# United States Patent

**Hatcher et al.**

[15] **3,697,135**

[45] **Oct. 10, 1972**


[54] **CONCRETE PAVEMENT CUTTING MACHINE**


[72] Inventors: **Cecil W. Hatcher; Gene Warner,** both of P.O. Box 1263, El Monte, Calif. 91734



[22] Filed: **Feb. 25, 1971**

[21] Appl. No.: **118,909**

[52] **U.S. Cl.** .......................................**299/39,** 173/24

[51] **Int. Cl.** ...............................................**E01c 23/09**

[58] **Field of Search** ......................299/39, 41; 173/24



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,223,213 | 11/1940 | Kersten | 299/39 X |
| 3,407,005 | 10/1968 | Simms et al. | 173/24 X |
| 3,606,467 | 9/1971 | Christensen et al. | 299/39 |



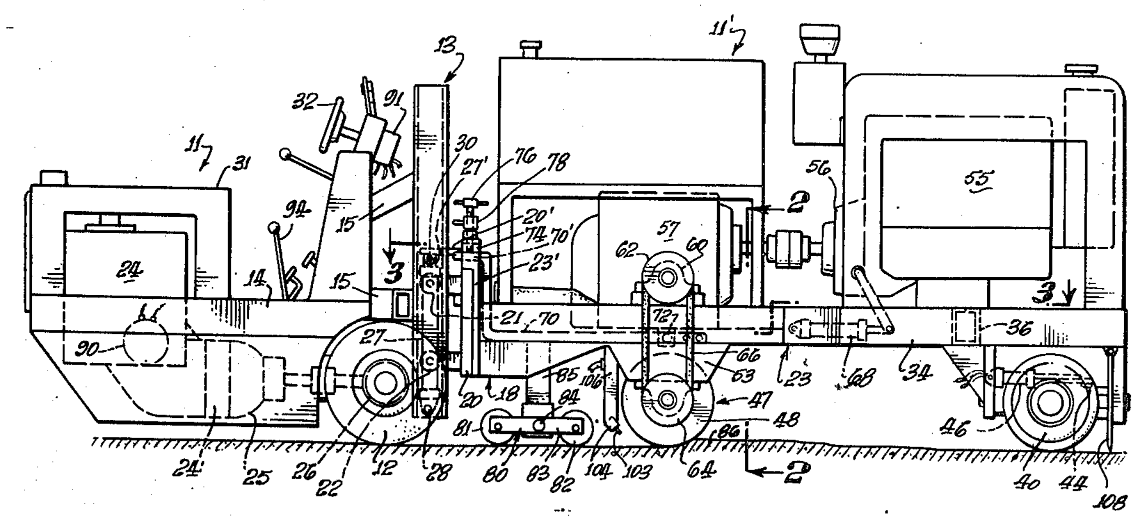
*Primary Examiner*—Ernest R. Purser
*Attorney*—William E. Beatty



[57] **ABSTRACT**

A self-propelled pavement cutting machine comprising a drive truck having a front end having an upright sliding coupling with the rear of a vehicle having an elongated cutter for cutting bumps or grooves, the vehicle having front wheels and rear wheels. When the cutter is active, the vehicle is supported by its two sets of wheels, depth control means being provided for the cutter. The truck has a pump supplying hydraulic fluid to raise and support the rear end of the vehicle with its cutter and rear wheels, the vehicle being supported then by its front wheels. When the vehicle is being pushed by the truck, side sway of the vehicle is prevented as the coupling is arranged on opposite sides of the longitudinal center of the truck and vehicle.


