(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 277 326**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87118651.6**

(22) Date of filing: **16.12.87**

(51) Int. Cl.⁴: **E01C 23/08** , E01C 23/09 , E02F 3/96 , E02F 3/38

(30) Priority: **08.01.87 GB 8700379**

(43) Date of publication of application:
10.08.88 Bulletin 88/32

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

(71) Applicant: **Econ Group Limited**
Boroughbridge Road
Ripon North Yorkshire, HG4 1UE(GB)

(72) Inventor: **Lupton, William George**
c/o Econ Group Limited Boroughbridge Road
Ripon N. Yorkshire, HG4 1UE(GB)

(74) Representative: **Denmark, James**
c/o Bailey Walsh & Co. 5 York Place
Leeds LS1 2SD Yorkshire(GB)

(54) Road working apparatus.

(57) The invention provides that a vehicle (10) has connected to the front or the rear thereof a beam (16) which lies at right angles to the fore and aft direction of the vehicle (10). Mounted on the beam (16) is a cutting unit (24) for cutting a road surface (20), such cutting unit (24) being movable along the beam (16) so as to cut a transverse strip in the road surface (20) whilst it moves. The arrangement has jacking means whereby the beam (16) which has support legs (182, 184) can be jacked onto the ground so that the vehicle weight is taken by said legs (182, 184) to ensure stable cutting by the cutting unit (24). By sequentially raising and lowering the beam (16) and moving the cutter (24) along the beam (16), and by indexing the vehicle (10) forwardly or rearwardly, parallel strips can be cut in the road surface (20) in order to remove an area of the surfacing material for resurfacing or for gaining access to service pipes or the like. The cutter (24) is a drum which lies normally with its axis at right angles to the length direction of the beam (16), but it can be turned through 90° in a modified form of the invention, and the vehicle (10) can be moved forwardly or rearwardly with the cutter (24) in this position so as to cut a strip of road surfacing material in a direction of travel of the vehicle (10).

EP 0 277 326 A2

Road Working Apparatus

This invention relates to road working apparatus comprising a mobile vehicle and road cutting equipment carried by the vehicle, said equipment being movable relative to the vehicle between a lowered or operating position in which the equipment can cut the road surface, and a raised or inoperative position in which the vehicle can be moved for the repositioning of the equipment in relation to the road surface. The equipment may be an attachment which can be easily connected to or disconnected from the vehicle or it may be permanently connected to the vehicle as required. The vehicle may be a self propelled vehicle such as a tractor, loader or lorry, or a trailer or semi-trailer vehicle, and the power source used for operating the said equipment may be the prime mover of the vehicle (when provided) or a separate prime mover mounted on the vehicle.

Examples of the type of apparatus to which the invention relates are disclosed in French Patent No. 2300173 and co-pending European Patent Application No. 0142277 and in each of these examples, a beam is connected to a traction vehicle so as to extend horizontally and cantilever fashion from an end of the vehicle; the beam carries a cutter unit which can be moved along the beam, when it is suitably lowered, to make a cut in the road surface. The cutter unit typically has a cutter drum which removes a strip of the road surface. If parallel strips of the road surface are to be removed so as to remove an area of road surface for example for patching work, or to dig a hole in the road to repair services pipes or cables, the vehicle has to be manipulated back and forth between cuts as in the case of the French patent or the beam has to be displaced laterally on a special mounting frame as in the case of the said European application.

The present invention aims to provide a road working apparatus of simple design and which is simple in operation enabling the effective cutting of road surfaces, especially the removal of areas of road surfaces for patching or the like by making side by side strip cuts in the road surface.

According to the present invention there is provided an apparatus for cutting roadway surfaces comprising:

a) a mobile vehicle

b) road cutting equipment carried by the vehicle and comprising

i) a substantially horizontal beam connected to the front or rear of the vehicle; and

ii) a cutter unit carried by the beam so as to be movable therealong so that a cutting means of the cutter unit can cut the road surface.

c) means enabling the cutting means to be moved between a lowered working position and a raised transport position in which the road cutting equipment can be transported by the vehicle,

characterised in that the beam is arranged transverse to the front to rear direction of the vehicle so that by sequentially moving the cutting means between the raised and lowered position, and by advancing or reversing the vehicle, the cutting means can be made to cut slots or grooves in the road surface which are parallel and transverse to the direction of movement of the vehicle.

By arranging that the road cutting equipment is carried by the vehicle, a mobile arrangement results. By arranging that the beam is transverse to the fore and aft direction of the vehicle, by simply moving the vehicle forwards or rearwards in steps and by sequentially operating the cutter unit, in a simple and effective manner, parallel and overlapping strips of road surface, comprising an area to be resurfaced, can be removed.

Also, as the beam is transverse to the vehicle fore and aft direction, as opposed to being cantilevered at one end, the beam can be mounted and held much more stably when cutting is taking place, and it is also easier to arrange for the vehicle weight to be loaded more evenly onto support feet at the ends of the beam during cutting.

The invention is therefore particularly advantageous when the cutting means is a road planing drum having road planing picks on the periphery thereof which removes strips of the road surface as it moves over such surface and in operative engagement therewith.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:-

Fig. 1 is a diagrammatic view of main parts of a tractor/planing apparatus in accordance with one embodiment of the invention;

Fig. 2 is a side view of the cutting unit shown in Fig. 1;

Fig. 3 is a part-sectional elevation of the cutting unit shown in Fig. 2;

Fig. 4 is a diagrammatic plan showing the road cutting apparatus of Fig. 1, the view showing also the connection of the apparatus to the agricultural tractor;

Fig. 5 is a diagrammatic rear view of the arrangement shown in Fig. 4;

Fig. 6 is a diagrammatic side elevation of the apparatus shown in Figs. 4 and 5;

Fig. 7 is a more detailed view of the apparatus shown in Fig. 6;

Fig. 8 is a rear view similar to Fig. 5 but showing how the cutting unit can be driven by means of an endless flexible member;

Fig. 9 shows, similar to Fig. 8, an alternative method of driving the cutting unit on the beam;

Fig. 10 is a diagrammatic view similar to Fig. 9 but showing an alternative form of drive mechanism for the cutting head;

Fig. 11 is a diagrammatic plan view similar to Fig. 4 but showing how a back hoe can be connected to one end of the beam of the road planing apparatus;

Figs. 12, 13 and 14 show diagrammatically alternative embodiments of the invention;

Fig. 15 is a view similar to Fig. 1 showing a practical arrangement;

Fig. 16 is a rear perspective view of the arrangement of Fig. 15; and

Fig. 17 shows a view similar to Fig. 15, but wherein the apparatus has greater flexibility of operation.

Referring to the drawings, and firstly to Fig. 1, the rear of an agricultural tractor 10 of conventional design is shown, and is provided with a linkage indicated by numeral 12 by which road cutting equipment 14 is connected to the rear of the tractor. The cutting equipment which is for road planing in the example, comprises essentially a beam 16 connected to the linkage 12 in a manner to be explained more fully herein so that the beam 16 lies at right angles to the fore and aft direction of the tractor 10.

The beam 16 movably supports a cutting unit 22 (shown only diagrammatically in Fig. 1) provided with a cutting drum 24 which is adapted to be driven about an axis 26 which in use is horizontal and lies at right angles to the length direction of beam 16. The beam 16 as shown in Fig. 1 extends at right angles to the fore and aft direction of a vehicle 10, and there is a means (not shown in Fig. 1) for moving the cutting head 22 along the beam 16 as indicated by the arrow 28. As the cutting head 22 is so moved along beam 16 and with the beam 16 appropriately set, so the cutting drum 24 cuts a groove or strip 30 in the ground surface 20 thereby planing away the road surface material.

This planing may be effected for any of a variety of reasons, for example the planing may be required when the road surface is to be repaired, or it may be required when the ground is to be excavated in order to expose or install service lines or pipes or it may be required to remove temporary patching of the road surface when a permanent reinstatement is to be effected such as may be required after repairs or installations of service lines have taken place.

Any suitable means may be provided for propelling the cutting head 22 along beam 16 such as hydraulic arms, chain drives, wire ropes, electric motors and the like, and some embodiments are described hereinafter.

The beam 16 is adapted to be raised and lowered by the linkage 12, whilst maintaining its attitude of lying at right angles to the tractor fore and aft direction. The beam is so raised when it is desired to transport the apparatus by means of the vehicle 10. The linkage arms may be extensible and contractable e.g. by being formed by hydraulic rams so that the tilt of the beam, as viewed end on, may be varied for the cutting of the road surface at an angle.

Figs. 2 and 3 illustrate the constructional details of the cutting head and its mounting on the beam 16. Such a cutting head (or unit) may be used in all embodiments of the invention described herein.

As shown in these figures, the beam 16 is a hollow steel member and the cutting head is made up of two side plates 72 and 74 which are secured and held in spaced position by means of spindles 76, 78 and 80. Each of these spindles is of similar construction and only one, spindle 76 will be described in detail. Spindle 76 is provided with a head washer 82 welded thereto which abuts the plate 72 when the spindle 76 is passed through apertures in the plates 72 and 74. At its other end, the spindle is threaded so as to receive a washer 84 and a locking nut 86. Where the spindle 76 passes through plates 72 and 74 on the insides thereof there are bushes 88 and 90 which are welded to the plates 72 and 74 respectively. The spindles pass through these bushes.

Fitted on the spindle 72 are bearing bushes 92 and 94 and these are held in position by spacer washers 96 and 97. The bushes 92 and 94 are of suitable material and support a roller 98 such as metalastic roller of suitable shock absorbing material such as elastomeric rubber or the like; alternative shock absorbing means may be used, or in some versions shock absorbing means may not be necessary. The roller 98 is freely rotatable in relation to the spindle 76, and as regards specifically the spindle 76 the roller 98 bears on the top surface of the beam 16. The equivalent rollers on the spindles 78, 80 as will be clear from Fig. 2 bear on the underside of the beam 16.

As an alternative or additional shock absorbing arrangement, the linkage which carries the beam, such as the parallelogram linkages described herein, may be provided with rubber bushes at the pivot points. On the inner surfaces of the plates 72 and 74 there are provided nylon or the like wear strips 100, 102, 104 and 106, these wear strips being connected to the plates by means of screws 108. The wear strips bear upon the sides of the beam 16. It will be understood from the description

of the cutting head thus far that the head can freely run on the beam 16, and that the wear strips 100-106 form a means of maintaining the head in accurate position on the beam 16 as it moves thereon.

On the outside of plate 72 is provided a mounting plate 109 which is welded to the plate 72, and screwed to the mounting plate is a support plate 110 supporting a trunion 112 for receiving the end 114 of the piston 116 of a hydraulic ram which is used for displacing the cutting head along the length of the beam 16.

