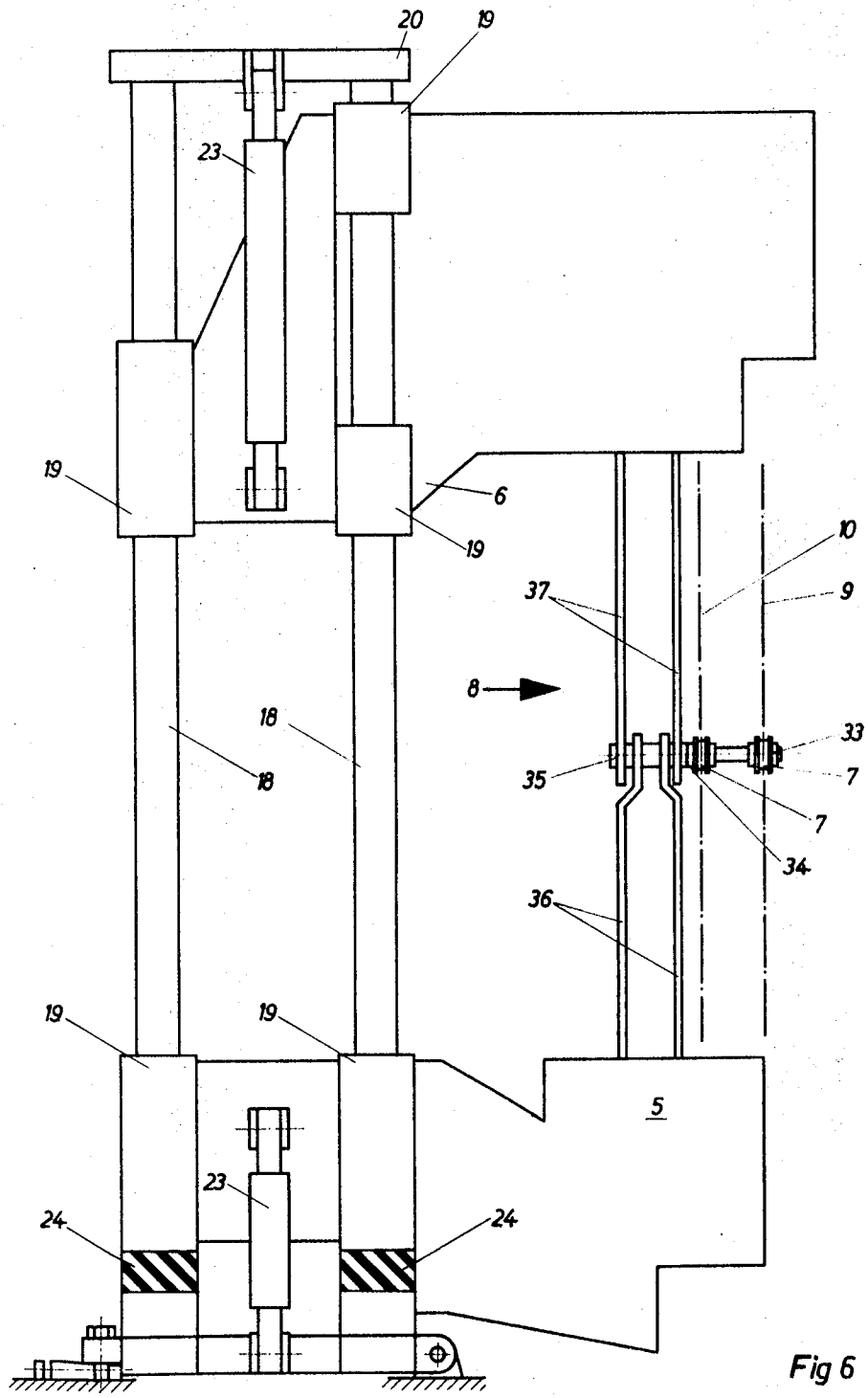


Fig 6

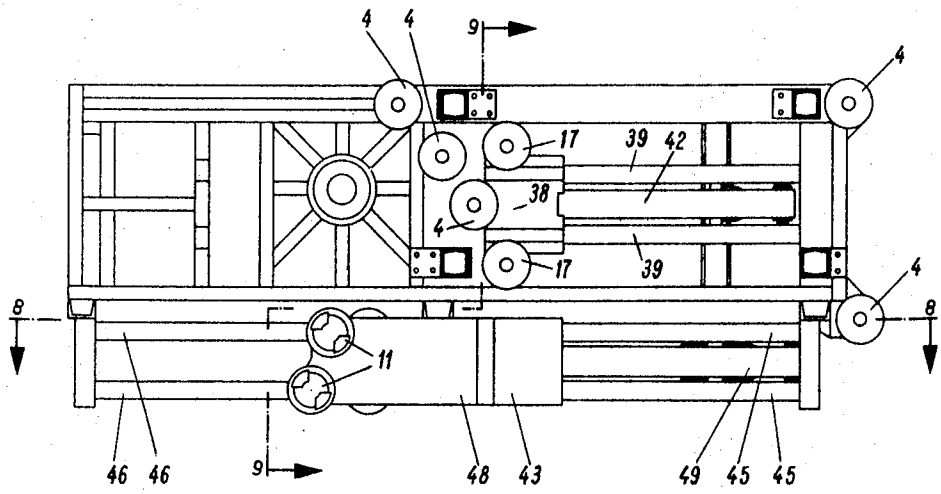


Fig 7

Fig 8

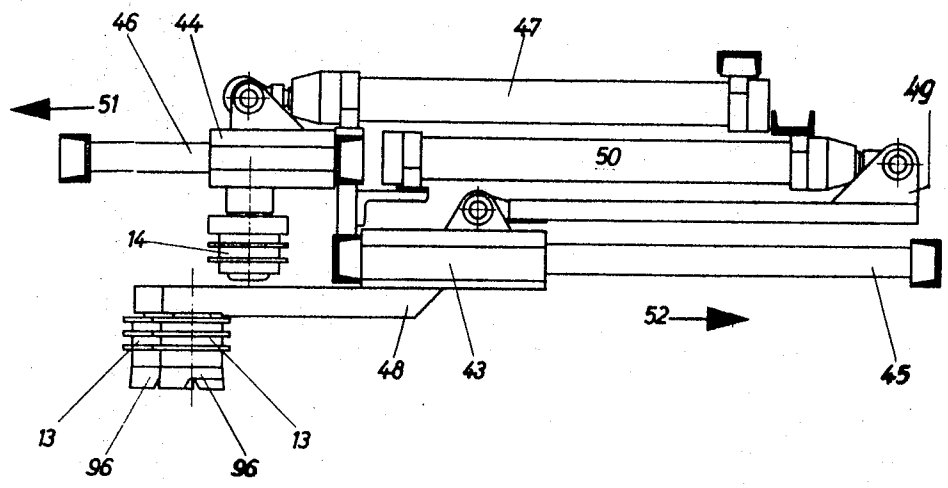
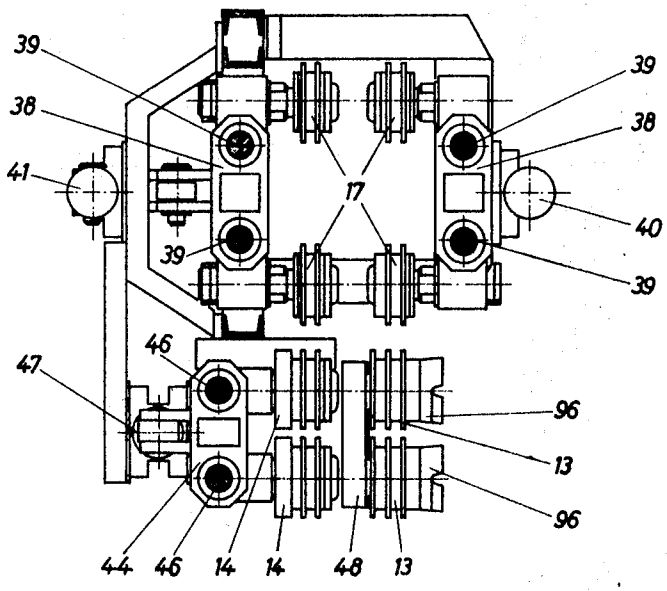

