United States Patent [19]

Eckey

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[54] **ROAD WORKING MACHINES**

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[52] **U.S. Cl.** **299/39**, 51/176, 172/122

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

[58] **Field of Search** 299/39–41; 51/176; 172/122

[56] **References Cited**

UNITED STATES PATENTS

2,197,549	4/1940	Hargrave et al.	299/39 X
1,883,404	10/1932	Ronning	299/39 X
3,606,468	9/1971	Walker et al.	299/39

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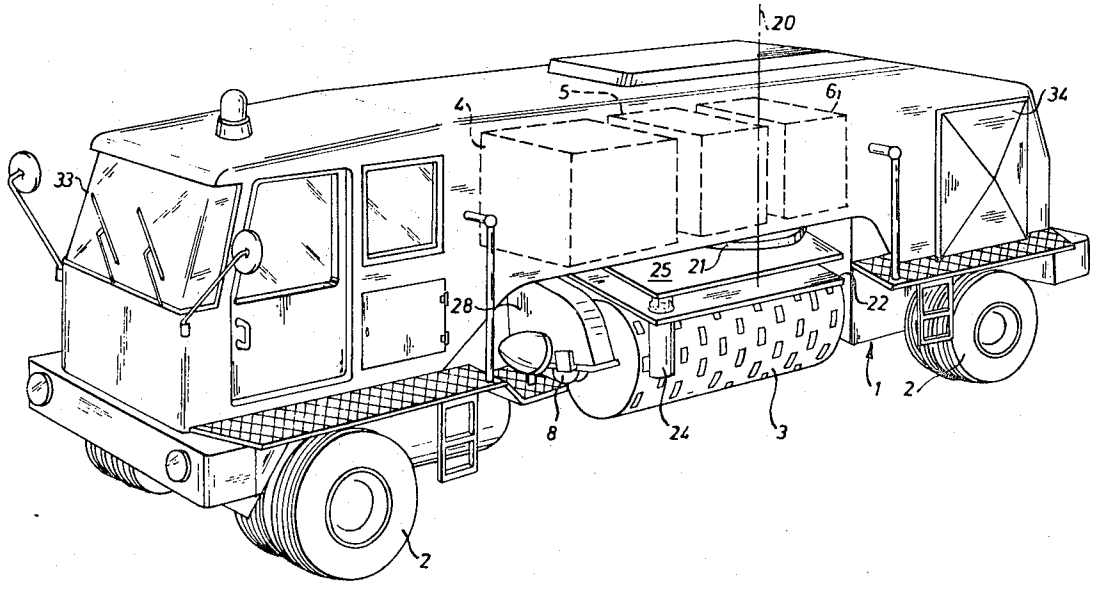
[57] **ABSTRACT**

A machine for removing a worn road surface comprises a chassis on which is supported a rotary cutting drum armed with cutting picks. The cutting drum is capable of being rotated about a vertical axis between a transport position within the track width of the machine and an operating position projecting from said track width.