On the outside of the plates 74 are welded a pair of support bars 118, 120 to which is secured a support plate 122, by means of bolts 124, and the support plate 122 supports a depth control leg 126 the position of which can be adjusted in a vertical direction as indicated by arrow 128. The depth control leg 126 which is only used in certain modes of operation as will be explained hereinafter can be fixed in any adjusted position by any suitable means (now shown) and at the bottom of the leg 126 is provided a depth control roller 130 mounted on a spindle 132 by means of sleeve bearings 134. The roller 30 is a fabricated metal roller and the spindle 132 lies with its axis horizontal. The roller surface 136 engages the ground 20 when in use so as to control the depth to which the cutter drum 24 cuts into the road surface. The leg 126 may include a jack so that the control roller can be jacked into position under power.

The cutter drum 24 is carried by the plate 72 in that in an aperture 138 in the plate 72 at the lower portion thereof is received a motor 140 (which is preferably hydraulic) whose drive shaft 144, arranged with its axis horizontal and parallel to the axis of shaft 132, is secured to a supporting cage 146 having an outer cylinder 148 on which the drum cutting elements 150 (see Fig. 1) are mounted. The cutting elements 150 are carried by a sleeve which can be fitted over the cylinder 148 as shown in Fig. 3 so that in fact the cutting drum sleeve and elements 150 are replaceable when the cutting surfaces of the elements have been blunted. The roller 130 is located under the plate 74 whilst the cutting drum 24 is located to the outside of plate 72 whereby a compact and efficient assembly results.

It will be understood that in use the drum 24 is driven by the motor 140 (under the control of the operator) so as to rotate at working speed and whilst cutting takes place, the cutting head 22 is moved by means of the piston 116 along the length of the beam 16. When the depth control wheel is used, by setting the position of the depth control wheel 130, so the depth of cut which is made in the road surface is controlled.

Referring now to Figs. 4, 5 and 6, in this embodiment the beam 16 is secured to an upper support beam 164 by means of end plates 167. Beam 164 is in turn secured to back plate 166 having spaced pivot lugs 168, 170 to which are connected parallelogram links 172 and 174. A mounting frame 176 connects to the opposite ends of links 172 and 174 thereby forming a parallelogram linkage and movement of which is controlled by a hydraulic ram or two hydraulic rams 178. The support frame 176 is adapted to be connected to the top link of the tractor hitch system or other suitable connecting point by means of a bracket 180 and at the lower end the frame is supported in this example by two loader box sections 177 carried by the tractor and protruding under the rear axle of same. The frame 176 has two box sections which engage and slide in the loader frame sections 177. The tractor may be an agricultural tractor, in which case the top link of the three point hitch may be used as a connecting point, or, where the tractor is a semi-industrial type, the frame 176 may be connected in any suitable manner.

The beam 16 is provided at the ends with telescopically adjustable legs 182, 184 which can be extended or contracted by suitable means, such as screws or hydraulic rams contained therein and the cutting head is adapted to be driven along the beam by any suitable mechanism of which several will be described hereinafter.

When it is desired to remove an area of road surface, the beam initially will be raised to the transport position. The support legs are set to the required position in which the cutter projects below the feet of the legs by the required depth of cut. The cutting drum is caused to rotate and the beam is now powered downwards by the ram(s) 178 and the cutter drum first engaged, is powered into the cuts the road surface until the jacks 182 engage the ground. Continued powering downwards of the beam causes lifting of the rear of the tractor. If the tractor has a front loader bucket, this may be jacked onto the ground to raise the front wheels of the tractor clear of the ground, whereby the entire tractor is jacked clear of the ground. The next step is traversing of the cutting unit 22 on the beam 16 whilst the cutting drum is rotating to cut a strip of the road surface. When such strip has been cut, the powering ram(s) 178 is (are) retracted until the cutter unit and beam are raised and the tractor again rests on its wheels. The tractor is now driven forward and stopped, and the next cut can be made, and so on. When the cutting equipment is connected to the front of the tractor, the tractor will be reversed between cuts.

In a cheaper and lighter version of the planing appartus, the apparatus is for fitting to the 3 point linkage of a normal agricultural tractor. The linkage is fitted with a ram or a pair of rams which operates

or operate by being at a joint position at the top link and pressing downwardly onto the beam so as to lift the rear of the tractor.

In the modified version of the apparatus shown in Fig.7, the beam 164 is omitted and the lugs 168, 170 are secured to the plates 167 connected to the ends of the beam 16. Otherwise, the parts having the same reference numerals as those used in Fig. 4 have the same function as those parts shown in Fig. 4.

Referring to Figs. 8, 9 and 10, three separate forms of drive for moving the cutting head 22 on beam 16 are shown. In Fig. 8, the drive is in fact housed in the upper beam 164 and comprises a drive sprocket 186 which is mounted on a shaft connected to a hydraulic motor or gearbox with a hydraulic drive driven from the tractor hydraulics. An endless chain 188 passes over the sprocket 186 and also round guide sprockets 190, 192 before passing to end sprockets 194 and 196 at the ends of the beam 164. A continuous reach of the chain 188 extends between the sprockets 194, 196, and this reach is secured to a lung 198 forming part of the cutting head 22. It will be understood therefore that driving of the chain 188 effects movement of the lug 198 and therefore movement of the cutting head along the beam.

In the drive arrangement shown in Fig. 9, which is suitable for any embodiment, a drive ram 100A is connected to one of the plates 167 and lies parallel to the beam 16. At the end of its piston rod 102A, it carries a double sheave pulley block 104A. A length of chain 106A (or wire rope) has one end anchored to the other of said plates 167, and the chain extends round one of the sheaves of block 104A, then back to a fixed guide pulley 108A at and fixed relative to the said plate 167. The chain 106A then extends round a second pulley 108B and in a reach 110A along the underside of beam 16 to another guide pulley 112B adjacent and fixed relative to the other plate 167. The chain extends round a second pulley 112A and back to the sheave block 104A which it passes round on the other pulley and eventually is directed back to an anchor point 106B fixed relative to beam 16. The reach 110A is connected to the cutting unit 22 and it will be understood therefore as the ram 100A is expanded and contracted, under the control of the operator, so the cutting unit is moved by the wire rope, back and forth along the beam 16. As an alternative to using double guide pulleys 108A-108B, 112A-112B, single pulleys 108A and 112A may be used.

In the arrangement shown in Fig. 10 a hydraulic ram 200 has one end pivotally connected to a mounting 202 at one end of beam 164. The other end of the ram 200 is connected to a mounting 204 secured to a swinging arm 206 pivotable about location 208. Mounting 204 is spaced from pivot 208 by a predetermined amount so that as the ram 200 is extended and contracted, the outer end 210 of the arm 206 will travel in the arc 212 as shown in Fig. 10. A link 214 is pivotally connected between the end 210 and the cutting head 22 so that as the arm 206 executes the swinging movement by being propelled by the ram 200, so the cutter 202 is caused to move along the beam 16 to effect the cutting of strips of roadway surface.

In the arrangement shown in Fig. 11, a small back hoe kingpost 216 is provided at one end of the beam 16 and pivoted on the kingpost is a back hoe boom 218 having at its outer end a bucket 220 which is of a width 224 which matches the length of the cutter drum 24 so that the bucket can excavate along a strip of road of which the surface has previously beam removed by the cutter drum. The back hoe boom 218 is provided with various hydraulic cylinders 222 and 225 supplied from the tractor hydraulics so that it can operate in conventional articulation and bucket movement.

For the control of the back hoe movements, it is proposed that a control unit 226 be provided at said end of the beam 16 whereat the kingpost 216 is located so that the operator simply stands on the ground adjacent that end of the beam 16 and manipulates the control levers 228 in order to effect control of the back hoe boom 218 and the bucket 220. The back hoe is, as will appreciated, hydraulically operated, and instead of utilising a back hoe a hydraulic excavator may be provided. Such excavators are known in the art as "micro excavators". To use the arrangement shown in Fig. 11, firstly the cutting head would be arranged to remove a strip of road surface, following which the tractor would be driven forward a short distance so that the excavator kingpost was located over the centre of the trench and then the excavator or back hoe would be arranged to excavate a trench in the normal way so that in one apparatus there is a complete trench opening and digging machine. If a loader is provided on the front of the tractor, then the loader can be used to bulldoze the excavated material back into the trench for re-filling same or re-fill can be effected using the excavator or back hoe.

Figures 12, 13 and 14 show three further embodiments of the invention, wherein the planer equipment is essentially similar to that in the Figs. 4 and 7 embodiments.

In Figs. 12 and 13, the vehicle is in fact a trailer with a platform 150A, rear wheels 152A, and a drawbar 154A. The trailer has its own power unit 156A, which may be an internal combustion engine, and a weight 158A is included in order to load the cutter head 22 when the trailer rear wheels are raised during the cutting operation. An oper-

ator's seat 160A is provided for an operator 162A who faces rearwards when operating the planing apparatus by virtue of a control box and lever assembly 164A.

A ram 166A, controlled by the operator serves to raise and lower the beam 16 and hence the cutting head 22 into and out of engagement with the road surface, and in each case, when the cutter is powered onto the road surface, the rear of the vehicle is raised, by reaction, to load the cutting head 22.

In the case of Figs. 12, the beam 16 is connected with the trailer by parallel links, in much the same fashion as in the Fig. 4 or Fig. 7 arrangement, whereas in the Fig. 13 arrangement, the beam 16 is carried on the ends or arms or a simple frame 168A pivoted to the platform 150A at points 170A, and the weight 158A rests on the frame 168A. Where a single frame is used for supporting the beam, preferably the horizontal links are long to give as near vertical lift to the beam as possible.

In the case of the embodiment of Fig. 14, the cutting equipment is attached to a road vehicle or truck 172A, the mounting of the planer being otherwise as in Fig. 13, the control of the planer being by controls in the vehicle cabin; but in all cases either the vehicle engine or a separate engine can be used for driving a hydraulic pump which powers the rams and where a hydraulic motor is used, the hydraulic motor of the cutting head.

The reason for using the weight 158A, is that the weight of the vehicle alone would be insufficient to make the planer drum penetrate many road surfaces. Also, the weight needs to be in a suitable position on a pick-up vehicle or trailer for high speed road travel. High speed road travel of the road cutting apparatus of this invention could be important, because the travelling time could well be larger than the time during which the apparatus is in use.

Each or any embodiment of the planer described herein could be provided with the small digger back hoe arm arrangement as shown in Fig. 11.

In a not shown embodiment, the beam 16 may be mounted transversely of a JCB excavator by removing both excavator arms and replacing same by the beam 16, which would be operable by the existing excavator rams in a fashion corresponding to the operation of ram 178 in Fig. 4.