46
44
47
49
51
50
14
52
48
43
45
13
96
96
13

Fig 9


39
38
41
17
39
39
38
40
39
46
47
96
13
96
44
46
14
14
48
13

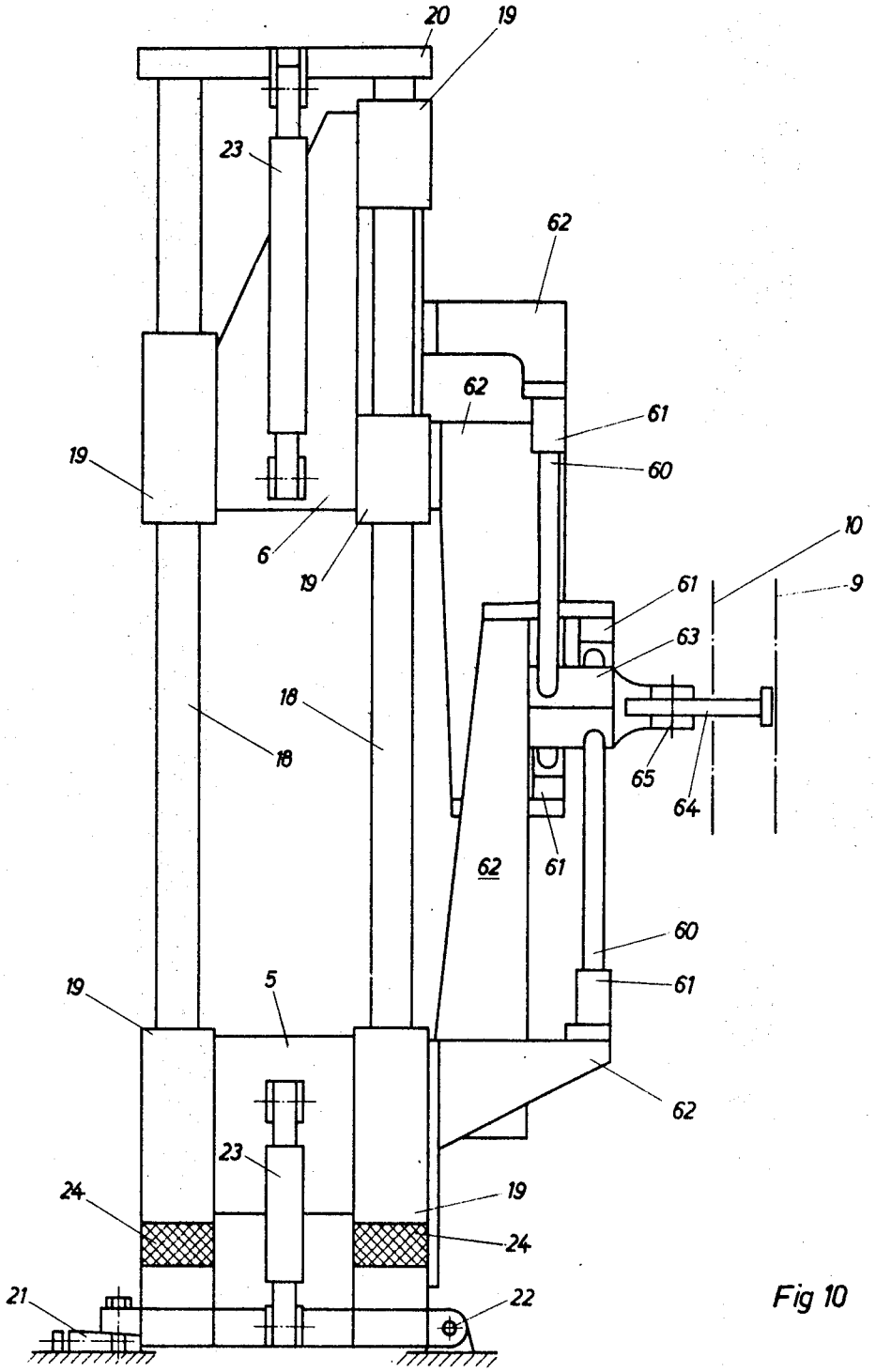

20
19
23
62
62
61
19
60
6
19
10
9
61
63
18
18
65
64
62
61
60
19
5
61
62
23
24
19
24
21
22