12 Claims, 4 Drawing Figures



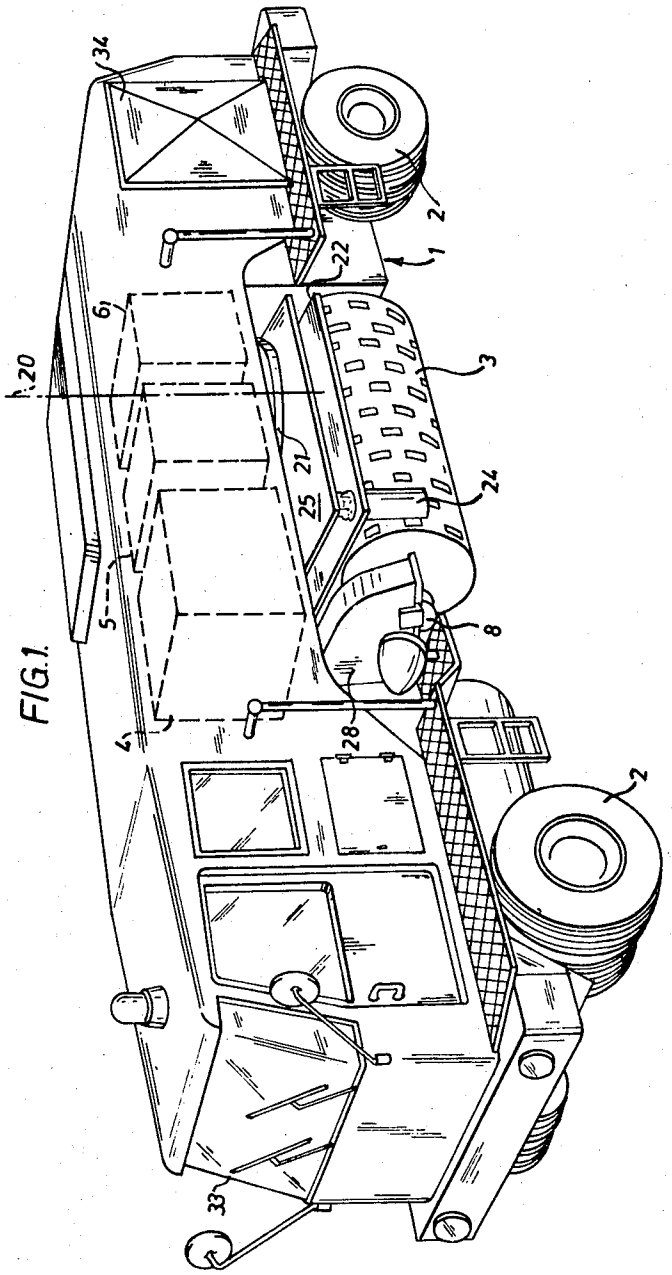


FIG. 1

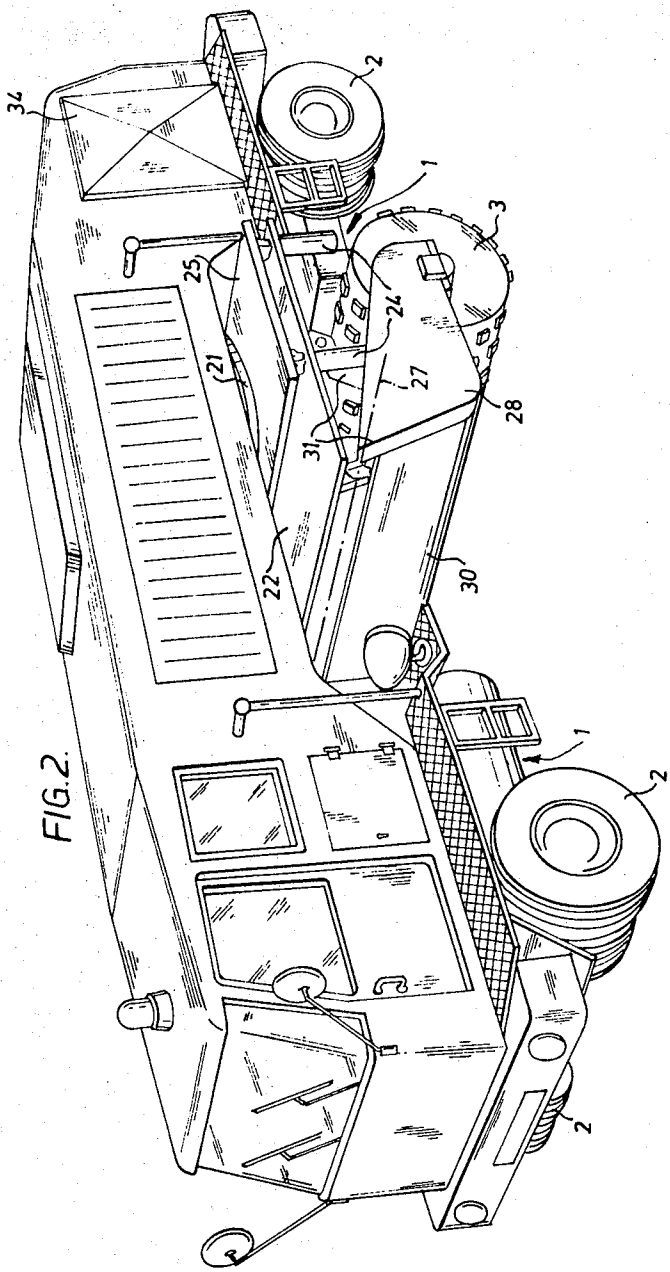


FIG. 2.