When the vehicle is a bucket loader, and the cutting equipment is mounted on the rear thereof the front loader bucket may be provided with a brush for sweeping up spoil created by the cutting operation, into the bucket of the loader.

Referring now to Figs. 15 and 16 which show another embodiment of the invention, in a practical form, this embodiment essentially is similar to what is illustrated in Fig. 1. The beam 16 is clearly shown as are the support legs 300, 302 without ground engaging feet 304 and 306. The rear wheels of the tractor are illustrated by references 308 and 310.

The cutting unit 22 is clearly shown and this is mounted on the beam 16 by means of a plate 312 and mounting rollers 314 (as shown in Fig. 9). The cutting unit 22 is propelled by the mechanism shown in Fig. 9, but any suitable mechanism may be deployed.

As shown clearly in Fig. 16, the apparatus is supported on the tractor by means of pivot links 316, 318, 320 and a fourth link not shown. The power ram for raising and lowering the apparatus is illustrated by reference 322. Of the legs 300 and 302, these are shown as being adjustable in height by means of screw devices 324 and 326 operable by handles 328 and 330. As explained herein, the links 316, 318 may be extensible and contractable in order to adjust the angularity of the beam 16 in relation to the ground, and in this connection the feet may be pivoted to the bottoms of the legs so as to be pivotable about axes which lie transverse to the fore and aft direction of the tractor instead of in the fore and aft direction of the tractor as shown in Figs. 15 and 16. These modifications may be embodied in any embodiment of the invention.

In Fig. 15 the cutter unit 22 is shown as being provided with a hood 332, and in another modification, a suction head may be connected to the hood 332 in order to remove spoil which is created by the cutting operation.

Fig. 15 shows that the cutting head 22 has been moved along the beam 16 in order to form a cut 334 in the road surface. The embodiment of Figs. 16 and 17 operates essentially as described hereinbefore, and reference is made to such earlier description.

In the apparatus shown in Fig. 17, there are two modifications compared to the apparatus shown in Fig. 15. The first modification is that the feet 304 and 306 are replaced by castor wheels 336 and 338, one or both of which is preferable powered so as to be rotatable to drive the tractor and the equipment forward at a creep speed as will be explained hereinafter. Additionally, the head 22 is provided with an adjusting ram 340 which is connected to the cutter drum, and the cutter drum is appropriately mounted so as to be pivotable about a vertical axis through 90°. The effect of this modification as will be understood enables the cutting drum to be turned so that its axis lies at right angles to the fore and aft direction of movement of the tractor. In the normal cutting operation as shown in Fig. 15 and in the other figures, the axis of rotation of the drum extends in the fore and aft direction of the tractor so that cutting can take

place by moving the cutter along the drum. When the cutting drum according to the Fig. 17 embodiment is turned through 90° however, cutting takes place as shown by the groove 342 in Fig. 17 in the direction of the movement of the tractor. To enable this cutting to take place, the rollers 336 and 338 become operative. Thus, when it is desired to cut a groove such as groove 342, the cutting drum is turned to the in line position shown in Fig. 17 and then the beam is jacked downwardly as described hereinbefore until the cutting drum first of all engages and cuts the road surface and until the rollers 336 and 338 engage the road surface and eventually until the rear of the tractor is raised from the road surface. In this condition, and with the cutting drum being driven, the rollers 336 and 338 are driven so as to cause the whole assembly to creep forward, the slot such as slot 342 being cut as the equipment moves forward. Such a machine as shown in Fig. 17 can also be used of course to cut the road surface in the manner illustrated in Figs. 1 and 15 and therefore it is a highly flexible piece of equipment. The facility to cause the tractor with planing implement carried thereby to move forward at creep speed by being supported on support legs with drivable rollers in itself constitutes an inventive step, as does the concept of providing a cutting head which has a cutting drum thereon which can be turned through 90° so as to cut transversely as in the Fig. 15 arrangement, or in line as in the Fig. 17 arrangement.

Any of the features of the embodiments of Figs. 15 to 17 may be embodied in earlier described arrangements.

The ground engaging wheel 130 as illustrated in Figs. 2 and 3 is only utilised when the support legs and support feet or support rollers as shown in Fig. 17 are not used. In other words it is possible to power the cutter into the ground until such times as the depth control roller 130 engages the ground and serves as the means for supporting the rear of the tractor above the ground in substitution for the legs and feet or legs and rollers 336, 338.

Furthermore, in any embodiment of the invention in which the support legs are used, these may be adjusted to differential heights to cause the beam to lie at an angle to the road surface, for example to take account of road surface camber whereby the cutter will cut a slot in a direction parallel to the road surface camber.

Claims

1. An apparatus for cutting roadway surfaces comprising:
a) a mobile vehicle
b) road cutting equipment carried by the vehicle and comprising
i) a substantially horizontal beam connected to the front or rear of the vehicle; and
ii) a cutter unit carrier by the beam so as to be movable therealong so that a cutting means of the cutter unit can cut the road surface.
c) means enabling the cutting means to be moved between a lowered working position and a raised transport position in which the road cutting equipment can be transported by the vehicle,
characterised in that the beam is arranged transverse to the front to rear direction of the vehicle so that by sequentially moving the cutting means between the raised and lowered position, and by advancing or reversing the vehicle, the cutting means can be made to cut slots or grooves in the road surface which are parallel and transverse to the direction of movement of the vehicle.

2. Apparatus according to Claim 1, characterised in that the cutting means comprises a rotatable cutter having cutting elements on its periphery, the cutter being arranged with its axis at right angles to the beam length so that the cutting elements will engage the road surface when the beam is lowered.

3. Apparatus according to Claim 2, characterised in that the cutter is mounted so as to be rotatable about a vertical axis to a position so that its axis lies in the direction of the beam length, so that in this position cutting of the road surface can be effected by rotating the cutter and moving the vehicle forwards or rearwards.

4. Apparatus according to Claims 1 or 2, characterised in that the beam is arranged to lie at right angles to the fore and aft direction of the vehicle.

5. Apparatus according to Claim 4, characterised by jacking means for raising and lowering the beam between said positions.

6. Apparatus according to Claim 5, characterised by support legs carried by said beam and onto which the weight of the tractor may be jacked for the support of same off the ground whilst the cutter moves along the beam.

7. Apparatus according to Claim 6, characterised in that said legs can be extended and contracted to vary the depth to which the cutter penetrates the road surface when in operation.

8. Apparatus according to Claim 7, characterised in that there are two of said legs, at or adjacent the respective ends of the beam.

9. Apparatus according to Claim 4, characterised by jacking means adapted to jack the cutting means towards the road surface, said jacking means being part of the cutter unit.

10. Apparatus according to Claim 1, characterised in that at one end of the beam there is a power operative back hoe which can serve to ex-

cavate the ground under an area of road surface previously removed by the cutting unit, said back hoe being pivotally mounted on the beam end for pivotal movement about an upright axis, and being in the nature of an articulated arm with a ground working means at the outer end thereof.

11. An apparatus according to Claim 1, characterised in that the vehicle is a tractor, an excavator, a trailer, a semi-trailer or a lorry.

12. An apparatus according to Claim 11, characterised in that the vehicle is a tractor, an excavator or lorry, and the power for operating the cutting unit and raising and lowering the cutting means is derived from the tractor, excavator or lorry power unit.

13. An apparatus according to Claim 11, characterised in that the vehicle is a trailer or semi-trailer, which carries a power unit dedicated to operating the cutter unit and raising and lowering the cutting means.

14. An apparatus according to Claim 1, characterised in that the cutting unit has a depth control wheel associated therewith.

15. An apparatus according to Claim 1, characterised by a means for moving the cutting unit along the beam comprising a hydraulic ram, a pulley block connected to the hydraulic ram to be moved thereby and flexible chain or the like means trained round said block and anchored to said cutting unit and the beam.