Fig 10

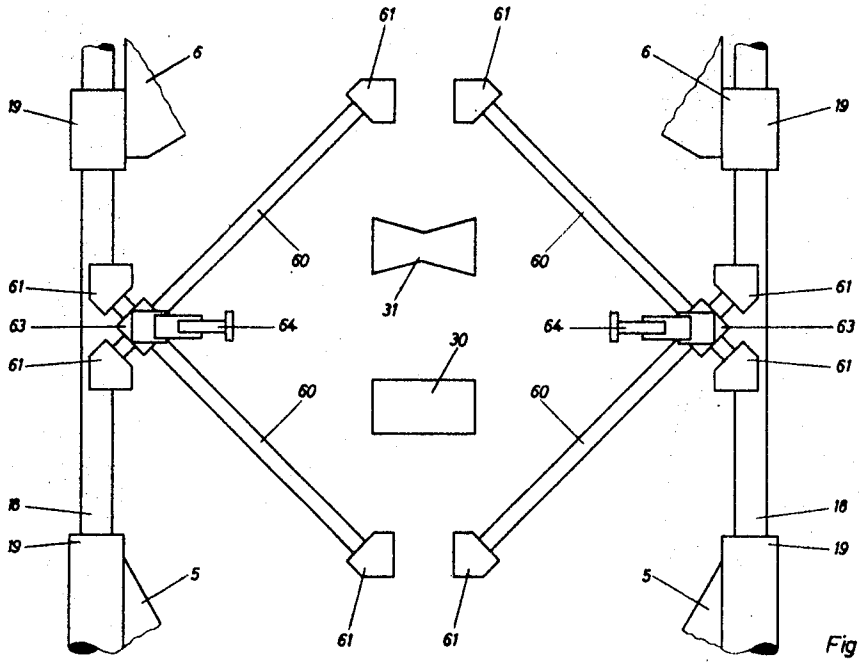

61
61
6
6
19
19
60
60
31
61
63
64
64
63
61
30
61
60
60
18
18
19
19
5
5
61
61

Fig 11

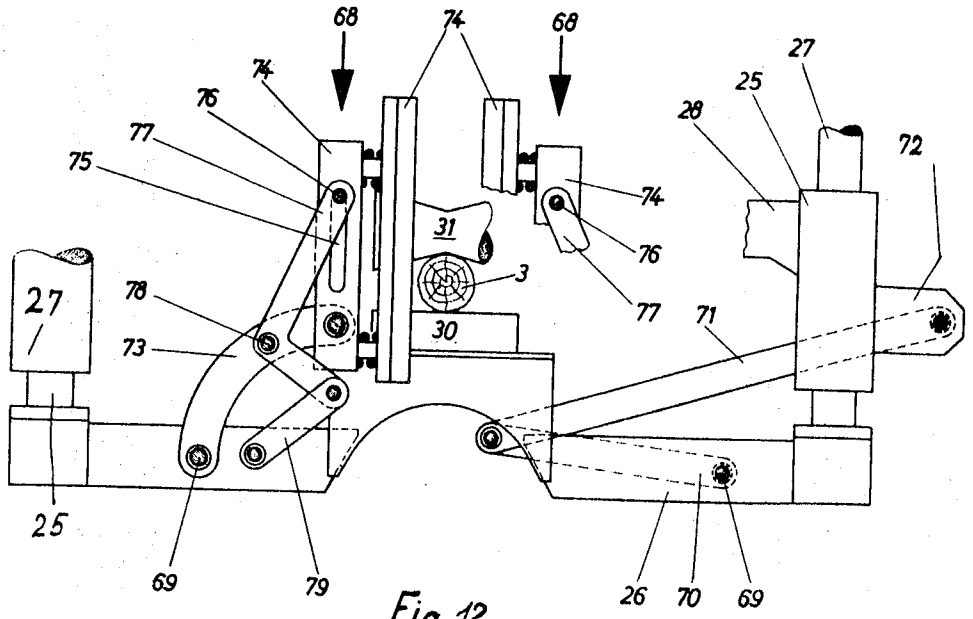

68
74
68
74
76
77
75
74
76
77
31
3
30
27
78
73
71
27
25
28
72
25
69
79
26
70
69

Fig. 12

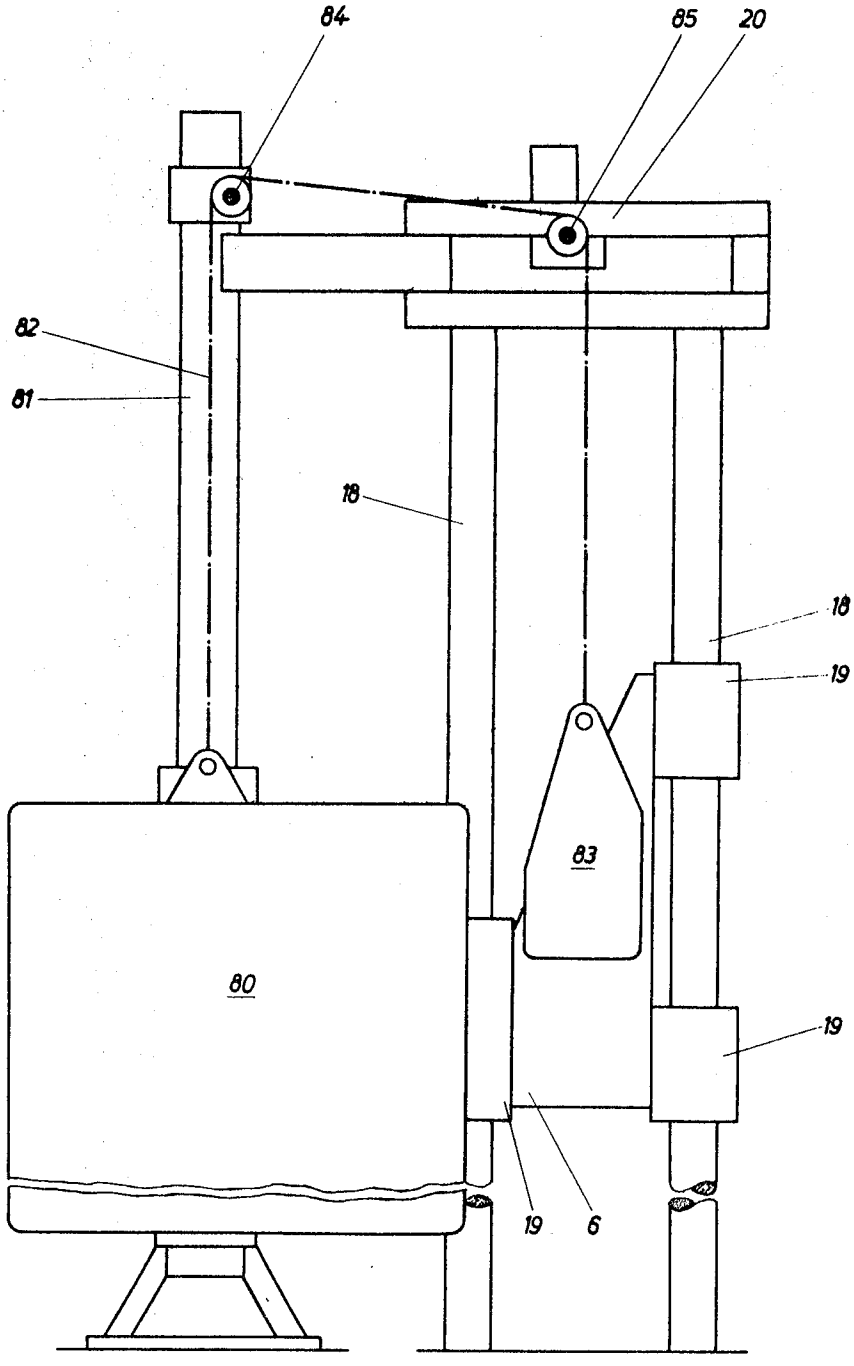


Fig 13

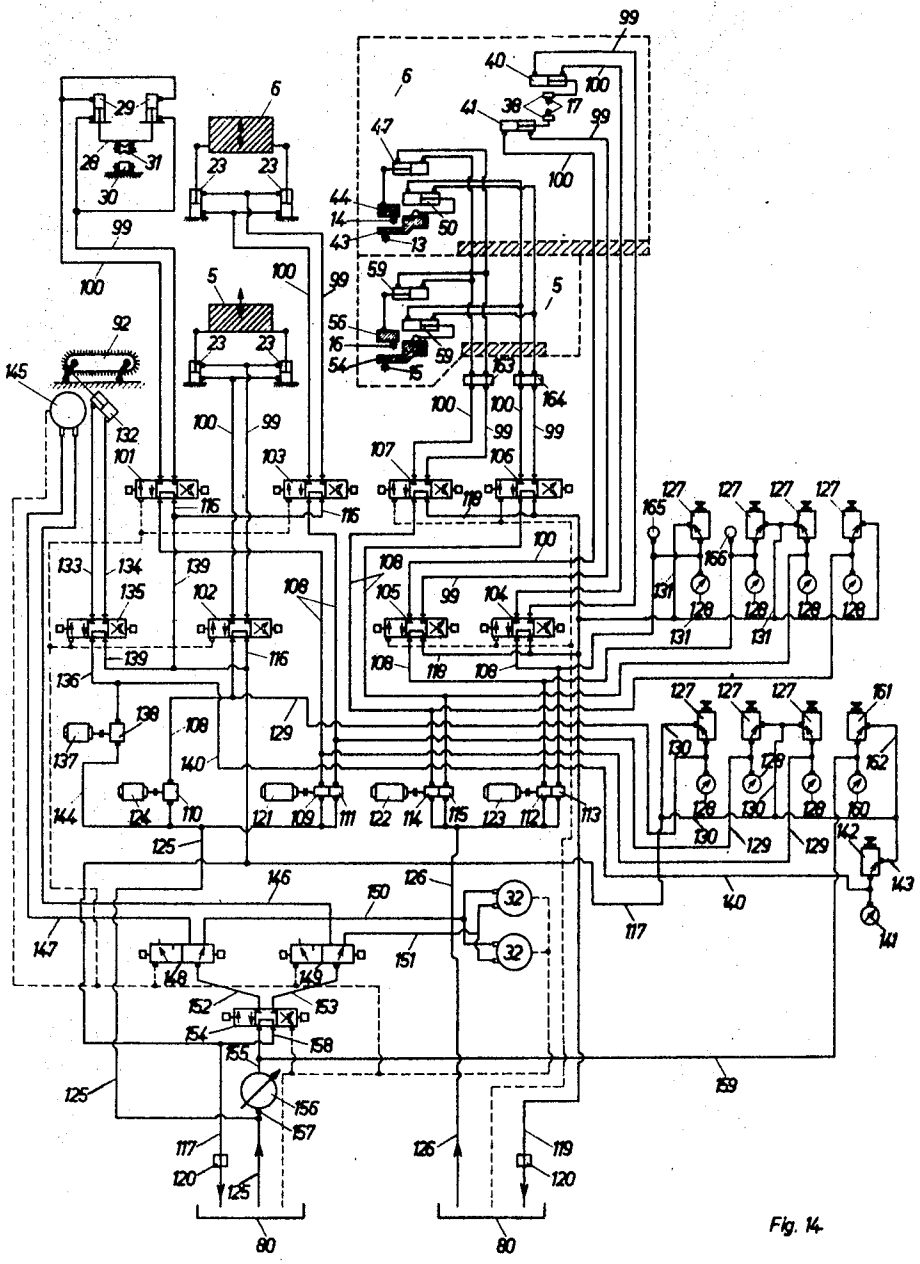
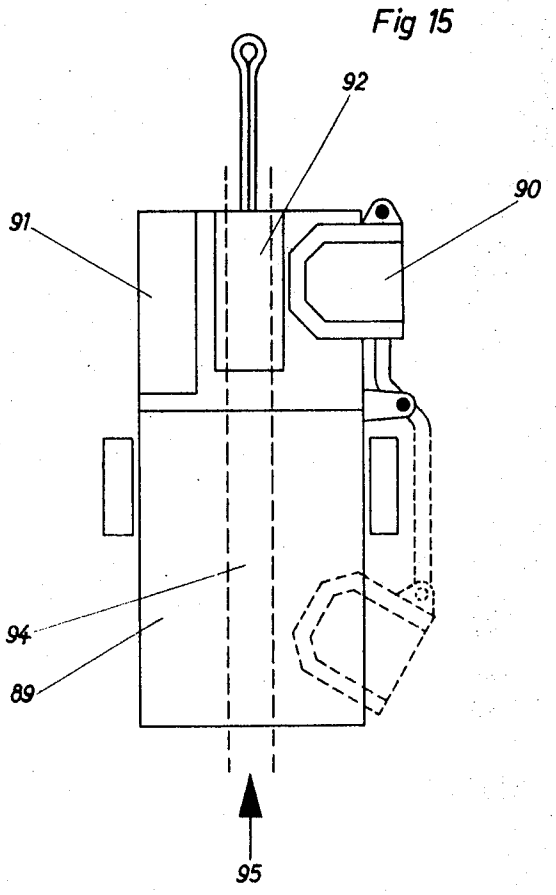


Fig. 14.

Fig 15



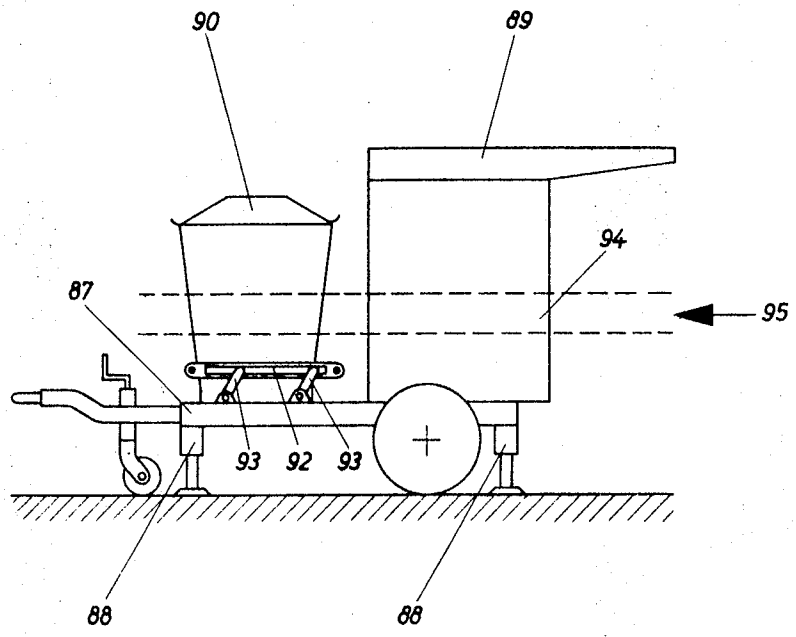


Fig 16

FIG. 17

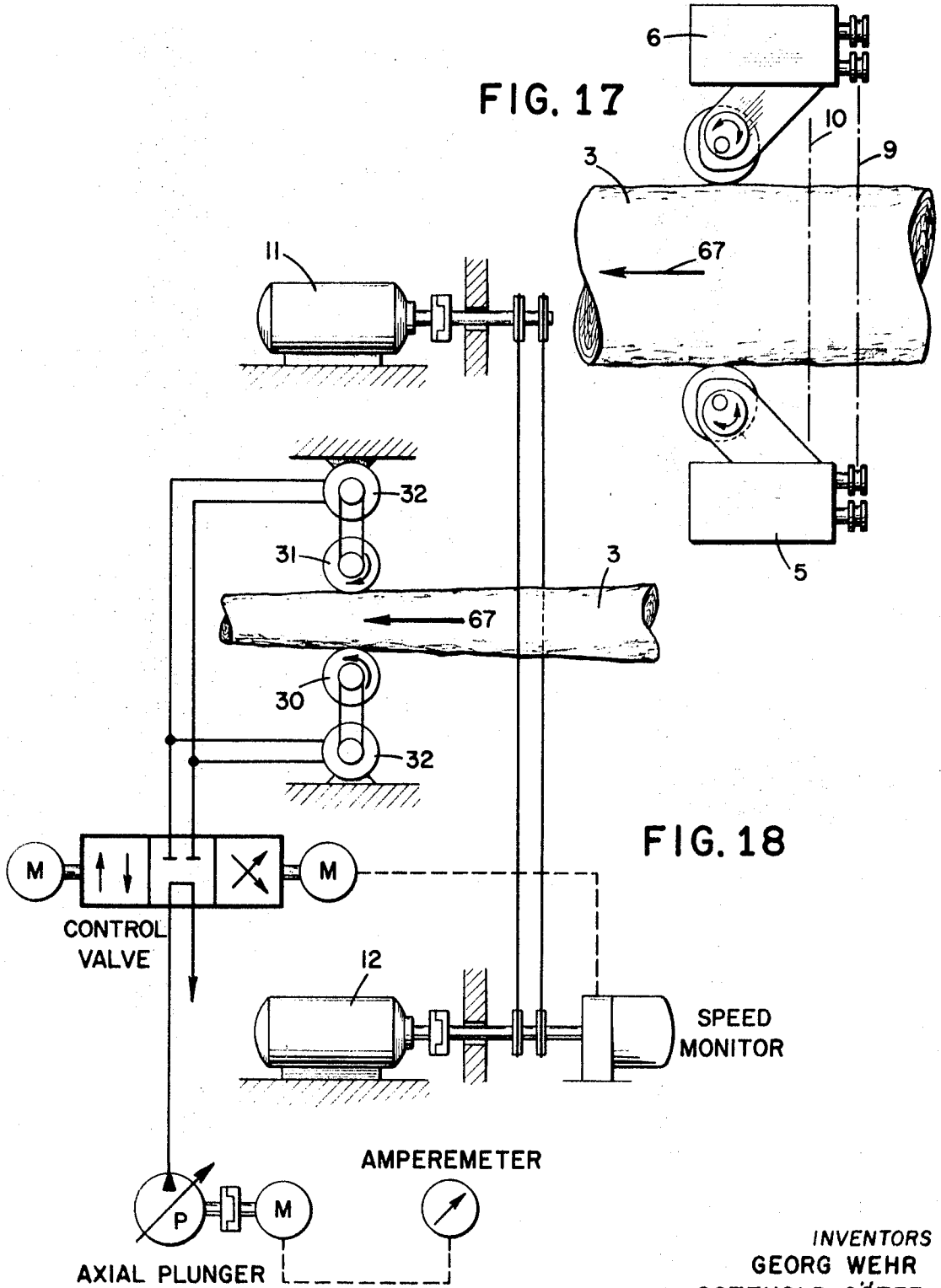


FIG. 18

INVENTORS
GEORG WEHR
GOTTHOLD GÖTZE
HANS HEESCH

BY Stevens, Davis, Miller & Mosher
ATTORNEYS

APPARATUS FOR DEBRANCHING AND/OR DEBARKING FELLED TREES

The invention relates to an apparatus for debranching and/or debarking felled trees, or tree trunks, by means of chain cutters.

In order to facilitate transportation and, especially in the case of conifers, to avoid insect attack, trees felled in wood exploitation are as a rule debranched and debarked in situ immediately after felling and, if necessary, they are also cut to lengths ready for the market. Apparatuses are already known by means of which some of this work can be carried out, among others, for instance, apparatuses using a chain cutter as the debarking element.