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FIG. 3.

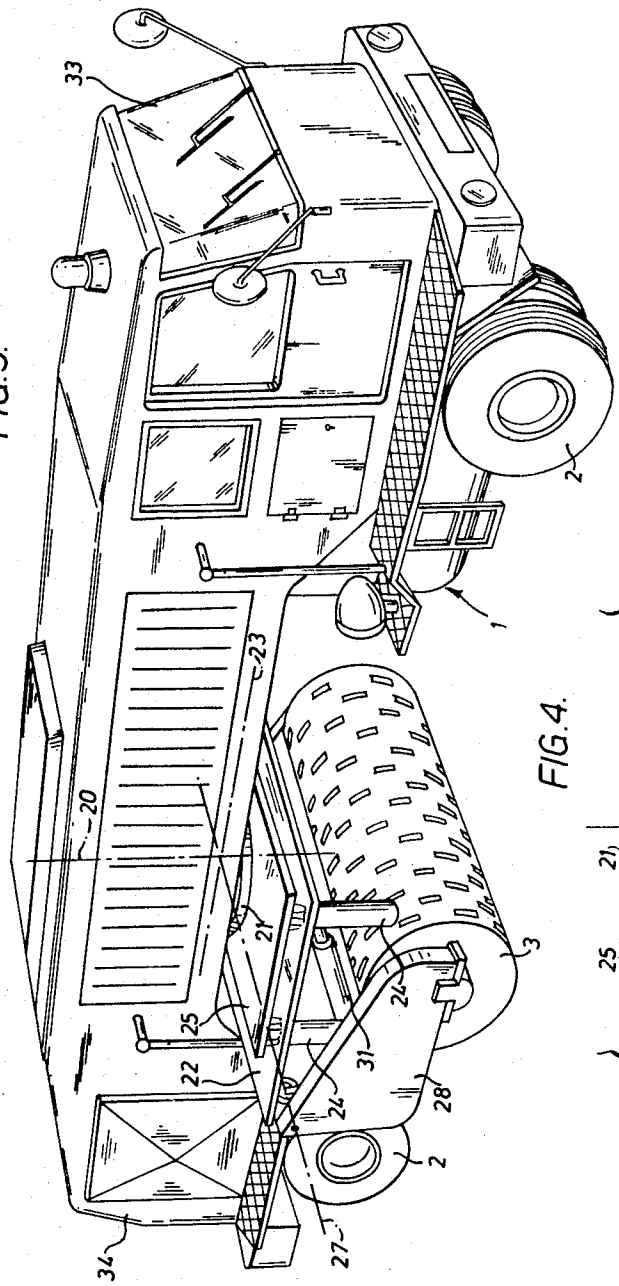
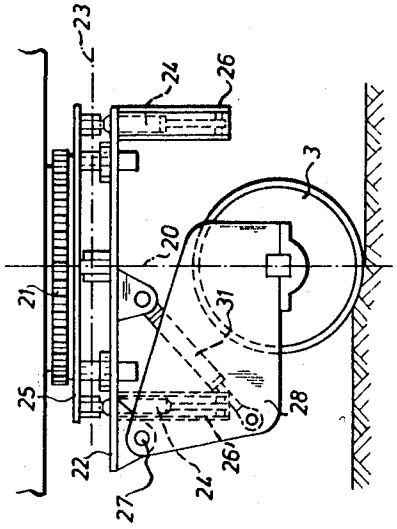


FIG. 4.



ROAD WORKING MACHINES

BACKGROUND OF THE INVENTION

Machines which make use of a rotary cutting drum to remove worn asphalt or macadam road surfaces prior to the application of a new surface are known from patent literature dating back to the early part of this century. While such machines have generally incorporated mechanism for adjusting the height and inclination of the drum from the horizontal no previous inventor has apparently proposed that the position of the drum should be adjustable with the object of varying its width as viewed from one end of the machine. Thus, U.S. Pat. No. 2,027,685 issued to B. H. Flynn on Oct. 25, 1934 shows a drum which is constrained to move between rigid vertical guides, and U.S. Pat. Nos. 2,062,232 issued to C. N. Pogue on Nov. 24, 1936 and 3,560,050 issued to P. Lockwood on Feb. 2, 1971 each propose a drum supported by frame members which pivot about fixed horizontal axes.