**13 Claims, 8 Drawing Figures**



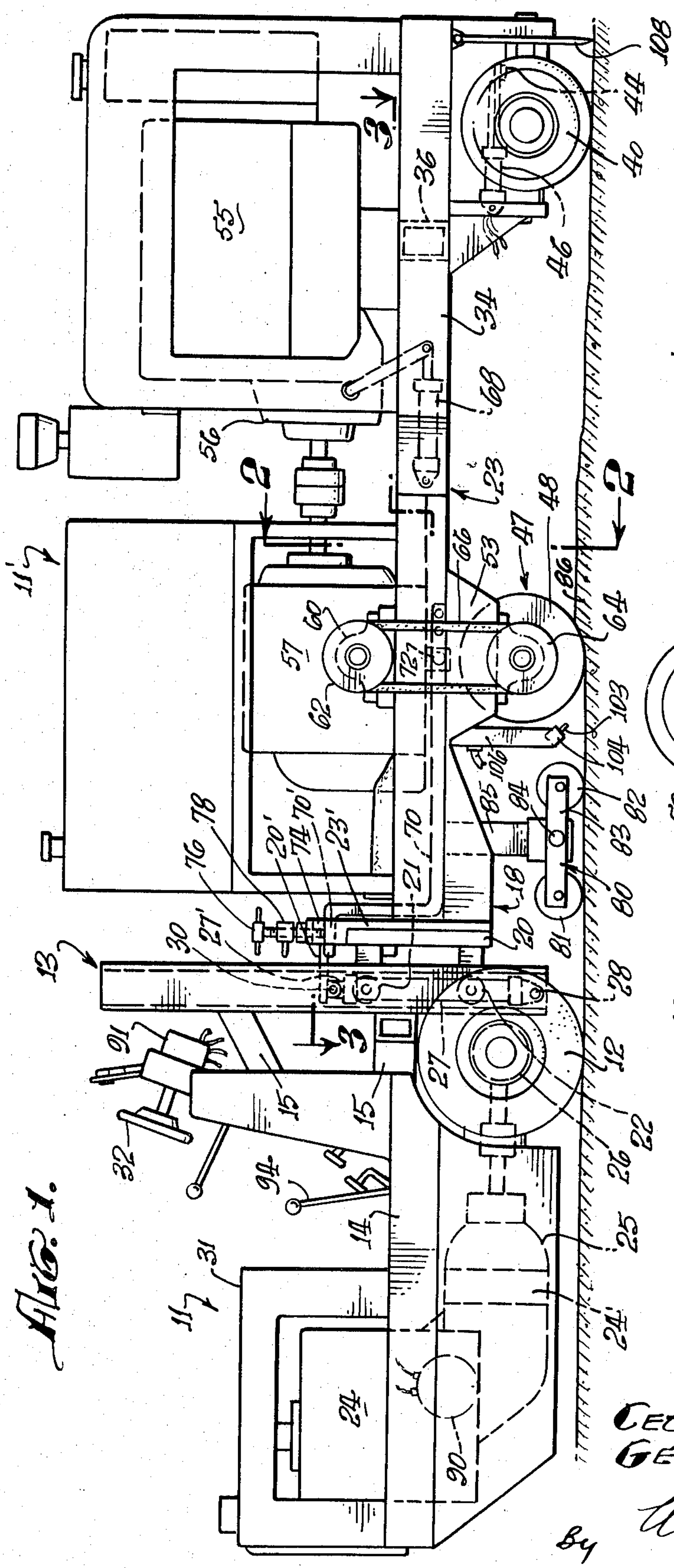


FIG. 1.

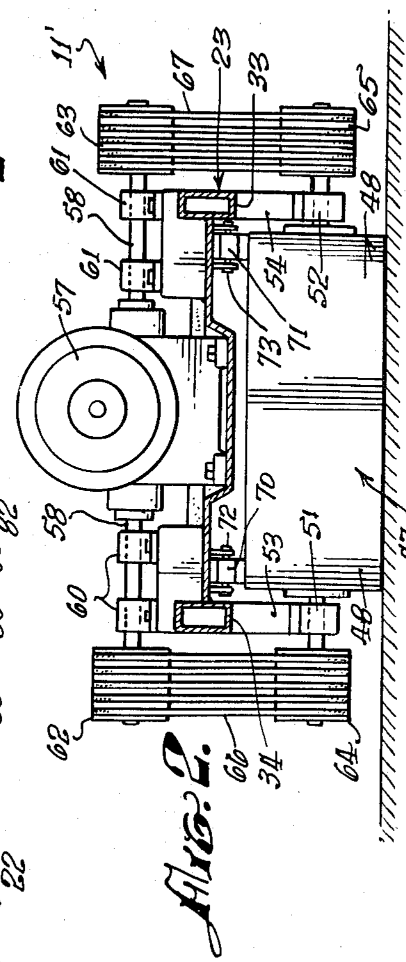


FIG. 2.

INVENTORS.
CECIL W. HATCHER,
GENE WARNER,

By W E Beatty
ATTORNEY.