Many difficulties arise in building such apparatuses. Above all, account must be taken of the totally asymmetrical configuration of the tree to be processed, which is not brought about merely by the presence of branches but is also the consequence of the irregular configuration of the trunk itself, since the trunk tapers from bottom to top, exhibits an axis curved to a greater or lesser degree in all possible directions, and at any level has a totally asymmetrical cross section. It should furthermore be borne in mind that the requirement is not merely to debark by mechanical means trunks already debranched, but both to debranch and debark felled tree trunks with one apparatus; and finally, that it is important that the branches be severed and the bark removed as completely as possible, i.e. in many cases as far as the inner most peel, but without damaging the wood. These facts show why development in this field has not yet ceased and why better solutions are being sought, taking all of these difficulties into account as far as possible.

It is an object of the invention to produce an apparatus for debranching and/or debarking felled tree trunks lying horizontally, which apparatus operates safely and reliably, i.e. which debranches felled trunks of different growths and/or debarks them as far as the inner most peel without damaging the wood of the trunk, thus making possible continuous operation with the smallest possible number of operators.

This aim is accomplished with an apparatus for debranching and/or debarking felled trees or tree trunks by means of chain cutters, the apparatus being characterized, according to the invention by at least two endless chain cutters which, in the operating position lie, running in opposite directions, with a portion of their length, against the trunk along a peripheral section greater than $360°/n$ (n= number of chains). The chain cutters are each driven by two motors, one driving the traction run and the other driving the thrust run, the one motor being arranged on the upper, and the other motor upon the lower, of two transverse supports vertically displaceable in relation to each other and adjustable from the top and bottom to the moving trunk. Each of the supports exhibiting stationary, rotatably mounted guide pinions for the chain cutters and, for each chain cutter, a pair of adjacent rotatably mounted input pinions and output pinions movable in tangential direction with respect to the periphery of the moving trunk. A tensioning device is furthermore provided for each chain and is associated with one of the two supports and consists of a pair of rotatably mounted tensioning pinions, the distance of which from a stationary guide pinion, located in the chain run between the tensioning pinions, is variable in accordance with the periphery of the moving trunk located between the supports.

This provides a plurality of advantages. For one thing, it ensures that no torque is exerted on the trunk passing through the apparatus by the cutting elements, i.e. the chain cutters, during debranching and/or debarking, that is to say the trunk does not rotate. It also results in the start of the chain being smoother and easier, while at the same time excluding any disadvantageous softness, i.e. unduly low tension in the chain cutters. This causes the chain cutters to run more smoothly in the guide- and drive-pinions. The arrangement of two superimposed chain supports not only ensures that the apparatus according to the invention is of relatively small dimensions

and thus requires a small amount of space, but also makes it possible to accommodate the more sensitive parts of the apparatus in the upper support, so that the functioning of the parts is not impaired by waste bark and branches. Moreover the pairs of input and output pinions make it possible to open the chain cutters without interrupting the running of the chain, so that, immediately following a debranched and/or debarked trunk, a new trunk may be introduced into the apparatus, and may be processed continuously and even completely automatically. The tensioning devices ensure reliable functioning of the apparatus for each diameter of trunk located between the chain supports.

A further advantageous embodiment of the invention provides an additional, lower, immobile transverse support and an upper transverse support vertically displaceable in relation thereto, independently of the previously mentioned chain supports, and capable of being pressed against the moving trunk. The supports are equipped with motor-driven rollers to feed the trunk forward. Thus the apparatus according to the invention has a bearing point for the moving trunk which always remains at the same height, this being of advantage because the devices for feeding the trunks to, and removing them from, the apparatus are usually set once and for all at a certain height, after which they are not altered. The above-mentioned pairs of displaceable and tensionable input and output pinions provided, according to the invention, tangentially movable to the moving trunk, and the also previously mentioned mobility of the two chain supports in the vertical direction, ensure that each trunk periphery, regardless of its configuration and size, and in spite of the constant height of its lowermost point in the apparatus, is always reliably debranched and/or debarked.

In further perfecting the invention, the chain-cutter drive motors may be provided with a speed monitor which allows the trunk feed-rolls to be driven only when the motor is running at a specific adjustable number of revolutions per minute. This makes it impossible for the chain cutters to operate at a speed which is too low in relation to the trunk feed velocity, i.e. they cannot engage the trunk and tear.

In a similar way, it has been found advantageous to connect a contact ammeter to the current-supply line to the chain-drive motors, the ammeter cooperating with the feed rolls drive in such a manner that when the chain drive motors draw an increased amount of current, the r.p.m. of the feed rolls decreases until a normal current is drawn, whereas the current drawn increases when the r.p.m. rises. This also prevents undue stressing and tearing of the chain cutters. Moreover, optimal throughput times for the trunks is ensured in this way.

In a further advantageous configuration of the invention, an apparatus having two lateral chain cutters engaging the moving trunk may be provided, at the upper and lower chain supports, with two guide columns sloping laterally outwards at 45°. The columns at the upper support and the columns at the lower support are staggered in relation to each other in the direction of feed of the moving trunk. The columns of the upper and lower supports which lie on the same side extend over the same with and at the same distance from the vertical center line of the supports and are provided with a carrier displaceably mounted on both columns at the same time and exhibiting a support for the traction run, lying against the moving trunk, of one or the other chain cutter, it being possible for the support to be a pinion engaging in the relevant chain cutter. These precautions have made it possible to keep the support, in the simplest manner, in a position corresponding to the trunk section located in the apparatus, and to ensure satisfactory guidance of the chain-cutter section cooperating therewith and embracing the adjacent half of the trunk, thus ensuring satisfactory debranching and/or debarking even at high feed speeds.

In a further embodiment of the invention, each chain cutter may have at least one guide pinion for the thrust run rotatably mounted on a carrier connected to the central joint of a two-member scissor, the ends of which remote from the central joint are hinged to the upper and lower chain supports. This

prevents any change in the distance travelled by the thrust run of the chain cutters when the two chain supports move; instead they remain constant in relation to each other, independently of the position of the two chain supports. The functioning of the chain-tensioning devices described, which only have to compensate for the change in length of the path travelled by the traction run of the chain resulting from a change in the distance between the upper and lower chain support, when the chains are opened or when the diameter and/or periphery of the trunk in that apparatus changes is thus assisted. The scissor may also be designed (more members, appropriate leverage, etc.) in such a manner that compensation is also provided for the change in length of the path travelled by the traction run of the chain, e.g. the increase in trunk periphery resulting from increasing trunk diameter may be fully compensated for without the use of hydraulic tensioning devices, additional compensation for deviations from the normal, geometrically correct shape or diameter being effected by means of springs or the like.

Moreover, the above-mentioned lower feed support may be provided, for the purpose of centering the trunk introduced into the apparatus for processing, with two trunk guides arranged on both sides of the vertical center line of the support (*s*), and capable of being swung in and out jointly. When the upper feed support is brought down, these elements, which are swung laterally outwards when the apparatus according to the invention is open, swing inwards, forcing the section of trunk introduced into the apparatus laterally into the desired central position, when the trunk section does not lie centrally in case the trunk is curved, as it usually is. It is of particular advantage to introduce the trunk top first. In the desired position in the vertical direction, and with the trunk section clamped between the previously mentioned feed rollers at the lower or upper feed support, the trunk section is guided by the upper feed roller, which may for this purpose be designed as a double cone, i.e. with its diameter increasing towards the lateral faces. Centering of the incoming tree trunk is effected by bringing down the upper feed support of the apparatus, during which time the two trunk guides and the upper, double-cone feed roller move simultaneously to the center of the opening in the apparatus.

The trunk guides may, with advantage, be carried through a linkage by a shaft rotatably mounted in the lower feed support, to which shaft a lever arm is attached and secured against rotation, the lever arm being hinged to the free end of a rod rotatably attached to the upper feed support.

In the case of an apparatus having chain cutters engaging the moving trunk laterally, it has been found of particular advantage to provide a common drive motor for the two thrust runs of the two chain cutters and a common drive motor for the two traction runs of the two chains. This ensures a particularly economical, light, and space-saving design.

It is also of advantage to arrange the above-mentioned tensioning devices for the chain cutters on the upper chain support. This arrangement above the trunk to be processed prevents the functioning of the tensioning devices from being impaired by waste, i.e. severed branches, pieces of bark, and wood chips.

According to another characterizing feature of the invention, in the case of an apparatus having two chain cutters engaging laterally with the moving trunk, the thrust runs of the two chain cutters, seen in the direction of feed of the moving trunk, may lie exactly one behind the other, and the corresponding stationary guide pinions for the chains may be rotatably mounted one behind the other on the same axis, on the upper and lower chain supports. With this arrangement, a two-member scissor only is provided on the side of the chain supports on which the thrust runs of the chain cutters run, the carrier fitted to the central joint exhibiting a guide pinion for each chain. In this arrangement, furthermore, the tensioning devices for the chain cutters may also be arranged, with advantage, one behind the other in the direction of feed of the moving trunk. This provides a particularly compact and space-saving design of the apparatus.

In a further embodiment of the invention, a roller running on a horizontal axis perpendicular to the direction of feed of the moving trunk may be fitted to each of the chain supports, the roller coming to rest against the moving trunk, and being eccentrically mounted in the upper and lower chain supports for the purpose of altering the distance between the surface of the trunk and the pairs of input and output pinions.

In the apparatus according to the invention, the moving and preloading of the chain supports, the upper feed support, the pairs of chain input and output pinions, and the tensioning devices is best carried out by means of hydraulically actuated piston/cylinder units. It has similarly been found particularly advantageous to provide a hydrostatic motor to drive the trunk feed rollers.

According to another characterizing feature of the invention, the oil for the piston/cylinder units and, if necessary, for the hydrostatic motors may be accommodated in two containers which are vertically mobile and are each connected to the upper chain support by means of a chain. When full, these containers act as counterweights for the support, which may thus be moved with a minimal expenditure of force. Four oil containers arranged in this manner may also be provided, two being allotted to the upper chain support and two to the lower, as counterweights. In this way, the lower chain support is also easily displaceable.

The chain supports may, with advantage, run on four vertical guide columns in a frame which, for the purpose of adjusting the planes in which the chain cutters lie, is adjustable in relation to the longitudinal axis of the moving trunk, about a horizontal axis perpendicular to the direction of feed. This assists in the smooth running of the chain cutters and especially avoids their cutting into the moving trunk.