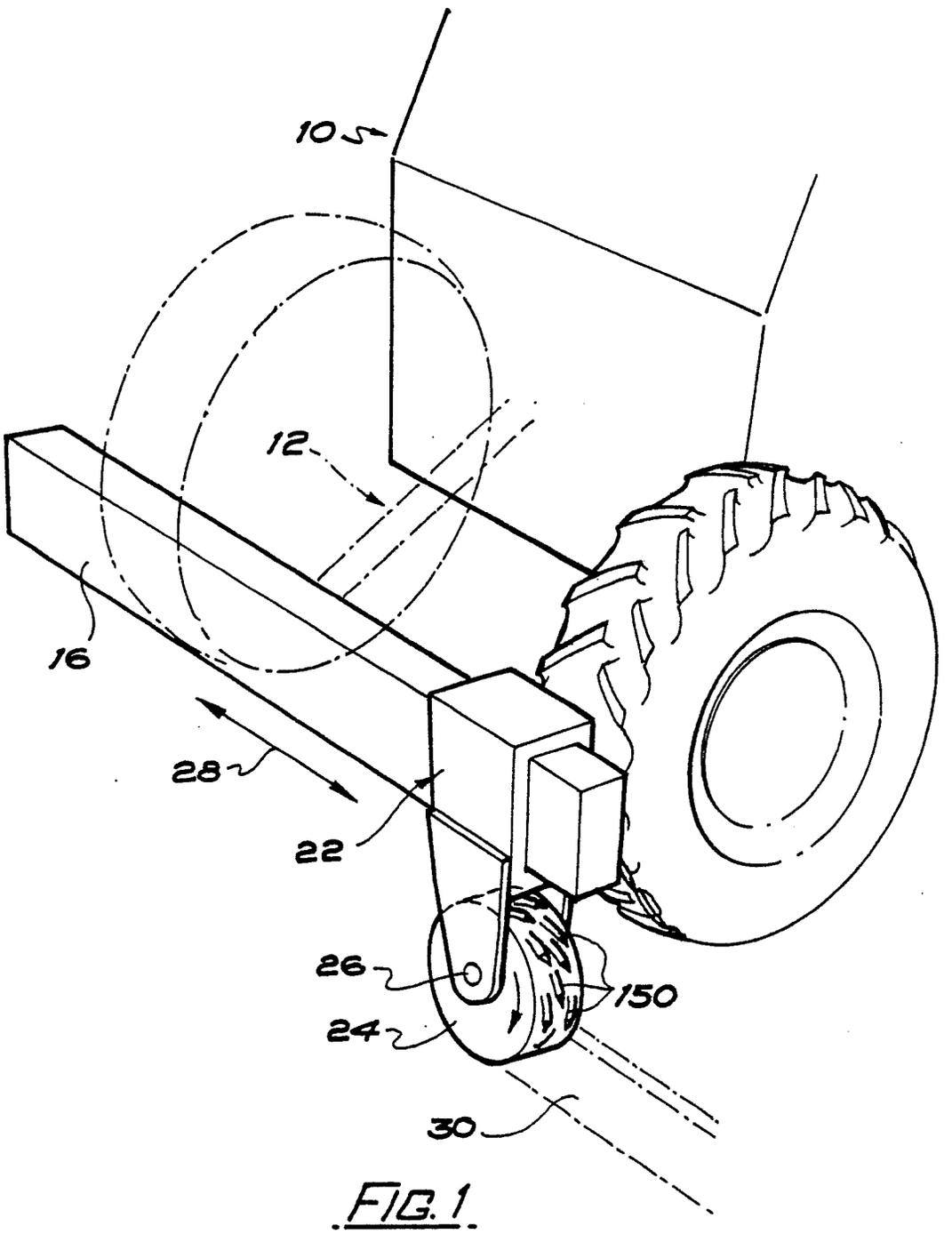

FIG. 1

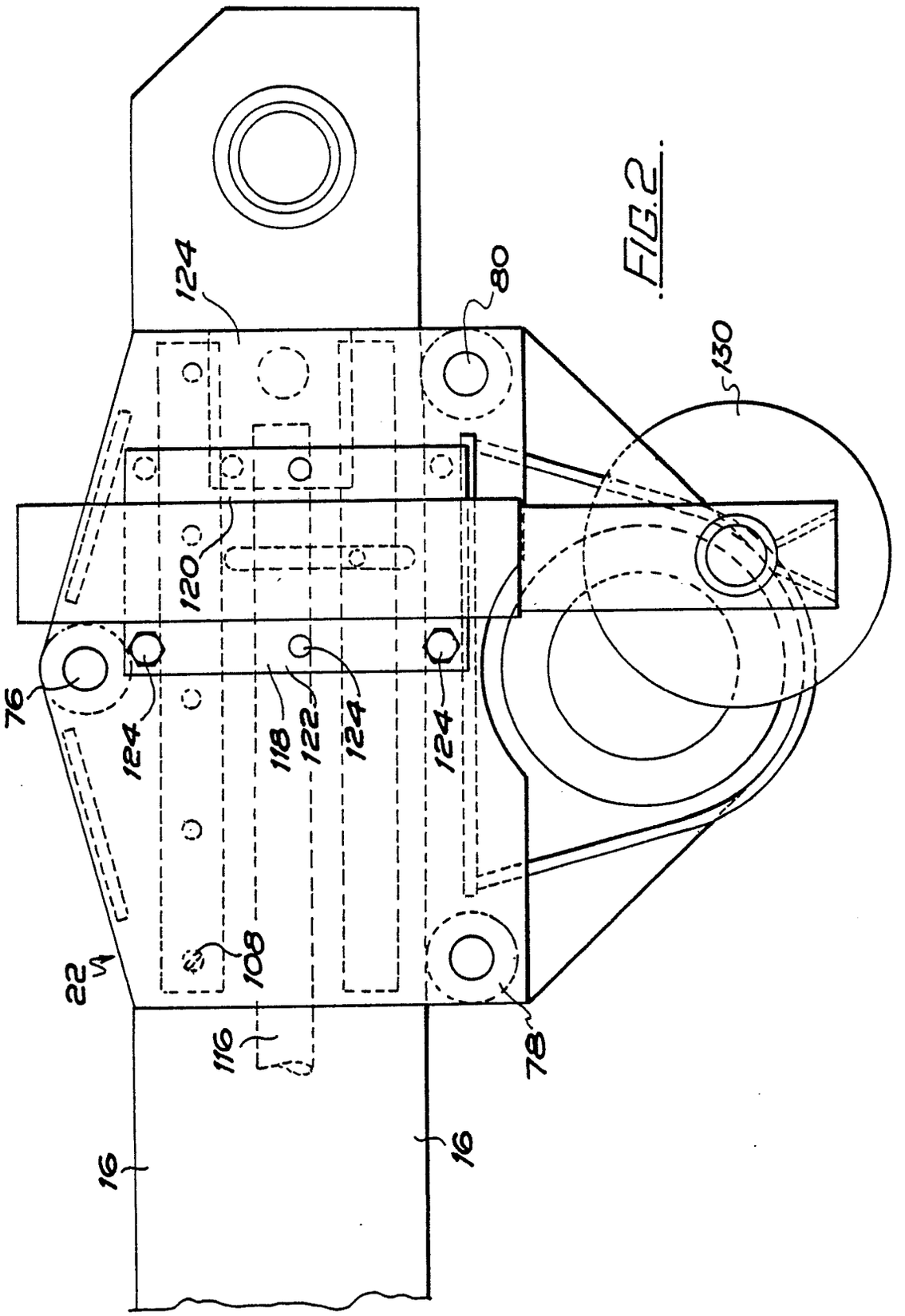

FIG.2.