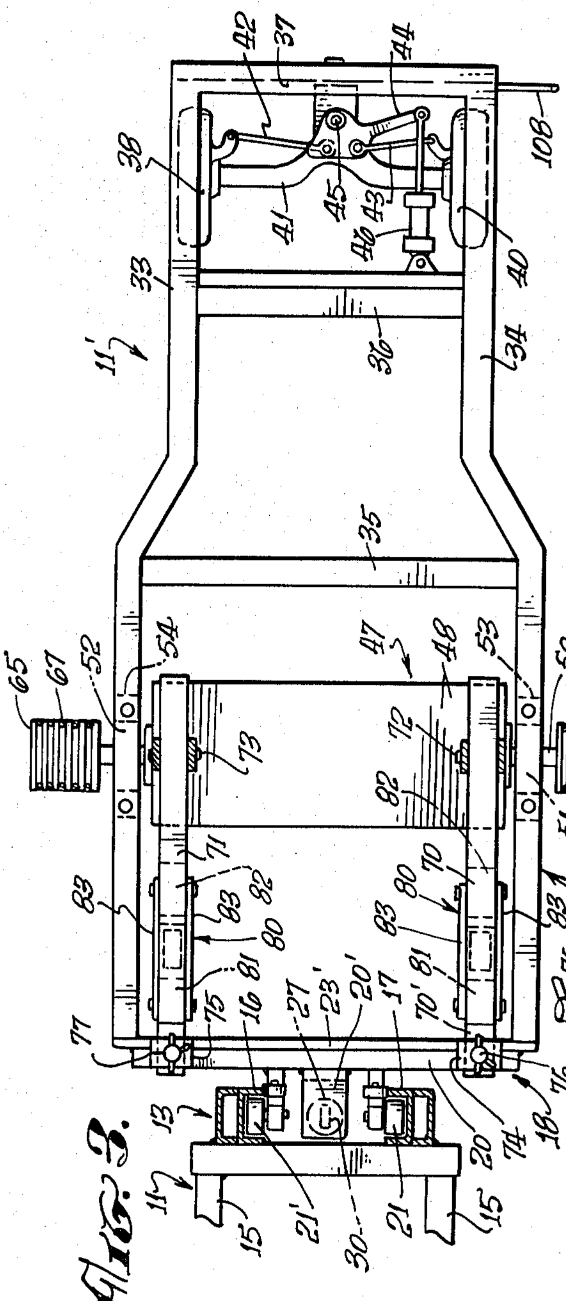


Fig. 3.

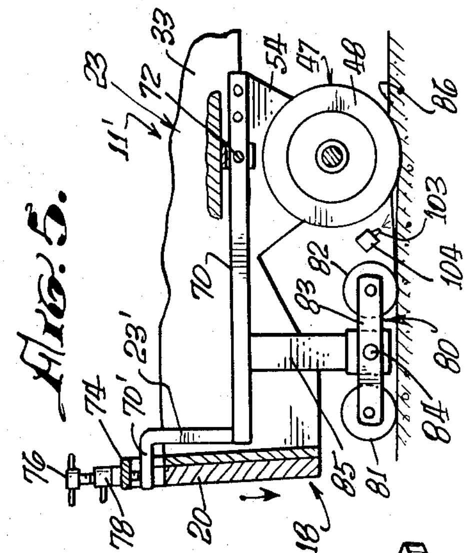


Fig. 5.

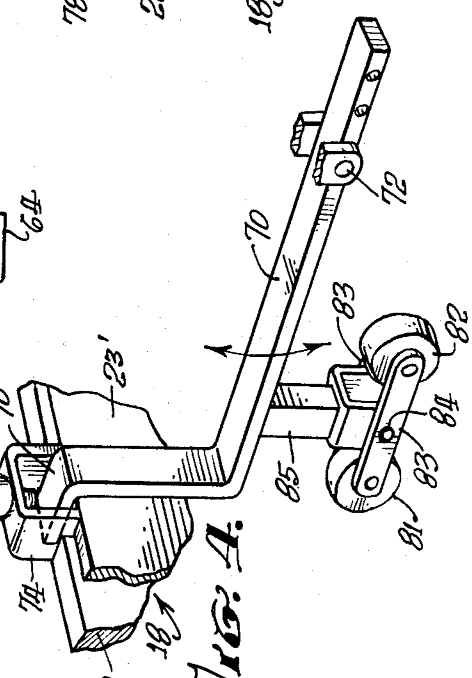


Fig. 4.

INVENTORS.
CECIL W. HATCHER,
GENE WARNER,

By W E Beatty
ATTORNEY.