According to another characterizing feature of the invention, each pinion of the pair of input and output pinions of the foremost chain cutter, seen in the direction of feed of the moving trunk, may be equipped with a cutting head. This prevents branches from running out over the ends of the pinions, which would block the passage of the trunk. These cutting heads, in conjunction with the overlapping, in the direction of feed of the trunk, of the chain-cutter sections lying against the trunk to be processed, already mentioned above, render unnecessary the provision of special precutting elements for removing all branches from the trunk to be processed, or even only of branches in a specific section of the periphery of the trunk, or for severing the outer portions of the branches.

Furthermore, the overlapping of the chain-cutter sections lying against the trunk to be processed, previously called traction runs, ensures reliable removal of the bark from the entire periphery of the trunk.

A shutoff valve may, with advantage, be inserted into the oil lines of the piston/cylinder units for the pairs of input and output pinions of each chain. This ensures reliable control of the pair of input and output pinions of each chain, i.e. they may be locked in any desired position.

The apparatus according to the invention may be set up on a stationary table, but is preferably rigidly mounted on a vehicle, for example, a motor-vehicle trailer, so that it may easily be transported. Auxiliary devices may also be mounted on the trailer, for example an operating pulpit, an electric switchbox and a hydraulic switchbox, the hydraulic pumps and their drive motors, a blower for blowing away the waste from the trunk-input end of the apparatus, and finally an output conveyor belt, the latter being swung downwards while the trunk is passing through the apparatus according to the invention, and is swung up under the processed trunk only when the latter has left the feed rollers in the apparatus.

The apparatus cooperates with devices for feeding the felled trunks to be processed, and for removing the debarked and/or debranched trunks. Thus when the apparatus is in its operating position, a guide frame is provided in front of the apparatus in alignment with the feed passage, the frame having a capstan table exhibiting one or more winches. A discharge frame, also aligned with the passage through the apparatus, is also arranged behind the apparatus and has a topping saw and

a red-rot saw for severing the top of the trunk and, if necessary, the red-rotted base of the trunk. In this way, the debranched and/or debarked trunks may either be ejected in whole lengths from the discharge frame, on which they are measured, to be transported away, or the trunks may be cut into desired lengths.

The guide frame and discharge frame are connected to the table or vehicle carrying the apparatus according to the invention, whereas the capstan table is attached to the guide frame. If the apparatus is in the form of a transportable unit, i.e. attached, for example, to a motor-vehicle trailer, these connections are made easily detachable, so that both the frames. and the capstan table may be transported to the desired site in a suitable vehicle.

Preferably, however, the guide frame and the discharge frame themselves are made as mobile units, the guide frame being provided with oblique runup surfaces for the trunk to be processed, so that a separate special capstan table is unnecessary. This provides particularly rapid and simple transportation for the two frames.

Easy transportability and rapid setting up of the apparatus according to the invention with its auxiliary devices is still further promoted in that the necessary generator installation is also made mobile and is accommodated in a protective motor-vehicle trailer enclosed on all sides, and in that a branch-conveyor belt with an appropriate surface for removing the branches and other waste severed by the apparatus according to the invention is provided and is also designed for road travel.

Thus the apparatus according to the invention is preferably used in the form of a wood-harvesting train consisting of five roadworthy, preferably single-axle units, namely the debranching and/or debarking apparatus, the guide- or input-frame, the discharge frame, the generator installation, and the branch conveyor.

The means for accomplishing the foregoing objects and other advantages, which will be apparent to those skilled in the art, are set forth in the following specification and claims, and are illustrated in the accompanying drawings dealing with a basic embodiment of the present invention. Reference is made now to the drawings in which:

FIG. 1 is a schematic end view of the guidance and arrangement of the chain cutters in an apparatus according to the invention having two such cutting elements;

FIG. 2 is a schematic front elevation of an apparatus according to the invention having the chain-cutter arrangement of FIG. 1, e.e. a view looking at the apparatus in the direction of feed of the moving trunk;

FIG. 3 shows a side elevation of the apparatus in FIG. 2;

FIG. 4 is a view of the feed unit of the apparatus in fig. 2, corresponding to FIG. 3;

FIG. 5 shows a front elevation of the left-hand portion of the feed unit of FIG. 4;

FIG. 6 is a view corresponding to that in FIG. 3 of the chain-cutter carrier unit of the apparatus illustrated in FIG. 3;

FIG. 7 is a front elevation of the upper one of the two chain-cutter supports shown in FIG. 6 merely as blocks, portions of the support being omitted for the sake of clarity;

FIG. 8 shows a section along the line 8–8 in FIG. 7;

FIG. 9 shows a section along the line 9–9 in FIG. 7;

FIG. 10 shows a view corresponding to that in FIG. 6 of the chain-cutter support unit, the front portions of the chain-carrier support being omitted, as well as the left-hand chain support with its associated guides;

FIG. 11 is a schematic illustration of the arrangement of the left and right-hand chain-cutter support in front elevation;

FIG. 12 shows the lower, stationary feed support, with the device provided thereon for lateral centering of the trunk;

FIG. 13 is a view corresponding to those in FIGS. 6 and 10, showing in particular the arrangement of the oil containers serving as counterweights for the weights for the upper chain support;

FIG. 14 is a schematic illustration of the hydraulic circuit of the apparatus according to FIGS. 1 to 13;

FIGS. 15 and 16 show a plan view and side elevation, respectively, of a mobile embodiment of the inventive apparatus;

FIG. 17 is a schematic representation of the eccentric mounting of the rollers; and

FIG. 18 is a schematic representation of the present invention including a speed monitor.

The apparatus illustrated in FIGS. 1 to 16, for debranching and/or debarking felled trees and tree trunks, comprises two chain cutters 1 and 2 which carry out the debranching and/or debarking. As may be seen in FIG. 1, they engage around moving trunk 3, running in opposite directions, along a section of the periphery greater than 180°. They run over guide pinions 4 rotatably mounted on the front of a lower and an upper transverse support 5 and 6. They also run over a guide pinion 7 rotatably mounted on the central joint of a scissor 8 hinged at one end to transverse support 5 and at the other end to transverse support 6.

Chains 1 and 2 run in two planes 9 and 10 lying one behind the other, as seen in the direction of feed of trunk 3, chain cutter 1 embracing the right-hand side of trunk 3 running in front plane 9, and chain cutter 2 embracing the left-hand side of trunk 3 lying in rear plane 10. These planes may be seen very clearly in FIGS. 3, 6 and 10, in which they are shown in chain-dotted lines.

Guide pinions 4 and 7 are accordingly arranged in such a manner that the two pinions for each chain cutter 1 and 2 correspond to each other in the run of the chain and are rotatably mounted on the same axis of rotation in planes 9 and 10, provided on lower transverse support 5 and upper transverse support 6, and on the central joint 7 of scissor 8.

Chain cutters 1 and 2 are respectively driven by two motors 11 and 12. Each motor 11 and 12 is provided with two drive pinions located in chain planes 9 and 10, by means of which chains 1 and 2 are engaged. In this way, while two motors act upon each chain, not four but only two motors are required for two chain cutters. Motor 11 pulls the section of the chain cutters designated as traction run 1' and 2' lying between motor 11 and motor 12 which does not engage with trunk 3, i.e. it runs back over guide pinion 7. Motor 12 pulls the section of the chain cutters designated as traction run 1'', and 2'' located between motor 11 and motor 12 and lying against the moving trunk.

Traction runs 1'' and 2'' run respectively over a pair of adjacent rotatably mounted input pinions 13 and 14 above trunk 3 to be processed, running thence over a pair of output pinions 15 and 16 similarly arranged one beside the other below the trunk 3. Pinion pairs 13 to 16 can be moved from the cutting or operating position shown in FIG. 1 in full lines, into the open-chain position shown in dotted lines, when a new trunk 3 is to be introduced between transverse supports 5 and 6. Pinion pairs 13 and 15 lie in chain plane 9 in front of pinion pairs 14 and 16 in chain plane 10.

Also provided on transverse support 6 for each chain cutter 1 and 2 are two pinions 17 which, like pinion pairs 13 to 16, are displaceable on a common carrier from the position shown in FIG. 1 in full lines, to the position shown in dotted lines. Pinion pair 17 serves to tension chain cutters 1 and 2, which is necessary for adaptation to various diameters of trunk periphery. Provided for each chain cutter 1 and 2 is a separate pinion pair 17 independent from the other, which forms a tensioning device with stationary guide pinion 4 lying in the same chain plane 9 or 10 enclosed by pinions 17 in the run of chain 1 or 2.

It emerges with particular clarity from FIGS. 2 and 3 that chain supports 5 and 6 are displaceably mounted on four vertical guide columns 18 with hard-chromed surfaces, by ball-bearing sleeves 19. Columns 18 are part of a frame 20 which can be adjusted by means of a wedge 21 about a horizontal axis 22, so that chain planes 9, 10 always lie perpendicular to the axis of moving trunk 3 (of FIG. 3). Movement of chain supports 5 and 6 on columns 18 is accomplished with the aid of hydraulically-actuated piston/cylinder units 23 provided on both sides and engaging on the one side with supports 5 and 6

and on the other with frame **20**, as may be seen above all in FIG. 2. Provided on the lower transverse member of frame **20** are rubber buffers **24**, upon which lower chain support **5** may rest via its ball-bearing sleeve **19** when the support is moved down to its lowest position.

From FIGS. **2** and **3** it may also be gathered that there is another frame, in addition to frame **20**, which also exhibits four vertical guide columns **25**, with hard-chromed surfaces, which are attached to lower transverse support **26** and carry ball bearing sleeves **27** of an upper transverse support **28** which is vertically displaceable, in relation to lower support **26**, with the aid of two symmetrically arranged piston/cylinder units **29**. On lower support **26**, a cylindrical roller **30** is mounted to rotate about a horizontal axis, while upper support **28** carries a double-cone-shaped rotatable roller **31**. Each of these two rollers **30** and **31** is driven by a hydrostatic motor **32**, and they move trunk **3** through the apparatus.

The frame carrying feed rollers **30** and **31** is shown alone in FIGS. **4** and **5**.

FIG. **6** is a side elevation of frame **20** showing chain supports **5** and **6** which are displaceable therein, the supports being shown only as blocks. This figure shows particularly clearly the configuration of scissor **8** carrying guide pinions **7** for chain cutters **1** and **2**. The pinions **7** are rotatably mounted on the same shaft **33** on a carrier **34** which in turn is fitted to central hinge **35** of scissor **8**. The two scissor members **36** and **37** are hinged laterally by their free ends to transverse supports **5** and **6**.