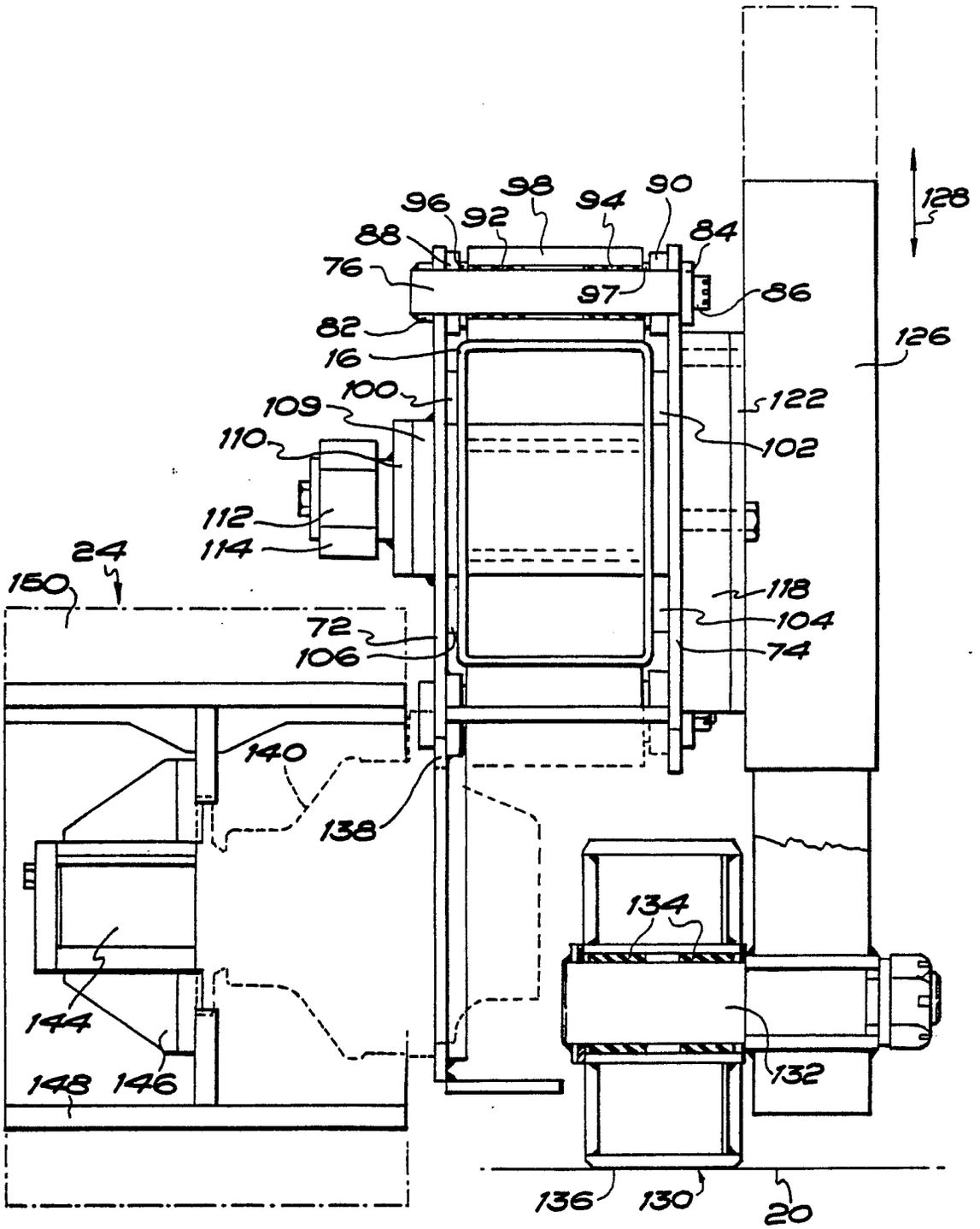

FIG. 3

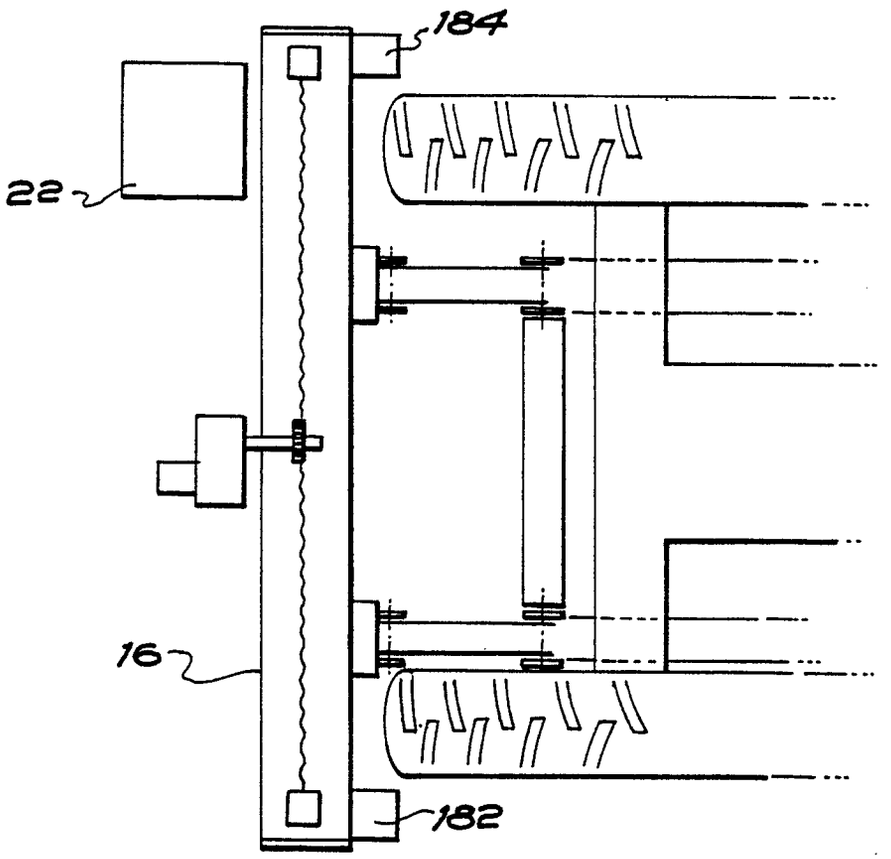

FIG.4

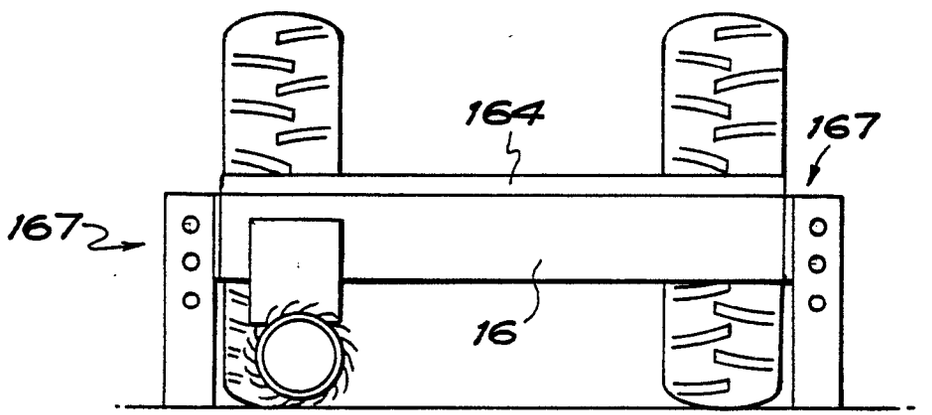

FIG.5

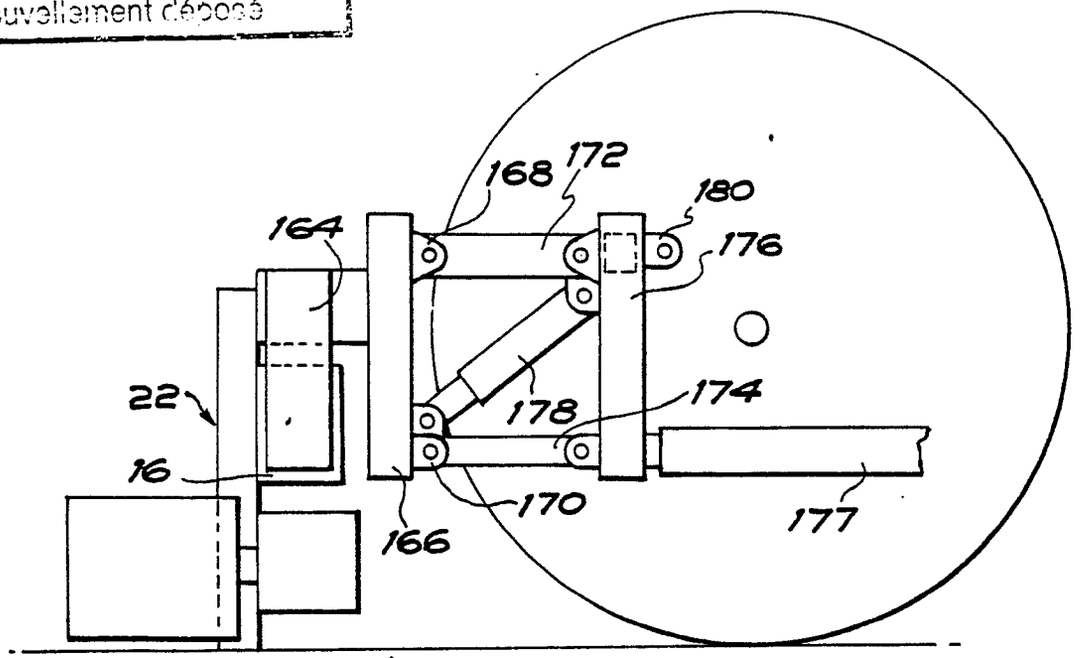

FIG. 6

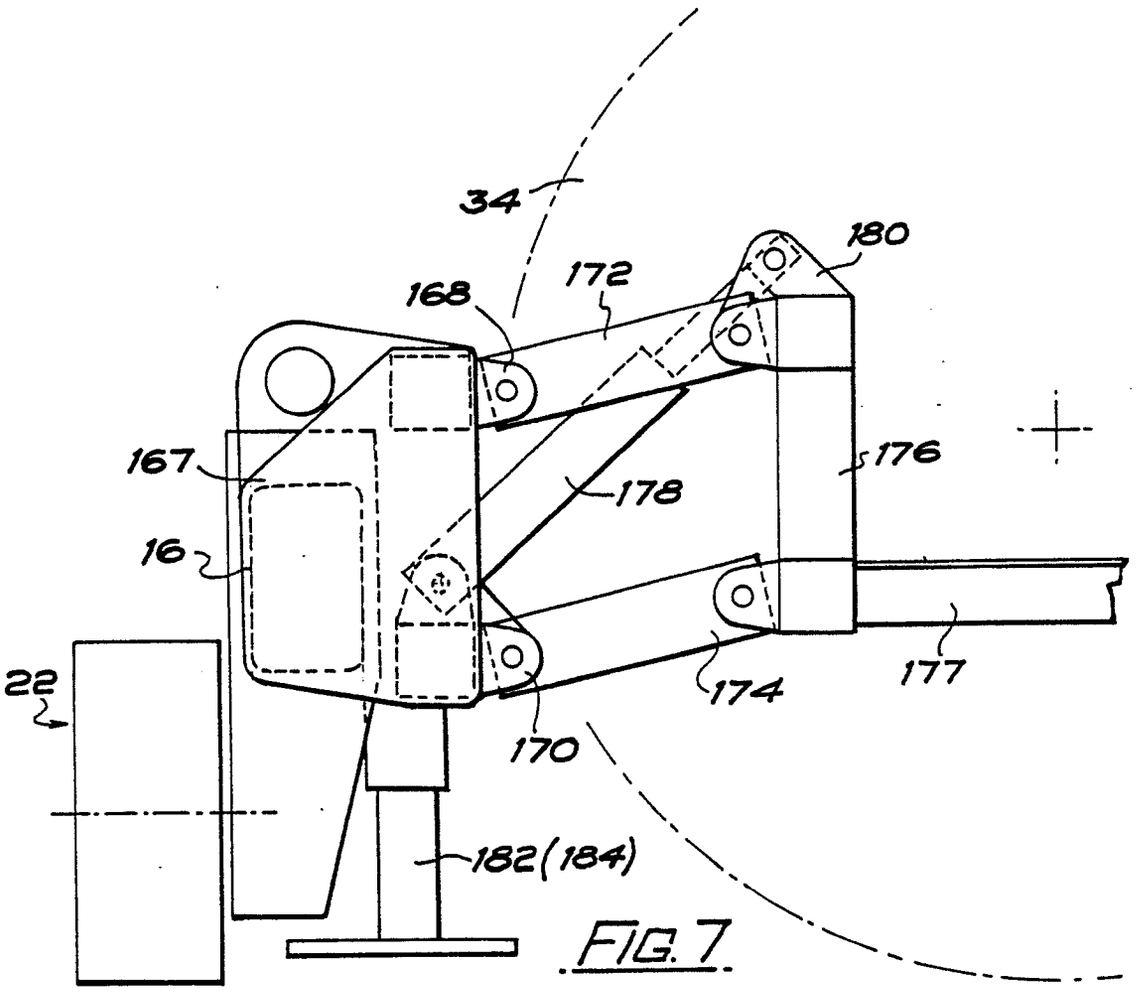

FIG. 7

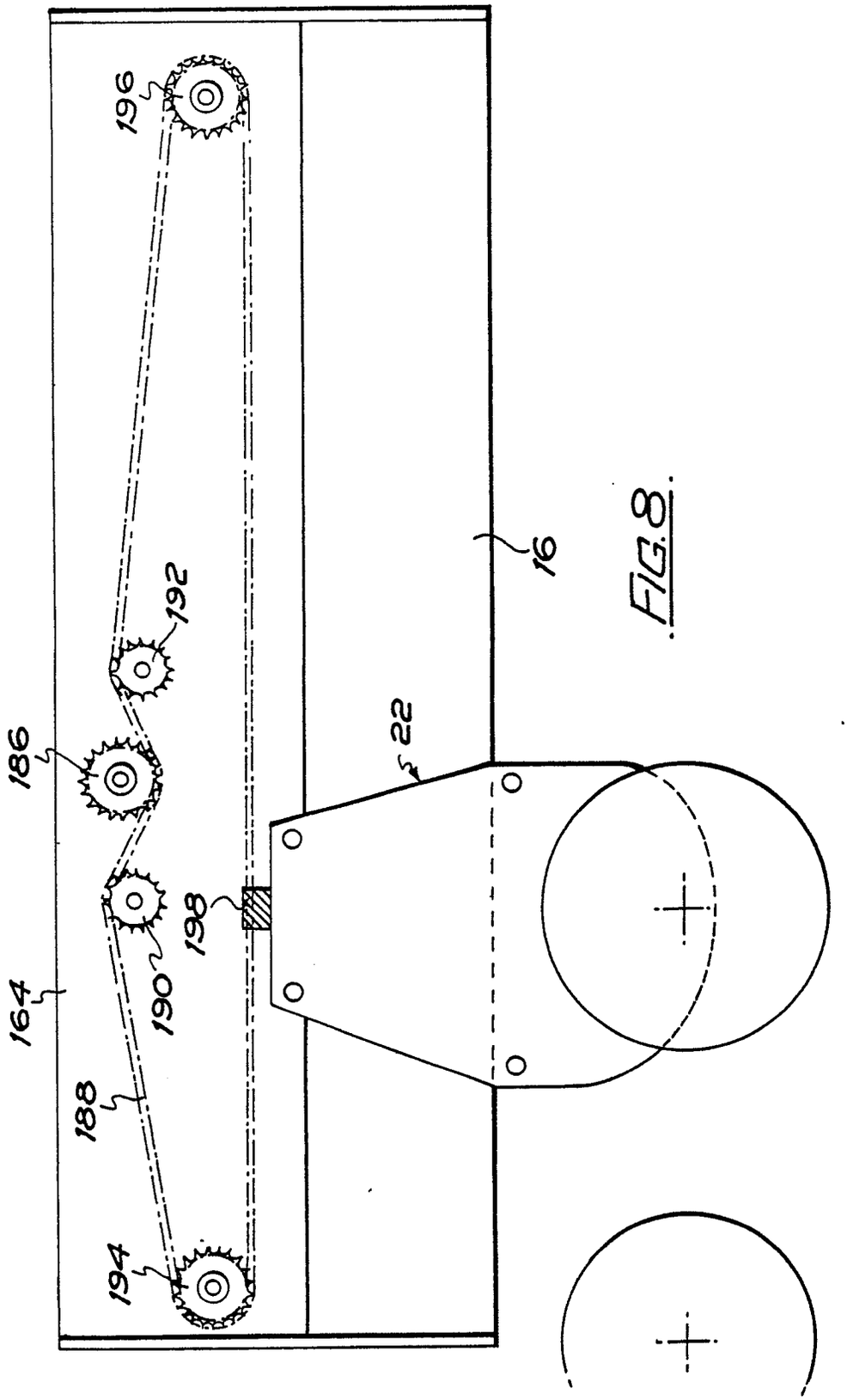

FIG.8.