PATENTED OCT 10 1972 3,697,135



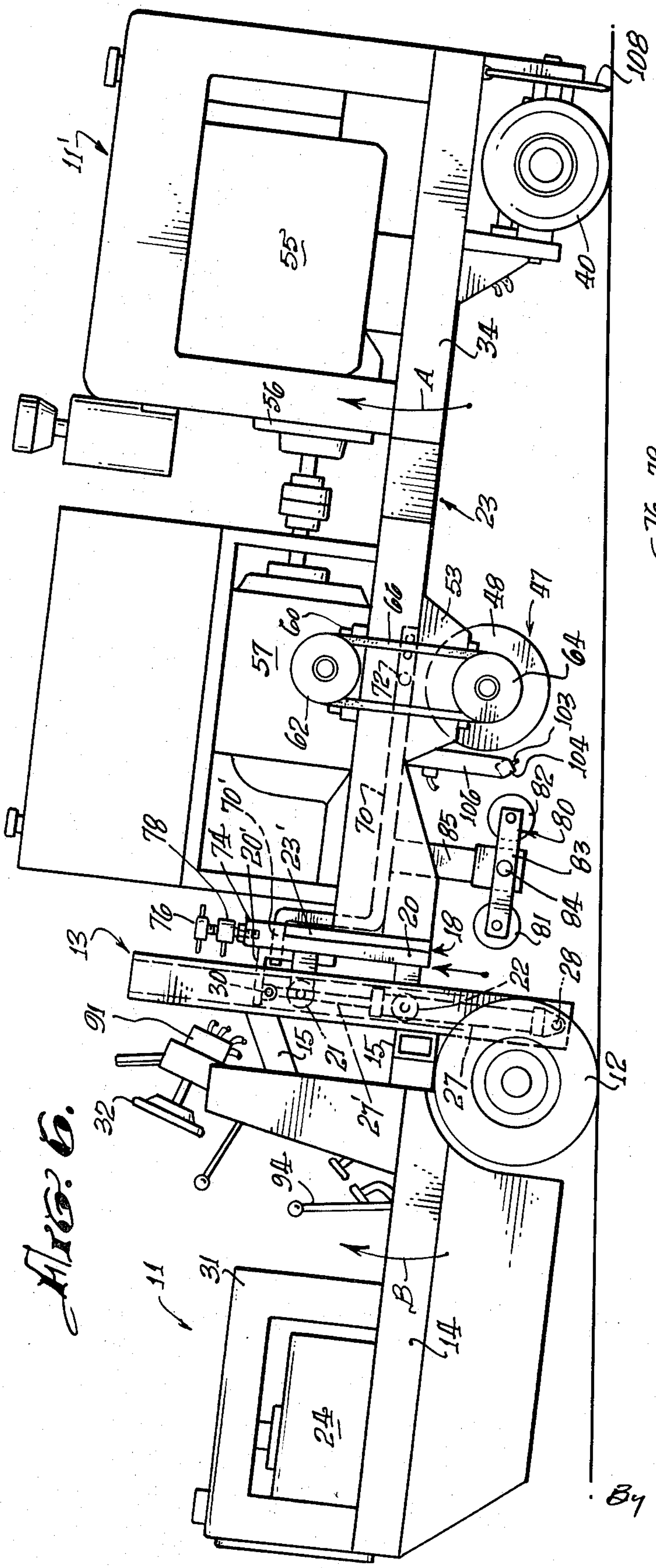


FIG. 6.

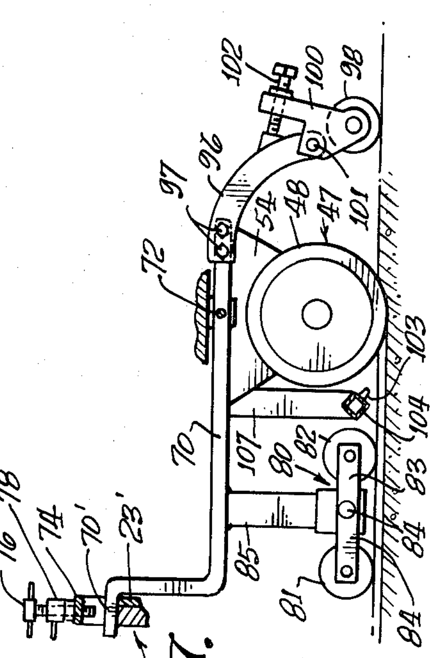


FIG. 7.

INVENTORS.
CECIL W. HATCHER,
GENE WARNER,
By W. E. Beatty
ATTORNEY.