FIGS. **7** to **9** show the construction of upper chain support **6** which, apart from the already-mentioned tensioning device for each chain cutter **1** and **2**, corresponds to the construction of lower chain support **5**. In FIG. **7**, motor **11** and its drive pinions are omitted. From FIG. **7** in conjunction with FIG. **9** it emerges that tensioning pinions **17** for chain cutters **1** and **2** are rotatably mounted on carriers **38** which can be displaced on parallel guide columns **39**. According to FIG. **9**, carriers **38** lie one in front of the other and are connected respectively to piston/cylinder units **40** and **41** attached to support **6**, in the case of rear carrier **38** by a rod **42** attached thereto, to the end of which is hinged the free end of the piston rod of piston/cylinder unit **41**. On the other hand, piston/cylinder unit **40** lies directly between front carrier **38** and support **6**.

Whereas FIG. **9** shows the two tensioning devices or pairs of tensioning pinions **17** provided in the apparatus according to the invention, FIG. **7** shows only the rear pair of tensioning pinions **17** for chain cutter **2**. The tensioning device for chain cutter **1** is omitted from FIG. **7** for the sake of clarity.

It emerges from all three FIGS. **7** to **9** that both input-pinion pairs **13** in front chain cutter **1** and input-pairs **14** of rear chain cutter **2** are mounted respectively on carriers **43** and **44**, which are displaceable on two horizontal, parallel guide columns **45** and **46** on upper chain support **6**. Rear carrier **44** of pinion pair **14** is hinged to the free end of the piston rod of hydraulically actuated piston/cylinder unit **47**, the cylinder of which is held by upper support **6**, as may be seen in FIG. **8**. Carrier **43** exhibits an arm **48** lying in front of input-pinion pair **14** for rear chain cutter **2** and carrying input-pinion **13** of front chain cutter **1**. Carrier **43** is hinged by a rod **49** to the free end of the piston rod of hydraulically actuated piston/cylinder unit **50**, the cylinder which is also held by upper support **6**, as may be seen clearly in FIG. **8**. By means of units **47** and **50** input-pinion pairs **14** and **13** may be moved from the position shown in FIGS. **7** to **9**, in which chain cutters **1** and **2** lie against the trunk **3** to be processed, in the direction of arrows **51** and **52** in FIG. **8**, so that they assume the position shown in dotted lines in FIG. **1**, in which a new trunk may be introduced into the apparatus.

As already mentioned and as shown in FIG. **2**, lower chain support **5** is of similar construction to upper support **6**. Thus rear output-pinion pair **16** of chain cutter **2** is arranged behind front output-pinion pair **15** of chain cutter **1**, pinions **15** being held by arm **53** of carrier **54** which is displaceably mounted on two horizontal guide columns **55** parallel with each other on lower support **5**, and output pinions **16** being furthermore rotatably mounted on a common carrier **56** which is also displaceable on two horizontal guide columns **57** parallel with each other on lower support **5**. Hydraulically actuated piston/cylinder units **59**, engaging in the case of carrier **54** through a rod **58**, and in the case of carrier **56** directly, with the free ends of their piston rods, and attached by the cylinders to lower support **5**, serve to move output-pinion pairs **15** and **16**.

The apparatus according to the invention is equipped with a chain-supporting device which, for the sake of clarity, is not shown in FIGS. **1** to **9**, but may be seen in FIGS. **10** and **11**. It consists of four guide columns **60** arranged at an angle of 45° to the horizontal and enclosing a quadrangle in front elevation (cf. FIG. **11**). According to FIG. **10**, the two lower guide columns **60** lie in front of the two upper guide columns **60** are carried by upper chain support **6**. Columns **60** are held at their ends by blocks **61** which in turn are flanged to upper and lower chain supports **6** and **5**.

FIG. **10** shows the two right-hand guide columns **60** of FIG. **11** with their associated blocks **61** and flanges **62**. From this, and from FIG. **11**, it emerges that the two guide columns **60** lying on the same side of the vertical center line of the apparatus jointly hold a displaceable carrier **63** exhibiting a countersupport **64** for the traction run of chain cutters **1** and **2**. Right-hand columns **60** carry counter support **64** for front chain cutter **1** while left-hand columns **60** guide the countersupport for rear chain cutter **2**. Countersupports **64** may be mounted in carriers **63** to pivot about a vertical axis **65** and may be preloaded, by means of springs, not shown, towards the center of the apparatus, i.e. towards each other against stops provided on carrier **63**.

Columns **60** are arranged on supports **5** and **6** in such a manner that the two chain countersupports **64** always lie between abutments **66** (cf. FIG. **3**) on lower support **5** and upper support **6**, with which these supports lie against trunk **3** when chain cutters **1** and **2** are in the cutting position. Furthermore, the arrangement of guide columns **60** described above and illustrated in FIGS. **10** and **11** ensures that each chain countersupport **64** is always spaced from the vertical center line of supports **5** and **6** by a distance equal to half the distance between abutments **66**. Thus countersupports **64** lie against the periphery of trunk at its horizontal diameter, supporting chain cutters **1** and **2** at this location. This ensures particularly smooth running of the chain cutters, even when the trunks are passed through the apparatus at extremely high speeds of up to 50 m/min.

FIGS. **10** and **11** show the apparatus in the open position i.e. with chain supports **5** and **6** moved away from each other, although in FIG. **11** upper feed support **28** and its associated feed roller **31** are not shown in their highest positions.

Chain cutters **1** and **2** are, for example, duplex link chains, i.e. two-row chains, equipped on their front sides with cutting teeth. These chains lie with their backs against countersupports **64**.

The apparatus according to the invention cooperates with a guide frame to feed-in the trees or tree trunks to be processed, and a discharge frame to remove the processed trunks. The bearing elements in these frames for the trunks are arranged at the height of feed roller **30**. Thus a trunk passes from the guide frame in the direction of arrow **67** (cf. FIG. **3**), through the apparatus of the invention, on to the discharge frame. As soon as a trunk has been debranched and/or debarked, the apparatus opens. i.e. input-pinion pairs **13** and **14** and output-pinion pairs **15** and **16** move apart on chain supports **5** and **6** which themselves simultaneously move apart. A new trunk for processing is then introduced into the apparatus by the guide frame, usually with the treetop first. Since the trunk is usually curved to a greater or lesser degree, the top of the trunk introduced does not lie in the middle of the apparatus, as required. In order to compel this central position, according to FIG. **12** two trunk guides **68** are provided on lower feed support **26**. The guides are cooperating with feed roller **31** on the

upper feed support in such a manner that the desired position of the top of the trunk is attained as soon as the two feed rollers **30** and **31** lie against the trunk to be fed forward. Feed roller **31** thus takes over substantially the guidance of the trunk in the vertical direction, while trunk guide **68** effects guidance in the lateral direction.

When the feed unit of the apparatus according to the invention is in its open position, i.e. when feed support **28** is raised up, trunk guides **68** are swung out laterally. When upper feed support **28** is moved down, they come together in synchronism, so that the trunk top located between them is brought into the central position and can be pressed by feed roller **31** against feed roller **30**.

FIG. **12** shows the arrangement of trunk guides **68**. For greater clarity only the linkage lying in front of lower feed support **26** is shown for left-hand trunk guide **68**, while in the case of right-hand trunk guide **68**, which is illustrated only in part, only the linkage lying behind support **26** is shown. It may be gathered from FIG. **12** that shafts **69** are rotatably mounted in lower stationary feed support **26**, to one end of each of which is attached, and secured against rotation, a rod **70**, the free end of which engages with another rod **71** hinged by its other end to lug **72** arranged on displaceable feed support **28** or to ball-bearing sleeve **27** thereof.

Attached to shafts **69**, at the ends opposite rods **70**, are curved levers **73** secured against rotation in relation to the shaft. Trunk-guide carrier **74** is hinged by its lower end to the lever. The carrier has an elongated hole **75** in which pins **76** on the upper end of the longer arm of elbow lever **77** engage, the elbow lever being connected at its elbow **78** rotatably to lever **73**, and being hinged at the end of its shorter arm to one end of a lever **79**, the other end of which is rotatably mounted on lower feed support **26**.

Arranged on carriages **74** are trunk abutments **74'** resiliently mounted on the carriers; the actual abutment may be a roller rotating about a vertical axis. It may be gathered from FIG. **12** that, when upper feed support **28** is raised, shafts **69** rotate outwardly, thus swinging out levers **73** which carry with them trunk guides **68**. The higher upper feed support **28** moves in relation to feed support **26**, the farther trunk guides **68** are swung away from each other. When support **28** is moved down, feed roller **31** descends and, at the same time, trunk guides **68** swing towards each other. These three elements constrict trunk top **3** increasingly, until it finally reaches the desired central position. Thereafter, chain supports **5** and **6** may move towards each other, and chain cutters **1** and **2** may be laid against the trunk. During the foregoing opening of the chain and introduction of the trunk, the chain must not be stopped. Tensioning device **17** adjusts the chains according to the periphery of the trunk located between feed rollers **30** and **31** and chain supports **5** and **6**.

Two containers **80** are provided for the oil for the hydraulically operated devices in the apparatus according to the invention, one of the containers being shown in FIG. **13** in side elevation. These containers **80** are displaceable in the vertical direction on guide columns **81** and serve as a counterweight for upper chain support **6**, to which they are connected by a chain **82** engaging with a flange **83** on support **6**. Chain **82** is guided on rollers **84** and **85** on frame **20** and columns **81**.

FIGS. **15** and **16** illustrate a single-axle motor-vehicle trailer, in plan view and side elevation, respectively, which can be supported on hydraulic supports **88** at the operating site. The apparatus according to the invention is mounted on trailer **87** and is covered by a roof **89**. In addition to the inventive apparatus, the associated oil containers **80** are accommodated under the roof **89**. Fitted to trailer **87** is a control pulpit **90** which, as shown in FIG. **15**, may be swung from the transporting position shown in full lines, to the operating position shown in dotted lines. Vehicle **87** is also provided with a switchbox **91** which, for the sake of clarity, is not shown in FIG. **16**. Arranged behind the apparatus is a chain-link conveyor **92** which can be swung by means of linkage **93** from the retracted position shown in FIG. **16**, into the conveying position in which it lies with its upper side at the level of the upper side of feed roller **30**, engaging the bottom of the trunk passing through the apparatus in the direction of arrow **95** in track **94**, and conveying the trunk onwards. The hydraulic control for raising conveyor **92** from the position shown in FIG. **16** is such that this raising occurs when a trunk leaves feed rollers **30** and **31** and is no longer conveyed thereby. As soon as the trunk has passed down conveyor **92**, the latter swings automatically back into the position shown in FIG. **16**. A hydrostatic motor may be used with advantage to drive the chain-link belt.

Also accommodated in vehicle **87** are the electric motors and oil pumps, as well as the control elements for the hydraulic devices provided in the apparatus of the invention, such as electromagnets and the like. These components are not shown in FIGS. **15** and **16**.