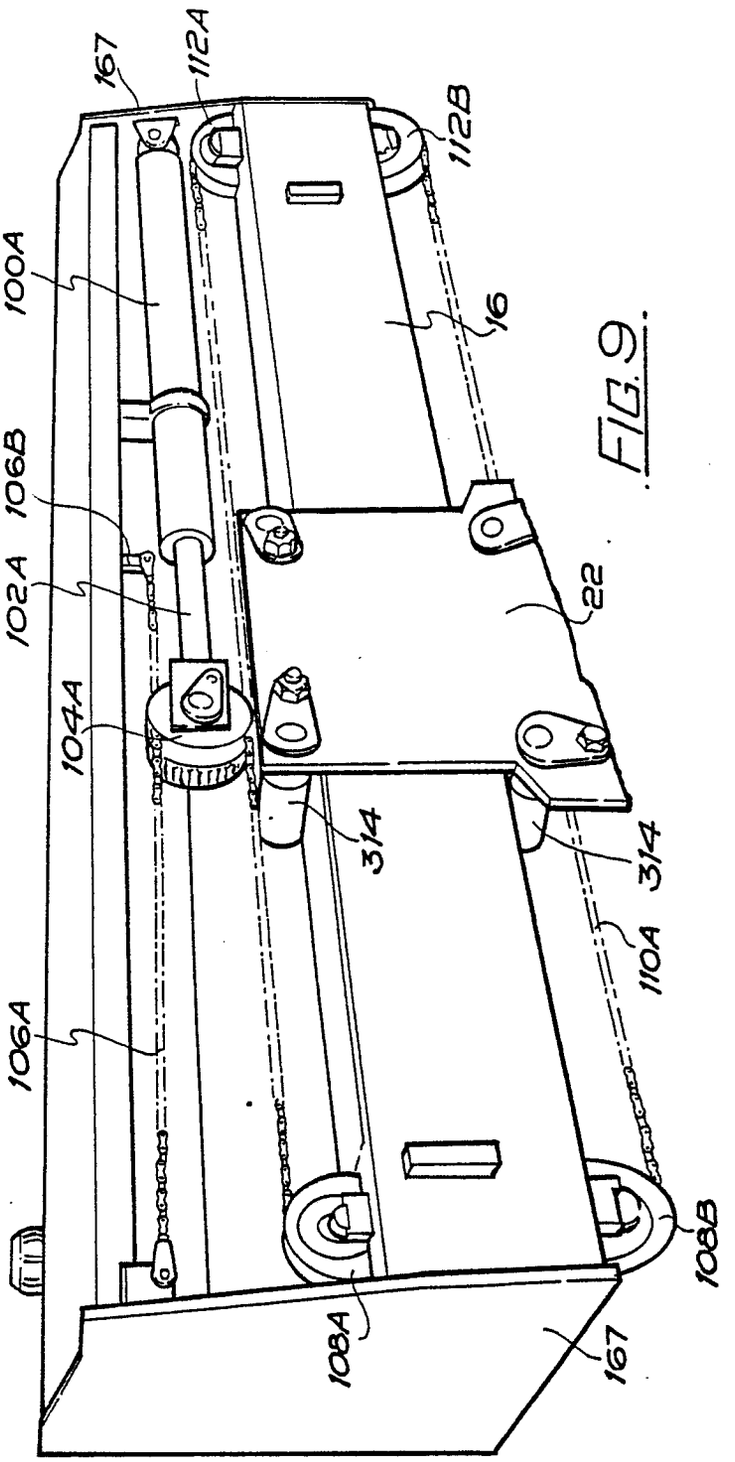

FIG. 9

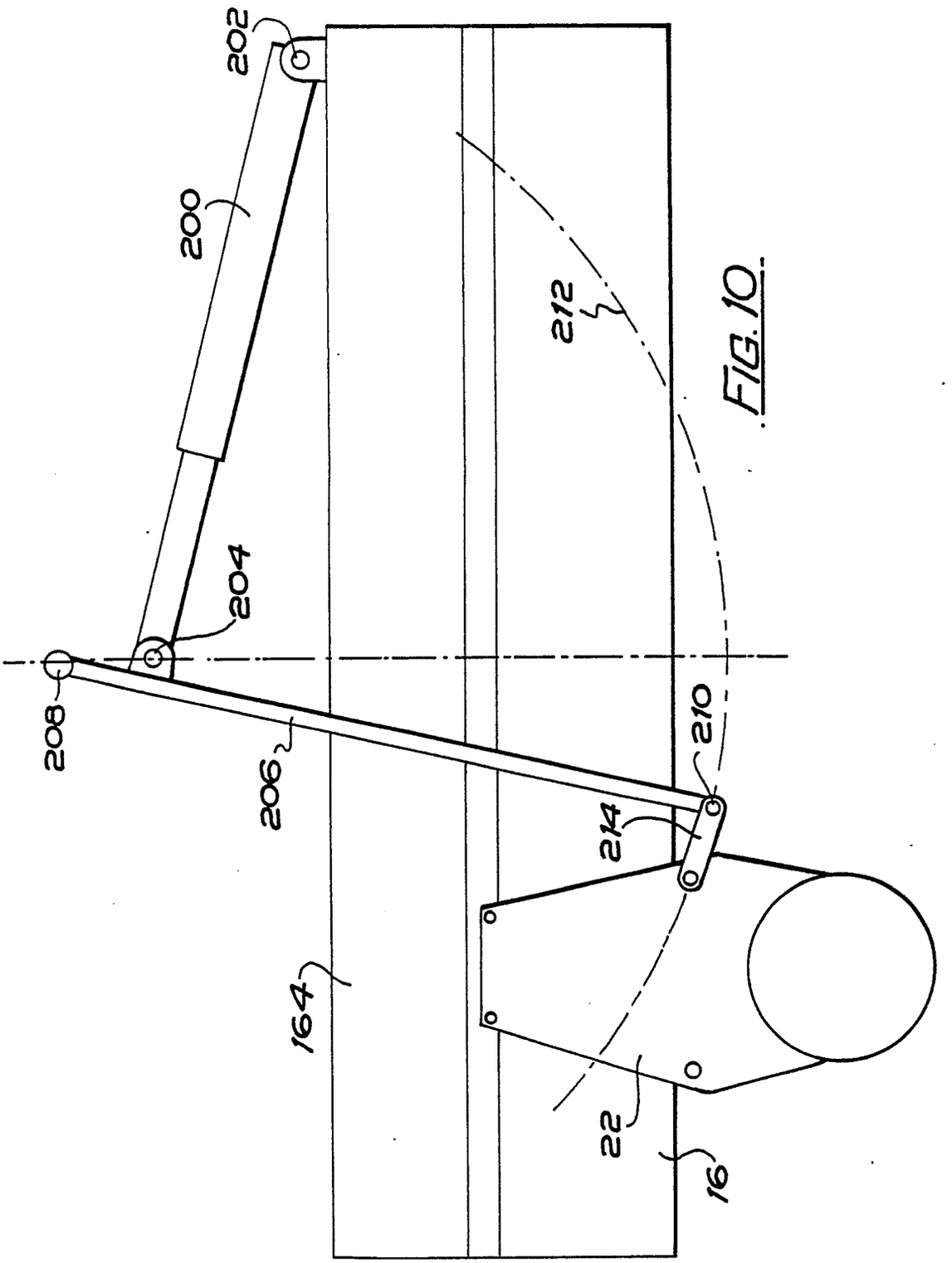

FIG. 10

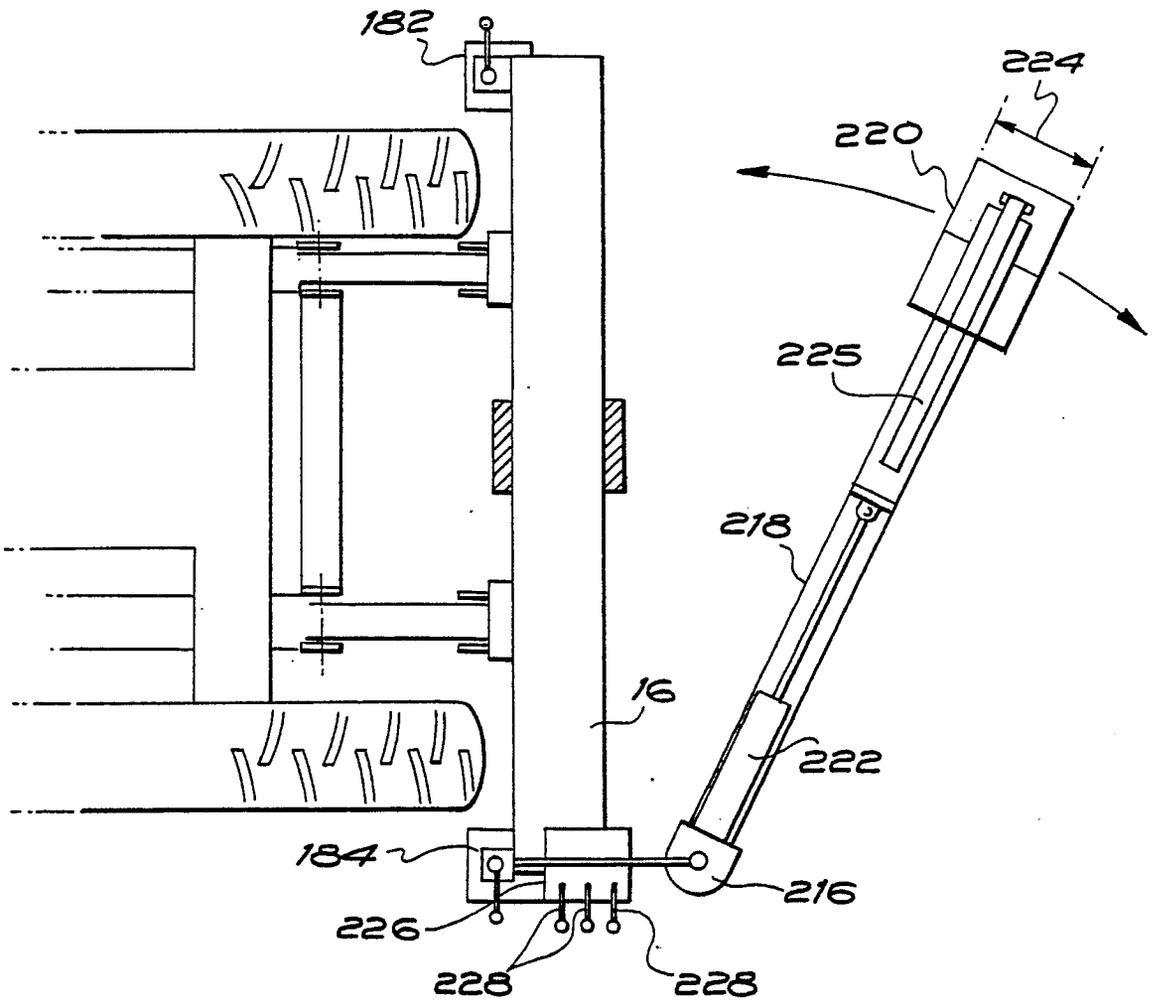

FIG.11