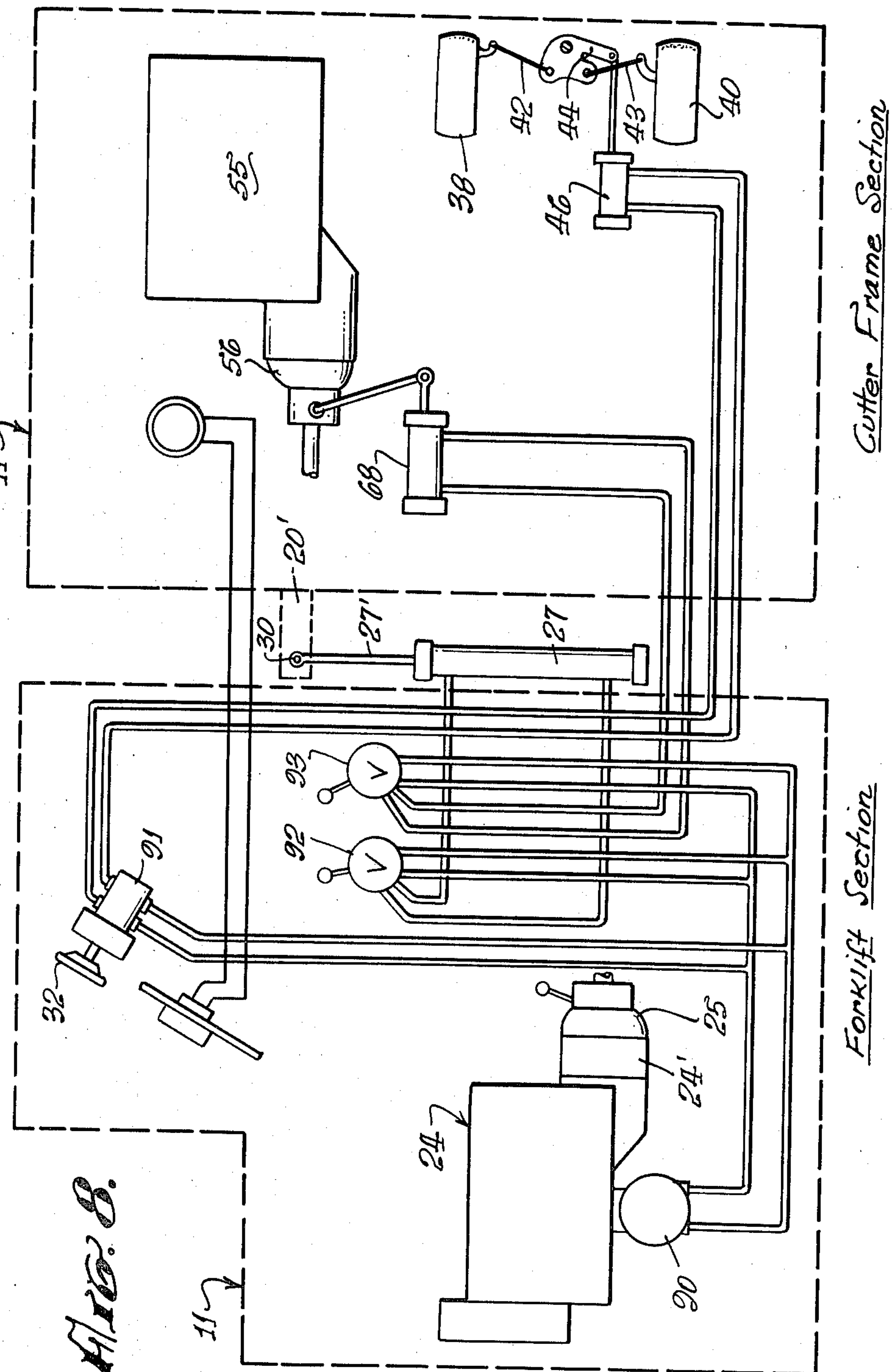



Fig. 8.

INVENTORS.
CECIL W. HATCHER,
GENE WARNER,

By W. E. Beatty
ATTORNEY

# CONCRETE PAVEMENT CUTTING MACHINE

## CROSS-REFERENCE TO RELATED APPLICATION

PAVEMENT CUTTING MACHINE, Ser. No. 119,476, filed Mar. 1, 1971, by Cecil W. Hatcher et al.

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to concrete pavement cutting machines and has particular reference to machines having axially spaced, rotatable, abrasive disks engagable with the pavement to remove bumps or the like or to cut anti-skid grooves therein.

2. Description of the Prior Art

Concrete cutting machines have been employed heretofore, cutting the surfaces of highways, airplane landing strips, or the like. Certain machines, as disclosed, for example, in U.S. Pat. No. 3,037,755, issued on June 5, 1962, have been developed for removing bumps or small rises in pavement which might affect the smooth riding of the vehicle. Others, as disclosed in U.S. Pat. No. 3,269,775, issued on Aug. 30, 1966, have been developed to cut closely spaced grooves in the pavement to reduce skidding tendencies of vehicles traveling thereon.

Although such machines have been generally satisfactory, they are relatively expensive to manufacture and are normally useful only for the specific purpose for which they were designed. Also, the drive wheels of such machines normally support one end of the framework carrying the cutter. Adjusting means is provided to adjust the height of the framework to regulate the depth of cut. Because of this, the drive wheels must be arranged to run or track in the path cut by the cutter in order to closely control the depth of cut.

## SUMMARY OF THE INVENTION

A principal object of the present invention is to provide a simple and economically manufactured machine for cutting the surface of a pavement.

Another object is to provide a machine of the above type which may be quickly and readily adapted to either remove bumps or to cut anti-skid grooves.

Another object is to provide an adjustable depth-of-cut control means which is independent of the means for raising or lowering the frame supporting the cutter.

A further object is to embody a conventional forklift truck, with certain modifications, as an operating component of a concrete cutting machine.

The present invention, preferably, although not necessarily, embodies a conventional forklift truck in which only one set of coaxial drive wheels are retained to act as the prime mover. The truck carries a mast assembly along which a carriage is movable. The carriage is attached to the rear end of a cutter frame, which is supported by vehicle wheels at its front and rear ends for movement over the pavement.