The electrical power required to operate the apparatus of the invention and its auxiliary devices is produced by a mobil generator installation. The guide frame for feeding the trunks into the apparatus and the frame for discharging the processed trunks, both described hereinbefore, are also made in the form of mobile units. A conveyor belt for removing severed branches is provided as the fifth mobile unit. This five-element wood-harvesting train may easily be moved from one felling site to another, where it can be erected within a very short time with a minimum amount of labor.

Also not shown in FIGS. **15** and **16** is a blower attached to the crossmember joining the two guide columns **81** for oil containers **80**, by which air is constantly blown, when the apparatus is in operation, over the front end thereof, in order to prevent any accumulation of waste material on chain cutters **1** and **2** and on the pinions engaging therewith. Since the apparatus operates with double-row link chains as supports for the cutting elements, these pinions are also provided with two toothed crowns, as may clearly be seen in FIG. **9**, but may also be gathered from FIGS. **3** and **6**. One row of the double-row chain cutters **1** and **2** engages in each crown. Moreover, chain supports **5** and **6** are provided with fingers, not shown, which engage in the annular gap between the two crowns of each pinion, removing, with their bevelled front ends, any waste falling between the crowns.

From FIGS. **7** to **9** it may be gathered that the front input-pinions **13** for front chain cutter **1** are provided with cutting heads **96** which sever any branches from the trunk to be processed and coming within the range of the cutters, so that the branches cannot run up and block the trunk feed. The same cutting heads **96** are also provided on front output-pinion pair **15** of front chain cutter **1**, but are not shown in the drawings.

As may be gathered from FIG. **3**, motors **11** and **12** are located coaxially directly behind drive pinion **97** for rear chain cutter **2** and drive pinion **98** for front chain cutter **1** arranged on the same shaft. Drive motors **11** and **12** are connected to the shaft-carrying pinions **97** and **98** by means of an electromagnetic clutch. Furthermore, an overspeed freewheel is located between this clutch and each pinion, i.e. between each pinion **97** and **98** and the shaft carrying them. This provides two closed components consisting of drive motor **11** or **12**, the electromagnetic clutch arranged coaxially therewith, coaxial drive pinions **97** and **98**, and the overspeed freewheel. The electromagnetic clutch is of the type which disengages when deenergized and engages when energized, i.e. connects the two shafts together.

At least one of motors **11** and **12** is equipped with a speed monitor controlling the drive of feed rollers **30** and **31** in such a manner that they can be cut in only after motors **11** and **12** reach a certain adjustable r.p.m. Thus a trunk **3** cannot be fed by feed rollers **30** and **31** through the apparatus unless motors **11** and **12** are running at an r.p.m. above a specific limit or are running at a specific r.p.m.

FIG. **18** illustrates the feature that a contact ammeter is connected to the power-supply line of chain-drive motors **11** and **12**. The ammeter cooperates with the drive of feed rollers **30** and **31** in such a manner that when motors **11** and **12** draw

more current, the r.p.m. of feed rollers 30 and 31 drop until motors 11 and 12 draw a normal amount of current, while when the r.p.m. of chain-drive motors 11 and 12 increases, the r.p.m. of feed rollers 30 and 31 increases.

FIG. 14 shows the circuit of the hydraulic devices provided in the inventive apparatus for debranching and/or debarking trees. According to this circuit, the following are connected via two lines 99 and 100 to electromagnet changeover valves 101, 102, 103, 104, 105, 106, and 107: the two piston/cylinder units 29 for moving upper feed support 28, the two piston/cylinder units 23 for moving lower chain support 5, the two piston/cylinder units 23 for moving upper chain support 6, piston/cylinder unit 40 for moving and tensioning the tensioning pinion 17 for front chain cutter 1, piston/cylinder unit 41 for moving and tensioning the tensioning pinions 17 for rear chain cutter 2, the two piston/cylinder units 50 and 59 for moving input- and output-pinion pairs 13 and 15 for front chain cutter 1, and the two piston/cylinder units 47 and 59 for moving input- and output-pinion pairs 14 and 16 for rear chain cutter 2.

These changeover valves in turn are connected via a line 108 to the pressure side of gear pumps 109, 110, 111, 112, 113, 114 and 115. Furthermore, changeover valves 101, 102, 103 communicate via a line 116 with a collector return line 117 leading to left-hand oil container 80, while changeover valves 104, 105, 106, 107 communicate via a line 118 with a collector return line 119 leading to right-hand oil container 80.

Filters 120 may be arranged in collector return lines 117 and 119.

The two gear pumps 109 and 111; 115 114; 112; 113 are driven jointly by electric motors 121, 122 and 123. Pump 110 is driven by electric motor 124.

Suction lines 125 of pumps 110, 109 and 111 are connected to left-hand oil container 80; suction lines 126 of pumps 115, 114, 112 and 113 are connected to right-hand oil container 80. Connected to each pressure line 108 is a relief valve 127 and a manometer 128, via a branch line 129. Relief valves 127, which are connected to pressure lines 108 of pumps 110, 109, and 111, are also connected via lines 130 to collector return line 117 to left-hand oil container 80. Similarly, relief valves 127, connected to pressure lines 108 of pumps 115, 114, 112 and 113, are also connected via lines 131 to collector return line 119 to right-hand oil container 80.

The parts of the hydraulic system described above raise and lower upper feed support 28, lower chain support 5, and upper chain support 6; they also move chain-cutter input-pinion pairs 13 and 14 on upper chain support 6, and chain-cutter output-pinion pairs 15 and 16 on lower chain support 5; finally, they also actuate tensioning devices 17 for chain cutters 1 and 2.

Chain-link conveyor 92 is swung up and down by piston/cylinder unit 132 which is in communication with an electromagnetic changeover valve 135 via lines 133 and 134. In turn, the valve 135 is connected, through a line 136, to the pressure side of gear pump 138 driven by motor 137. The changeover valve 135 is also connected, through a line 139 to collector return line 117 to left-hand oil container 80. A branch line 140 runs from pressure line 136 to a manometer 141 and to a relief valve 142, which is also connected, through a line 143, to collector return line 117 to left-hand oil container 80. Gear pump 138 is in communication with left-hand oil container 80 via its suction line 144.

Three hydrostatic drive motors are provided, namely the two drive motors 32 for trunk feed rollers 30 and 31, and motor 145 which drives chain-link conveyor 92. Hydrostatic motor 145 communicates, via two lines 146 and 147, with the left-hand outlet of two electromagnetic changeover valves 148 and 149. In a similar manner, the two hydrostatic motors 32 are in communication, via two lines 150 and 151, with the right-hand outlet of changeover valves 148 and 149. The inlet sides of changeover valves 148 and 149 are connected, through lines 152 and 153 to an electromagnetic changeover valve 154 which, in turn, is connected to the pressure side of an adjustable pump 156, through a line 155, suction line 157 of the pump being connected to the left-hand oil container 80. Furthermore, changeover valve 154 is connected, through line 158, to collector return line 117 to left-hand oil container 80. Connected to pressure line 155 is a branch line 159 leading to a manometer 160 and a relief valve 161, the latter being connected, through a line 162, to collector return line 117 to left-hand oil container 80.

When the apparatus is in operation, motors 121 to 124 and motor 137 are running, so that gear pumps 109 to 115 and 138 draw oil from containers 80 and deliver it to changeover valves 101 to 107 and 135. Similarly, oil is delivered by adjustable pump 156 from left-hand container 80 the changeover valve 154. Changeover valves 101 to 107, 139 and 154 are electrically controlled units which can assume three different positions which will be explained by taking valve 101 as an example. In the first position, line 108 is connected to line 100, and line 116 is connected to line 99. In the second position, all four lines 99, 100, 108 and 116 are shut off. In the third position, line 108 is connected to line 99 and line 116 to line 100. Thus depending on the position of changeover valves 101 to 107, 135, and 154, the oil delivered by the pumps connected thereto flows either through line 100 or 135 or 152 from the changeover valve, and through line 99 or 134 or 153 back into it, or in the reverse direction, or the flow of oil is cut off. Thus the movements of the connected hydraulically actuated piston/cylinder units may be controlled in both directions by the changeover valves, and may be arrested when the desired position is reached.

Shutoff valves 163 and 164 are inserted into lines 99 and 100 leading to piston/cylinder units 47 and 59 of input- and output-pinion pairs 14 and 16 and to piston/cylinder units 50 and 50 of input- and output-pinion pairs 13 and 15, in order to prevent input- and output-pinion pairs 13 and 15 and their carriers 43, 44 54 and 56 from being moved by chain cutters 1 and 2 against the pressure of oil in the relevant piston/cylinder units. The shutoff valves open only when acted upon by electromagnetic changeover valves 107 or 106, either through line 99 or through line 100.

As already mentioned, a trunk passing through the apparatus and processed therein is moved forward by feed rollers 30 and 31 driven by hydrostatic motors 32, this forward motion being continued by conveyor 92 as soon as the trunk has left rolls 30 and 31. During this first phase, only rollers 30 and 31 are running, whereas hydrostatic motor 145, and therefore conveyor 92, are stationary, the latter being moreover swung away from the processed trunk. In this connection, both electromagnetic changeover valves 148 and 149 are arranged in such a manner that the oil delivered by pump 156 passes only to hydrostatic motors 32. As soon as the trunk runs off rollers 30 and 31, changeover valves 148 and 149 are actuated, and pump 156 now feeds hydrostatic motor 145 and conveyor belt 92 runs, while rollers 30 and 31 stop. At the same time, changeover valve 135 is automatically actuated so that pump 138 can feed piston/cylinder unit 132. The piston thereof extends, applying chain-link conveyor 92 to the underside of the trunk. The latter is pushed by the apparatus on to the discharge frame already mentioned above, while a new trunk is introduced for processing into the apparatus by the input or guide frame also mentioned above. As soon as the first trunk is ejected from conveyor 92, which is moreover equipped with an electric counting device to count the trunks ejected, changeover valve 135 automatically changes over, so that the piston of piston/cylinder unit 132 retracts and conveyor 92 is swung down. In a similar manner, changeover valves 148 and 149 are also changed over automatically so that motor 145 is stopped and motors 32 start running again. The direction of rotation of these motors, and of motor 145, can be reversed by changeover valve 154.