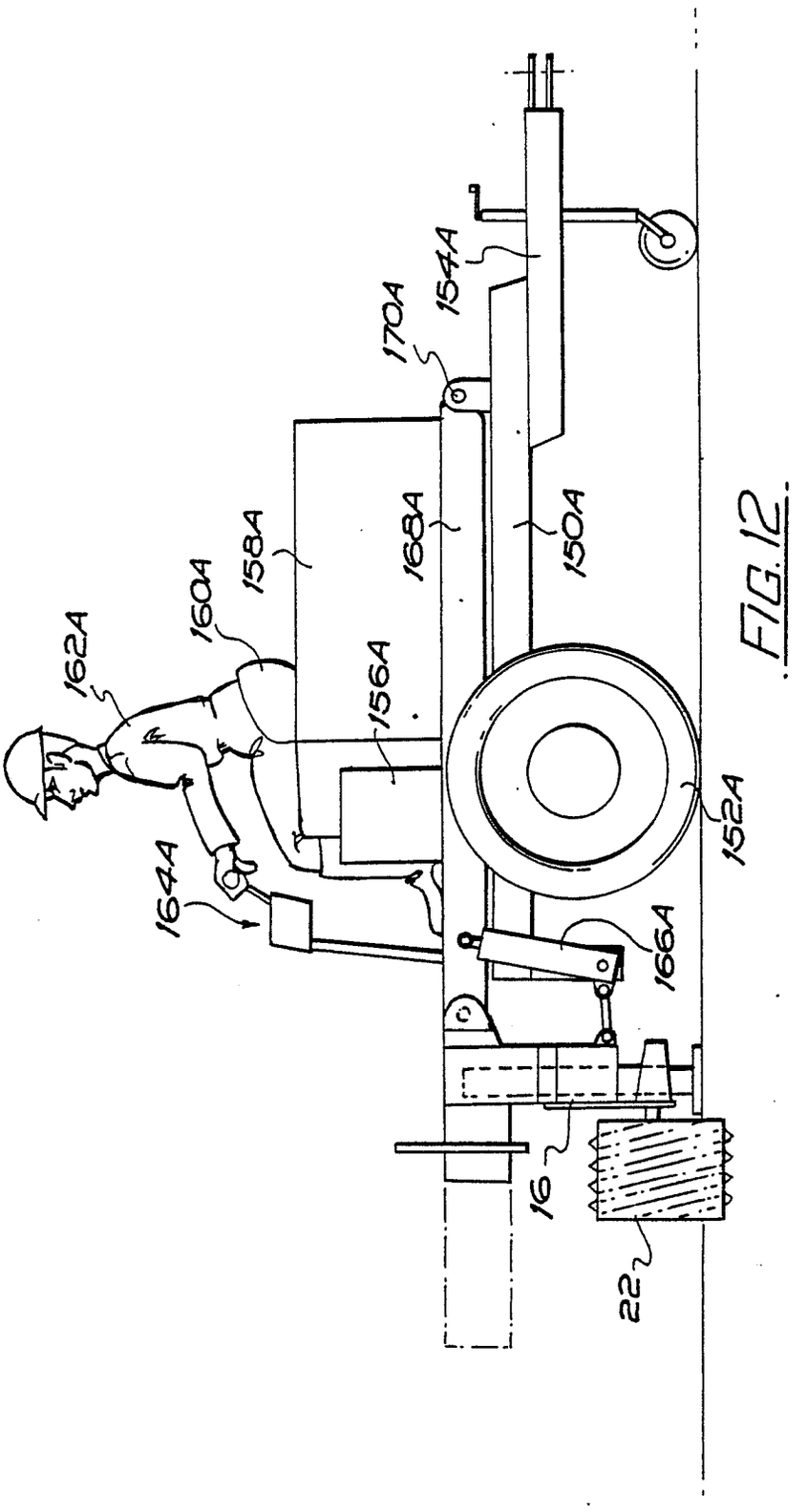

FIG. 12

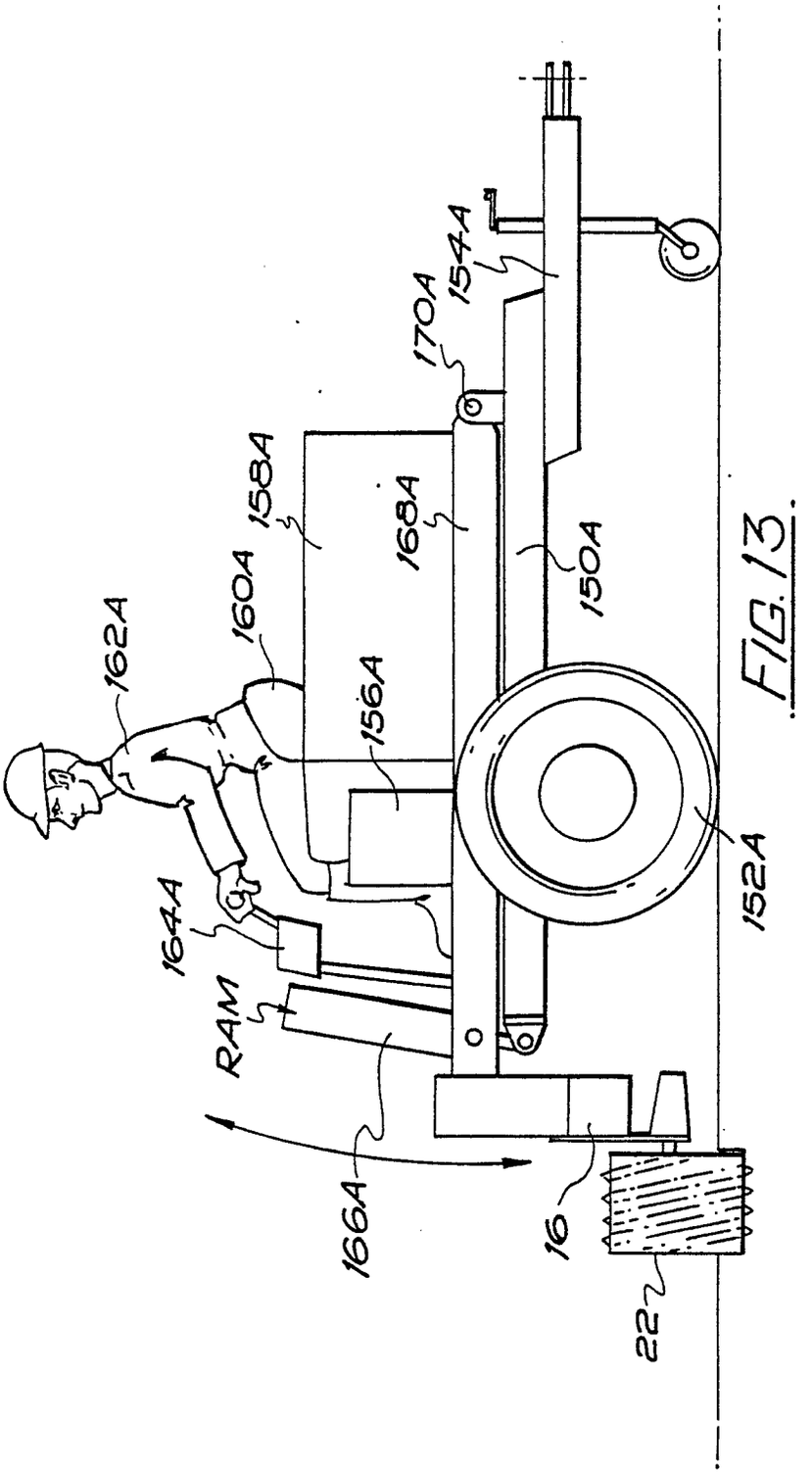

FIG. 13.

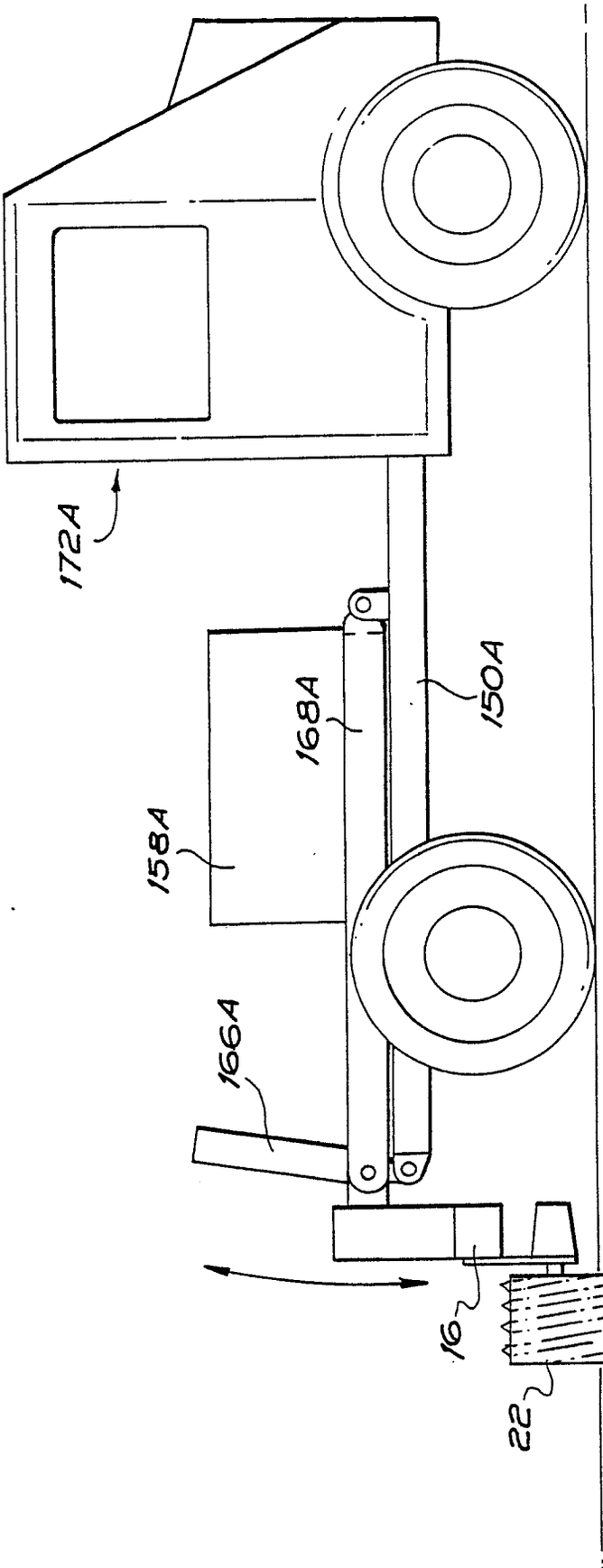

FIG. 14.