The rotary cutter is supported by the frame; and by raising the carriage under control of an operator on the truck, the cutter and its rear wheels can be readily raised to a transporting position, the front end of the frame being supported by the front vehicle wheels, so that it may be driven at high speed from place to place. The carriage may be lowered to a cutting position wherein the frame is supported by the front and rear vehicle wheels. Accurate control of the depth of cut is effected by transversely spaced arms pivoted on the frame and carrying wheeled supports engagable with the pavement. Adjustable stop means limits pivotal movement of the arms to thus accurately control the depth of cut.

When a cutter having more widely spaced abrasive disks is employed to cut anti-skid grooves, additional wheeled supports are attached to the pivoted arms and are adjustable to accurately control the depth of cut independently of the lowered position of the cutter frame. Accordingly, the truck drive wheels may be located inside or outside the path of cut without affecting the depth of cut.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a machine embodying a preferred form of the present invention.

FIG. 2 is a transverse sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a sectional plan view taken substantially along line 3—3 of FIG. 1.

FIG. 4 is a fragmentary perspective view of one of the cutting depth control arms.

FIG. 5 is a fragmentary sectional side view showing one of the control arms in depth-limiting position, as used in cutting bumps or small rises.

FIG. 6 is a view similar to FIG. 1 but showing the machine raised in transporting position.

FIG. 7 is a view similar to FIG. 5 but showing an adjustable auxiliary wheeled support attached to one of the depth control arms, as used in cutting anti-skid grooves.

FIG. 8 is a schematic diagram of the hydraulic controls.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the machine comprises, in general, a truck **11** coupled to a cutter vehicle **11'**. The truck **11** is supported by a single set of coaxial drive wheels, one of which is shown at **12**. An upright mast assembly **13** is attached to the truck frame **14** by brackets **15** and comprises inwardly facing U-channel members **16** and **17**, FIG. 3, along which a carriage **18** is movable. The carriage comprises a vertical plate **20** carrying two vertically spaced rollers **21** and **22** which move along the channel member **17**, and two similar rollers which move along the channel member **16**, upper roller **21'** appearing in FIG. 3. The plate **20** is welded or otherwise attached to the rear cross member **23'** of a cutter supporting frame **23**. When the vehicle **11'** is being pushed by truck **11**, side sway of vehicle **11'** is prevented as the slide couplings including channel members **16** and **17** are laterally spaced apart on opposite sides of the longitudinal axis of the truck **11** and vehicle **11'**.

An engine **24** is carried by the truck **11** and is connected to the drive wheels **12** through a drive train comprising a fluid coupling **24'**, a multi-speed transmission **25**, and a differential **26**.

As shown in FIGS. **1** and **6**, a hydraulic cylinder **27** is secured at **28** to the lower end of the mast assembly **13**, and its piston rod **27'** is connected at **30** to a bracket

20' fixed to the carriage plate 20, whereby extension of the piston will raise the rear end of the frame 23 which tilts about the horizontal axis of the front wheels 38, 40.

The aforementioned truck 11 preferably comprises a conventional forklift truck from which a second set of wheels and the usual fork attached to the carriage have been removed. A seat 31 is provided for the operator, and various controls, including a steering wheel 32, are mounted on an upright part of the truck frame within easy reach of the operator.

The frame 23 comprises spaced side frame members 33 and 34, FIG. 3, and integral cross members 23', 35, 36 and 37. The frame 23 is supported at its forward end by spaced, steerable wheels 38 and 40, which support an axle 41 suitably attached to the frame 23. A power-operated steering linkage is provided, comprising cross links 42 and 43 connected between the bearing supports of the wheels and a crank 44 pivoted at 45 and operable by the piston of a hydraulic cylinder 46 mounted on the cross member 36.

A rotatable concrete cutter, generally indicated at 47, is provided, comprising a plurality of closely spaced abrasive cutting disks 48 secured on a cutter shaft 50 (FIGS. 1, 2 and 3). The latter is rotatably mounted in bearings 51 and 52 suitably secured to pillow blocks 53 and 54 integral with the side frame members 34 and 33, respectively.

For the purpose of removing bumps, etc., the disks 48 are preferably closely spaced, with the spaces therebetween being on the order of 0.020 to 0.025 inches, and are rotated counterclockwise, as viewed in FIG. 1, at a relatively high peripheral speed. For this purpose, an engine 55 is mounted on the forward part of the frame 23 and drives the cutter through a drive train including a clutch 56 and a differential unit 57, output shaft 58 of which is journaled in bearings 60 and 61 supported by the frame 23. Pulleys 62 and 63 are secured to the outer ends of the shaft 58 and drive pulleys 64 and 65 secured to the cutter shaft 50 through sets of drive belts 66 and 67, respectively.

The cutter 47 is selectively driven by engaging the clutch 56; and for this purpose, the clutch is controlled by a hydraulic clutch engaging cylinder 68 under control of the truck operator, as will appear later.