In order to ensure smooth running of the chains, care is taken to ensure that chain cutters 1 and 2 can run only when tensioning devices 17 are tensioned at a specific pressure. To

this end, contact manometers **165** and **166** are connected in parallel to branch lines **129** of pressure lines **108** leading from pumps **112** and **113** to changeover valves **104** and **105**, which in turn communicate with piston/cylinder units **40** and **41** of tensioning device **17** for front chain cutter **1** and rear chain cutter **2**. These manometers control electrical switches in the circuit of the electromagnetic clutches of chain-drive motors **11** and **12**, in such a manner that current is supplied to the electromagnetic clutches of chain-drive motors **11** and **12** and these clutches engage only when a specific adjustable pressure is attained in piston/cylinder units **40** and **41**. Below this pressure limit, motors **11** and **12** can indeed run, but no connection is possible between them and their associated drive pinions **97** and **98**.

It has already been pointed out that the r.p.m. of feed rollers **30** and **31** is variable in relation to the current drawn by chain-drive motors **11** and **12**. The rollers are driven only when chain-drive motors **11** and **12** reach a specific, adjustable r.p.m. This may be accomplished, for example, by means of an electromagnetic clutch interposed between rollers **30** and **31** and motors **32**. The clutch is energized and engages only when chain-drive motors **11** and **12** reach a specific r.p.m. A simpler way of accomplishing this, however, is to arrange for changeover valve **154** to be switched from the shutoff position, when changeover valves **148** and **149** are switched to motors **32** only when the chain-drive motors have reached the required r.p.m.

The change in the r.p.m. of feed rollers **30** and **31** in accordance with the current drawn by chain-drive motors **11** and **12** may be effected by a regulator in pressure line **155** which throttles the amount of oil flowing in this line per unit of time when the drive motors draw an abnormal amount of current, allowing the flow to rise again to normal as soon as the current drawn by the chain-drive motors is normal. However, the output of pump **156** may also be influenced in this sense, for example, by speeding up or slowing down its electric drive motor.

The configuration of the apparatus according to the invention described above is not the only configuration possible. For example, more than two chain cutters may be provided. Drive motors **11** and **12** may also be driven jointly in opposite directions, or one motor in a different direction from the other. Moreover, separate motors may be provided for each chain. The chain arrangement may also be symmetrical, thrust runs **1'** and **2'** returning on opposite sides of the apparatus. If necessary, in addition to the two oil containers **80** serving as a counterweight for upper chain support **6**, two additional oil containers may be provided and may be arranged as a counterweight for lower chain support **5**. Furthermore, abutments **66** on the upper and lower chain supports **6** and **5** (cf. FIG. 3) may be replaced by rollers rotating about horizontal axes perpendicular to the direction of feed of moving trunk **3** and coming to rest against the surface thereof. The rollers are mounted eccentrically in upper and lower chain supports **6** and **5**, for the purpose of altering the distance between the surface of the trunk and input-pinion pairs **13** and **14** and output-pinion pairs **15** and **16**, as shown in FIG. **17**.

Control of the apparatus, i.e. switching on chain-drive motors **11** and **12**, engaging the clutches thereof, switching on pump motors **121** and **124** and **137** and the motor of pump **156** etc., control of electromagnetic changeover valves **101** to **107**, **135**, and **154**, also **148** and **149**, is carried out from control pulpit **90**, whence the moving trunk may be accurately observed. However, by means of limit switches and programming control, the apparatus may be operated completely automatically, the few remaining operators serving merely to monitor the apparatus.

The processing of a trunk in the apparatus of the invention occurs in such a manner that the trunk is first of all inserted into the apparatus with chain supports **5** and **6** moved apart, with input-pinion pairs **13** and **14** and output-pinion pairs **15** and **16** also moved apart, with feed support **28** raised, with trunk guides **68** swung apart, and with chain countersupports **64** moved away from each other, during which time chain cutters **1** and **2** continue to run. Thereupon, upper feed support **28** is first brought down and trunk guides **68** are simultaneously swung in towards each other. The trunk top is centered in the manner already described, finally lying between feed rollers **30** and **31** and trunk guides **68**. The feed rollers are now stationary. The main weight of the trunk lies upon the feed frame set up in front of the apparatus to which it has been raised by means of winches. In stead of this, however, the trunk may be carried on the retaining chains or cables of two or more travelling cranes which can travel along a track in a feed frame of a different type of construction.

Chain supports **5** and **6** are then brought together until their abutments **66** lie against the trunk. At the same time, chain countersupports **64** move towards the trunk.

Feed rollers **30** and **31** are now switched on and, at the same time, input-pinion pairs **13** and **14** and output-pinion pairs **15** and **16** are moved one over the other, so that the moving chains **1** and **2** place themselves in front of chain countersupports **64** against the trunk to be processed, the latter being continuously debranched and debarked.

As soon as the debranched and debarked trunk leaves feed rollers **30** and **31**, they are stopped and the trunk is moved onwards by chain-link conveyor **92**. At the same time, chain supports **5** and **6** move apart and upper feed support **28** moves upwards, trunk guides **68** swing out, and chain countersupports **64** move outwards. Input-pinion pairs **13** and **14** and output-pinion pairs **15** and **16** are moved apart, and a new trunk may now be introduced.

The trunk ejected from chain-link conveyor **92** lies on the discharge frame set up behind the apparatus. Here the base of the trunk, affected by red rot, and the top of the trunk are cut off, and the trunk is measured. If desired, the trunk may also be cut to marketable lengths on the discharge frame.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by by the appended claims rather than the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore to be embraced therein.

We claim:

1. An apparatus for debranching and debarking felled trees or tree trunks comprising a frame having four vertical guide columns, upper and lower transverse chain supports each vertically displaceably mounted on said columns, at least two endless chain cutters, at least one stationary, rotatably mounted guide pinion on each of said chain supports for each of said cutters, a pair of adjacent rotatably mounted input pinions for each of said cutters mounted on one of said chain supports, a pair of adjacent rotatably mounted output-pinions for each of said cutters mounted on the other of said chain supports, said input- and output-pinions being tangential to the periphery of the trunk being processed, said chain cutters being mounted on said pinions to run in opposite directions with a portion thereof engaging overlapping peripheral sections of the trunk, two motors operatively connected to each said cutter and running in the same direction with respect to the associated chain cutter with one motor driving the trunk-engaging portion of the associated chain cutter in traction and the other in thrust, said motors being mounted on said upper and lower chain supports, and tensioning means for tensioning each of said chain cutters, each said tensioning means comprising a rotatably mounted pinion displaceable with respect to said stationary, rotatably guide pinions in accordance with the periphery of the trunk being processed.

2. An apparatus according to claim **1**, further comprising an additional frame including a lower, immovable, transverse support and four vertical guide columns, and an upper transverse support displaceable in relation to said support in a vertical direction independently of the chain support and capable of being pressed against the tree trunk, motor-driven rollers mounted on said supports to feed said trunk.

3. An apparatus according to claim 2, further comprising speed monitoring means on said drive motors for the chain cutters to drive said trunk feed rollers only when the motors run above a specific, controllable r.p.m.

4. An apparatus according to claim 2 further comprising contact ammeter connected to the current-supply line of the chain-drive motors, said ammeter being operatively connected to the drive of the feed rollers so that when the motors draw more current, the r.p.m. of the feed rollers drops until the amount of current drawn is normal and increases with an increase in the r.p.m. of the chain-drive motors.

5. An apparatus according to claim 1 further comprising guide columns sloping laterally outwards at an angle of 45° from the lower and upper chain supports, the columns on the supper support and the columns on the lower support being staggered in relation to each other in the direction of feed of the trunk, and the columns of the upper and lower supports lying on the same side, extending over the same width and being at the same distance from the vertical center line of the supports; and common carriers including countersupports for the traction run of chain cutters displaceably mounted on the columns lying on the same side of the upper and lower supports.

6. An apparatus according to claim 5, in which the counter support consists of a pinion.

7. An apparatus according to claim 1 further comprising a two member scissor, at least one guide pinion for the thrust run of each chain cutter being rotatably mounted on a carrier connected to the central joint of said two-member scissor, the ends of which remote from the central joint are hinged to the upper and lower chain supports.

8. An apparatus according to claim 1 further comprising means for centering the incoming trunk to be processed, said means comprising two trunk guides on both sides of the vertical center line of the lower feed supports, said guides being capable of being swung outwards and inward jointly.

9. An apparatus according to claim 8, further comprising a shaft rotatably mounted on the lower feed support to which shaft a lever is fitted and secured against rotation, a rod hinged to said lever and rotatably attached to the upper feed support, linkage means connecting said trunk guides to said shaft.

10. An apparatus according to claim 1, two chain cutters engaging laterally with the moving trunk, a common drive motor for the thrust run of the two chain cutters and a common drive motor for the traction run of the two chain cutters.

11. An apparatus according to claim 1 in which the tensioning means for the chain cutters are arranged on the upper chain support.

12. An apparatus according to claim 1 in which the thrust runs of said chain cutters lie one behind the other, the stationary guide pinions corresponding to each of the chains being rotatably mounted one behind the other on the same shaft on the upper and lower supports.

13. An apparatus according to claim 7 in which said two-member scissor is provided on the thrust run side of the supports, the carrier fitted on the central hinge including a guide pinion for each chain.

14. An apparatus according to claim 1 in which the tensioning means for the chain cutters are arranged one behind the other.

15. An apparatus according to claim 1 further comprising roller means running on a horizontal axis perpendicular to the direction of feed of the moving trunk and fitted to the chain supports, said roller means coming to rest against the surface of the moving trunk and being mounted eccentrically on the chain support to alter the distance between the surface of the trunk and input-pinion pairs and output-pinion pairs.

16. An apparatus according to claim 1 further comprising hydraulically operated piston/cylinder units operatively connected to move the chain supports, upper feed support input- and output-pinion pairs and the tensioning device.

17. An apparatus according to claim 2 further comprising a hydrostatic motor operatively connected to drive each of the feed rollers.

18. An apparatus according to claim 16 further comprising containers containing hydraulic fluid for the piston/cylinder units, said containers being connected to the upper chain support and serving as counterweights.

19. An apparatus according to claim 18 further comprising two additional oil containers which are connected, as counterweights, to the lower chain support.

20. An apparatus according to claim 1 further comprising means for tilting the frame guiding the movable chain supports about a horizontal axis perpendicular to the direction of feed of the trunk being processed so that the chain cutters run in planes perpendicular to the axis of said trunk.

21. An apparatus according to claim 1 further comprising cutting heads mounted on the input- and output-pinion pair of the foremost chain cutter.

22. An apparatus according to claim 16 further comprising a shutoff valve inserted in the oil lines for the piston/cylinder units of the input- and output/cylinder pair of each chain.

23. An apparatus according to claim 16 further comprising a contact manometer connected to the pressure lines for the piston/cylinder units of tensioning-pinion pairs of the chain cutters said manometer releasing power to electromagnetic clutches of the chain-drive motors only when these lines are at a specific pressure, so that said motors may be coupled to the drive pinions.