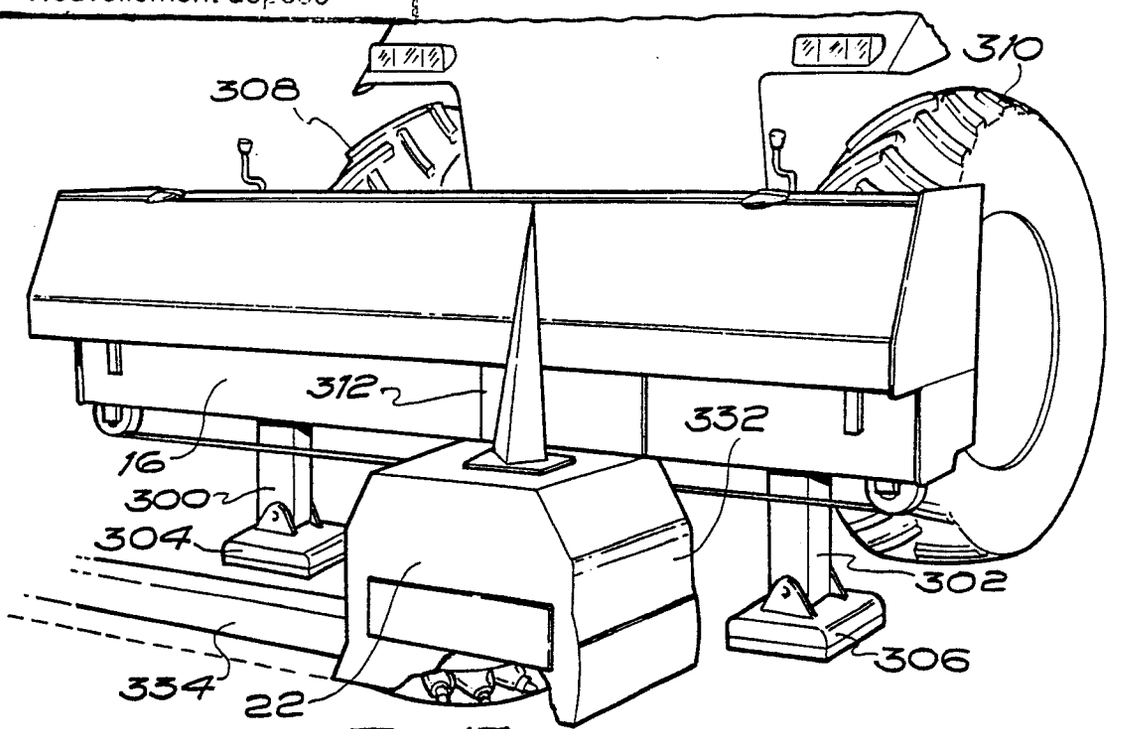

FIG.15

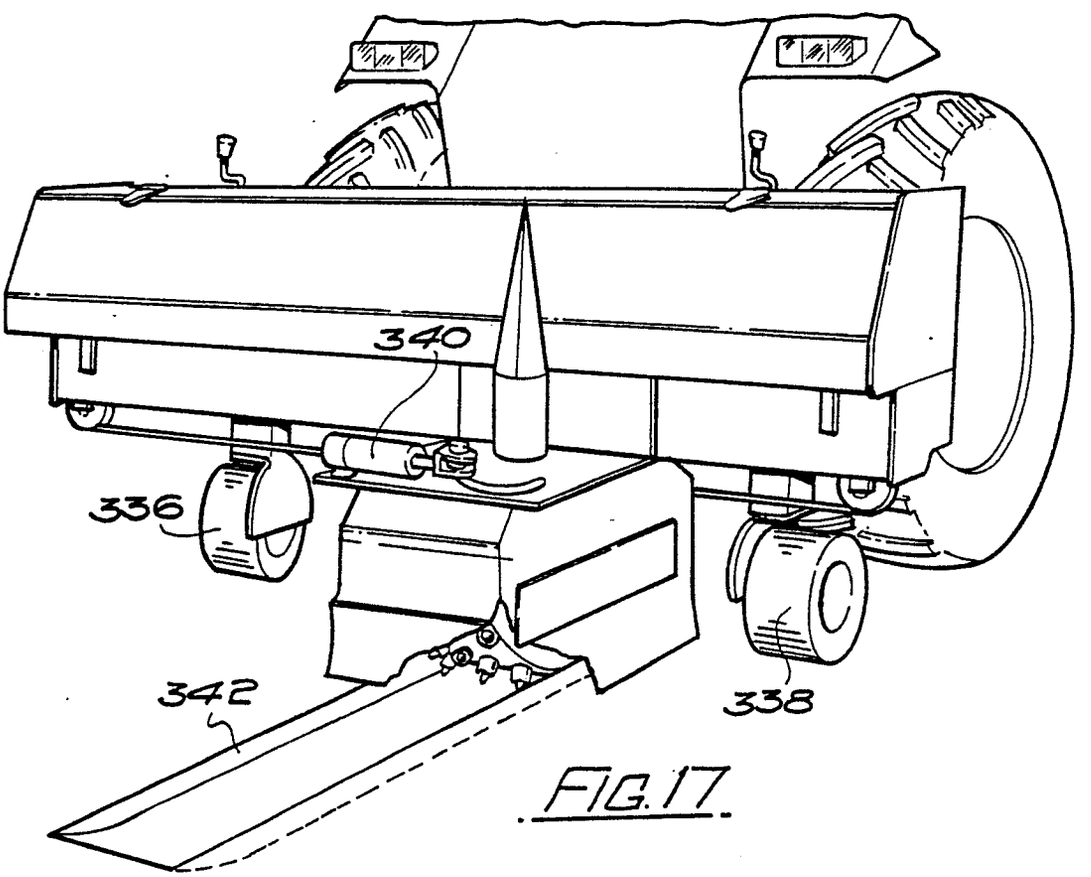

FIG.17

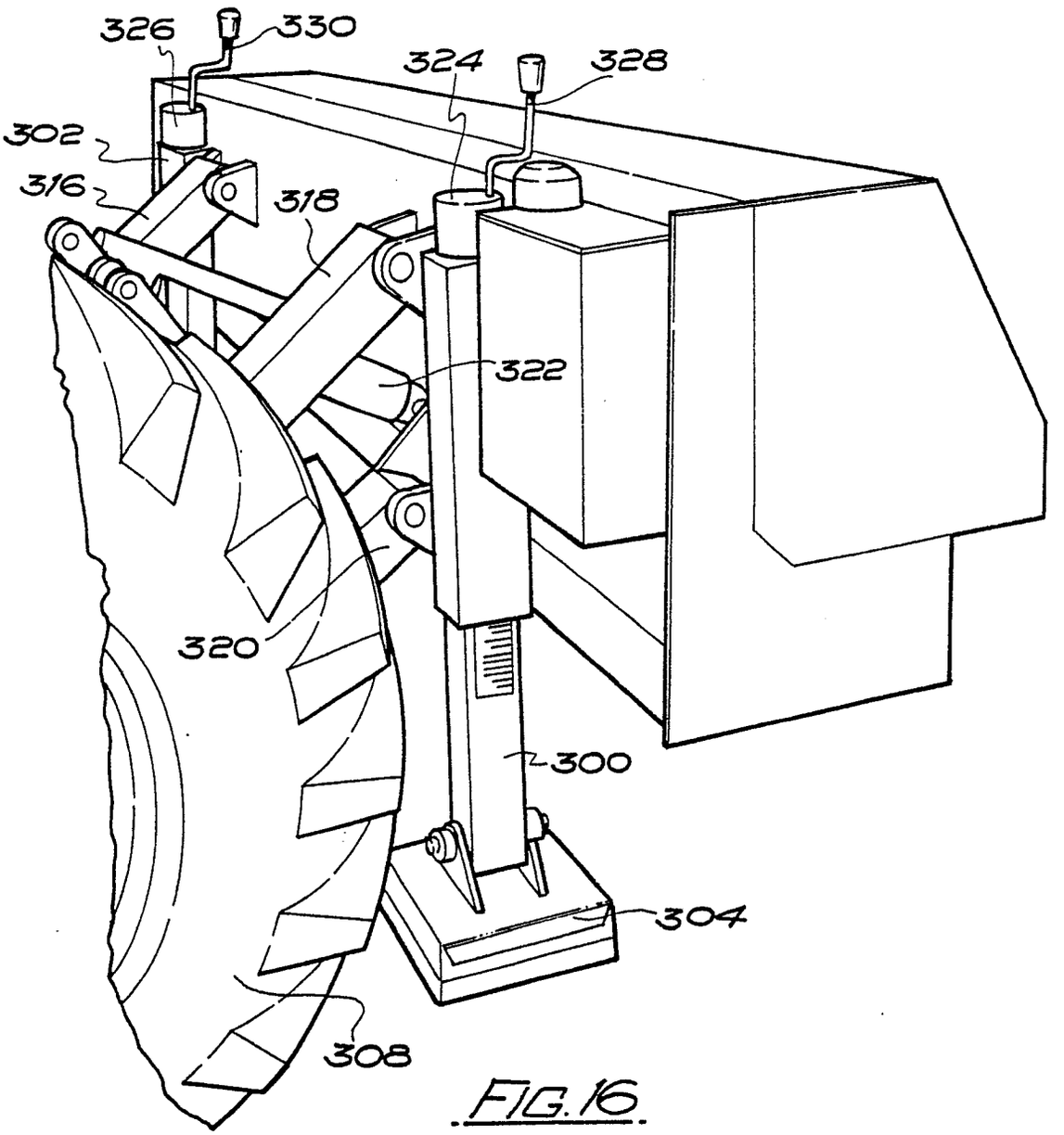

FIG.16