Means exclusive of the lift cylinder 27 are provided to accurately limit the depth of cut and to provide an accurate adjustment which may be preset according to the depth of cut desired. For this purpose, a pair of arms 70 and 71, Figs. 1, 3, 4 and 5, are pivoted on a horizontal axis at 72 and 73, respectively, on the side frame members 33 and 34, vertically above the axis of shaft 50.

The arms 70 and 71 are guided at their upper horizontal end portions like 70' in inverted U-shaped members 74 and 75 welded to the carriage plate 20 and to cross member 23'. Adjustable limit screws 76 and 77 are threaded in the members 74 and 75 to engage end portions like 70' and limit the vertical movement of the arms. Lock nuts, like nut 78, are provided to lock the screws 76 and 77 in different adjusted positions. When the frame 23 is raised to its transporting position shown in FIG. 6, arms 70 and 71 engage the top of the plate 20 and are thus raised, with their wheeled supports, like 80, with the frame. A wheeled support, like support 80, is mounted on each of the arms 70 and 71, and each



comprises a pair of wheels 81 and 82 rotatably mounted at opposite ends of a wheel truck 83 pivotally attached at its center at 84 to a column 85 integral with and depending from the respective arm.

By adjusting limit screws 76 and 77 relative to each other, the frame 23, and hence the cutter 47, may be tilted slightly or not in a transverse direction relative to the level of the pavement.

From the above, it will be seen that, when the rear end of the frame 23 is lowered by the hydraulic cylinder 27, the cutting disks 48 will engage the surface of the pavement. At substantially this time, the wheels 81 and 82 also engage the pavement, rocking the arms 70 and 71 upward on pivots 72, 73 until arrested by the limit screws 76 and 77. The screws 76 and 77 are preferably preadjusted so that the cutting disks 48 will cut to a predetermined depth in any bump or short rise, as indicated at 86, FIGS. 1 and 5. Therefore, a fine and accurate control of the lift cylinder 27 is not required.

As seen in FIG. 6, when hydraulic pressure is applied below the piston of the cylinder 27, to extend piston rod 27', the carriage 18 will be driven up along the mast assembly, causing the cutter frame 23 to rock upwardly in the direction of the arrow A about the axis of wheels 38 and 40. Likewise, the truck 11 will be caused to similarly rock in the direction of the arrow B about its wheels 12; but in all cases the truck frame 14 will remain parallel to the frame 23, due to the upright sliding connection between them provided by the mast assembly 13.

Hydraulic power for enabling remote control of the steering cylinder 46, clutch control cylinder 68 and lift cylinder 27 is derived from a hydraulic pump 90 driven by the truck motor 24. For this purpose, FIG. 8, the steering wheel at 32 controls a valve 91 connected in a fluid circuit between the pump 90 and the opposite ends of the steering cylinder 46, as well known. A lift cylinder control valve 92, within reach of the operator, is connected in circuit between the pump 90 and opposite ends of the lift cylinder 27. Likewise, a clutch control valve 93, also within reach of the operator, is connected in circuit between the pump 90 and opposite ends of the clutch control cylinder 68.

The truck transmission 25 is controlled by a gear shift lever 94, FIG. 1, whereby the machine may be selectively driven at a slow rate of speed, as when cutting, or a fast rate when transporting from one place to another.

As noted heretofore, since the machine may be readily adjusted to cut anti-skid grooves in a pavement, for this purpose the cutter 47 is replaced by a similar cutter wherein the abrasive disks are spaced further apart, i.e., with a spacing on the order of 0.375 inches between adjacent disks. In this case, see FIG. 7, a downwardly curved bracket, like bracket 96, is secured to each of the arms 70 and 71 by bolts like 97. A wheeled support comprising a wheel 98 is rotatably mounted on an arm 100 pivoted at 101 to each bracket 96, and extends directly in front of the cutter 47. An adjustment screw 102 is threaded through the arm 100 and engages the bracket 96 to swing the arm 100 relative to its bracket whereby to provide a height adjustment for the rear of the associated arm 70 or 71 independently of the stop screws 76 and 77, which, in this case, are preferably backed off.

FIG. 7 shows the screw **102** at one extreme of its adjustment wherein the extension **70′** of arm **70** rests on the top of the carriage plate **20**.

As the cutter frame **23** is lowered, the wheels **81**, **82** and **98** engage the pavement on opposite sides of the cutter, and by adjusting the screw **102**, the depth of cut of the groove-cutting disks can be accurately adjusted without requiring close attention by the operator.

The abrasive disks are cooled by a spray of water forced through orifices of **103** spaced along a pipe **104** supported from the side frame members **33** and **34** by brackets **106** and **107**. An indicator rod **108** is suspended from the front end of the frame **23** to aid the operator in steering the machine along a line or previous cut or grooved section of the pavement.

Various modifications may be made in the invention within the scope of the following claims.

We claim:

**1**. A self-propelled pavement cutting machine comprising

a drive truck having a front end,

a vehicle having front wheels, rear wheels and an elongated pavement cutter intermediate said front and rear wheels, said cutter extending transversely of the direction of travel, said vehicle having a rear end,

an upright sliding coupling between the front end of said drive truck and the rear end of said vehicle,

fluid pressure means operative at certain times to raise and support the rear end of said vehicle with its rear wheels and cutter in elevated position and with the front end of said vehicle supported by said front wheels for transportation to another location, said fluid pressure means being operative at other times to lower the rear end of said vehicle for support by its said front and rear wheels and with said cutter in cutting relation with the pavement, and

means at each end of said cutter for controlling the depth of cut when said cutter is in operative relation with the pavement.

**2**. Machine according to claim **1**, said coupling being arranged on opposite sides of the longitudinal center of said truck and vehicle to prevent side sway while said vehicle is being driven by said truck.

**3**. Machine according to claim **1**, said coupling comprising upright U-channels facing the center line of said truck and vehicle and arranged on opposite sides of said center line, vertically spaced rollers in each of said channels, the front of said truck and the rear of said vehicle each having a frame member, said channels being carried by one of said members and said rollers being carried by the other of said members.

**4**. Machine according to claim **1**, said truck having only front wheels which are traction wheels driven by an engine on said truck, the rear end of said truck being unsupported by the pavement and tilting up or down substantially like the tilt movement of the rear end of said vehicle when said fluid pressure means is operated.

**5**. A concrete cutting machine comprising

a drive truck including a set of coaxially arranged drive wheels supporting said truck for movement over pavement,

an upright mast on said truck,

a vehicle movable over said pavement,

said vehicle comprising a frame movable about a horizontal axis,

a rotatable cutter carried by said frame, said cutter being rotatable on an axis extending transversely of said vehicle,

a carriage carried by said frame adjacent the rear of said frame,

said carriage being guided by said mast for movement along said mast,

means for moving said carriage along said mast to raise or lower said frame and said cutter about said horizontal axis and relative to said pavement, and

means for driving said drive wheels and said cutter.

**6**. Machine according to claim **5** wherein said driving means comprises a first motor on said truck for driving said drive wheels and a second motor on said frame for driving said cutter.

**7**. Machine according to Claim **5** wherein said vehicle comprises front wheels supporting said frame adjacent the front end of said frame for movement over said pavement and for tilt movement of said vehicle about said front wheels as said carriage moves up and down, and means for steering said front wheels.

**8**. Machine according to claim **5** comprising

an arm having a pivotal connection with said frame on a horizontal axis vertically above said cutter axis,

a wheeled support for said vehicle on said arm on one side of said pivotal connection,

said wheeled support having wheels engagable with said pavement intermediate said set of drive wheels and said cutter, and

adjustable means to adjustably limit the position of the outer end of said arm to adjust the vertical position of said wheeled support with respect to said cutter.

**9**. Machine according to claim **8** comprising means on said frame engagable with the outer portion of one end of said arm for raising said arm and said wheeled support upon raising said frame.

**10**. Machine according to claim **8**, said adjustable means comprising means providing a recess in which said outer end of said arm is vertically movable, and an adjusting screw to limit the vertical position of said outer end of said arm.

**11**. Machine according to claim **8** comprising

a second wheeled support for said vehicle on said arm on the other side of said pivotal connection,

said second wheeled support being engagable with said pavement on the side of said cutter opposite said first-mentioned wheeled support, and

means for adjusting the vertical position of said second wheeled support relative to said pivotal connection.

**12**. Machine according to claim **11** comprising means for removably supporting said second wheeled support on said arm.

**13**. A concrete cutting machine comprising

a drive truck including a set of coaxially arranged drive wheels supporting said truck for movement over pavement,

first motor means for driving said drive wheels,

an upright mast on said truck,

a cutter frame,

a set of front wheels supporting said cutter frame adjacent the front thereof for movement over said pavement,

a carriage carried by said cutter frame adjacent the rear thereof,

means supporting said carriage for movement along said mast,

a rotatable cutter carried by said frame intermediate said drive wheels and said front wheels, said cutter being rotatable on an axis extending transversely of the direction of travel,

second motor means for rotating said cutter,

means for moving said carriage along said mast to raise or lower said frame with said cutter relative to said pavement,

an arm having a pivotal connection with said frame on a horizontal axis vertically above said cutter



axis,

a wheeled support for said frame on said arm between said pivotal connection and an outer end of said arm,

said wheeled support having wheels engagable with said pavement intermediate said cutter and said drive wheels, and

adjustable stop means between said outer end of said arm and said frame to limit the upward movement of said outer end of said arm to thereby limit the downward movement of said frame and said cutter as said arm partakes of pivotal movement about said wheeled support, said wheeled support having wheels pivotally connected to and arranged at the front and rear of a column fixed to said arm.

* * * * *