The disadvantages of these prior art machines are three-fold. Firstly, the operator is limited to cutting out a path having a width equal to the axial length of the drum. It is true that Lockwood proposes the selective mounting on the machine of drums of different widths but this is a laborious procedure if the task in hand demands an adjustment of the path width during the cutting operation. Secondly, if, as proposed by Flynn, the drum is very long, the machine may prove an inconvenience to road users when the machine is en route to the site. Thirdly, if, as in all the prior art patents referred to above, the drum is located wholly or substantially within the track width of the machine, it is impossible to cut out an arcuate path having an inside diameter less than the turning circle of the radially inner wheels of the turning machine.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a machine which overcomes these disadvantages of the prior art machines discussed above.

The invention therefore provides a machine in which the cutting drum is mounted so as to be rotatable about a vertical axis. The drum may therefore have a transporting position in which its axis is in line with the longitudinal axis of the machine and an operating position in which the drum axis is at an angle to the machine axis. In the operating position the drum may project from one or both sides of the machine. Thus, during movement to and from the site, the machine need not inconvenience other road users while, when operational, the path cut out may be as wide or wider than that achieved by prior art machines, there also being provision for fine adjustment of the width of such path.

A convenient arrangement of the cutting drum is obtained if the vertical pivot axis is disposed nearer the forward or rearward road wheels of the chassis and is asymmetrically arranged relative to the length of the drum. With this arrangement, the drum can be arranged to project from one side or the other of the machine when the latter is working. In consequence, compensation may be made for the relatively large turning circle of this type of machine since a reduction in the inner radius of the path cut out may thereby be achieved. By providing for the drum to be rotated through 180° about the vertical axis, the machine may use a climb-milling or plunge-cut milling action, depending upon what is required, without changing the actual direction of rotation of the drum, irrespective of whether the machine is driven forwards or rearwards. By providing for asymmetric support of the drum, the working positions of the drum for rearward and forward travel may overlap by just a small amount so that it is possible to cut out two paths by merely making a forward and rearward traverse of the machine without intervening lateral displacement. This possibility substantially increases the usefullness of the machine, particularly when working on narrow roads.

The motors which drive the road wheels and the cutting drum are preferably hydraulic motors so that the speeds of the machine and drum may be infinitely variable. The front wheels may be steered by power-aided means, with provision for manual steering in an emergency, while the rear wheels may have a castor action and be steered by hydraulic cylinders in response to steering of the front wheels, thereby increasing the manouvreability of the machine.

The position of the cutting drum with respect to height and transverse inclination may be adjusted by hydraulic rams controlled manually or by sensing means continually responsive to the camber and undulations in the road surface ahead of the machine. Continual height and inclination control is thereby provided ensuring a uniform depth of cut. Further objects, advantages and features of the invention will become apparent as the description of a preferred embodiment thereof proceeds.

DESCRIPTION OF THE DRAWINGS

FIG. 1 shows in a perspective view a machine according to the invention with the cutting drum in the transport position,

FIG. 2 shows the machine with the cutting drum positioned for forward travel,

FIG. 3 shows the machine with the cutting drum positioned for rearward travel, and

FIG. 4 is a side view of the cutting drum suspension system of the machine.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings, the machine comprises a chassis 1 having a portal-like construction supported on the ground by road wheels 2, a cutting device constituted by a cutting drum or cylinder 3 which is provided with picks or chisels on its external surface and is located towards the rear end, an internal-combustion engine 4 coupled to a pressure fluid pump 5 which receives fluid from a pressure fluid tank 6 and supplies it to hydrostatic motors for the road wheels and the cutting drum 3, which motors are supplied with pressure fluid in a specific ratio by means of a distribution device connected downstream of the pressure fluid pump. The drive motors for the drum, two in number are mounted within the drum and diagrammatically indicated at 3' in FIG. 4.

As can be seen from FIG. 2, the length of the cutting drum is greater than the track width of the machine. To make it possible for the machine to travel when out of use on ordinary roads, the cutting drum 3 can be rotated about a vertical axis 20 into a "transport" position parallel to the longitudinal axis of the machine or into any desired "operating" position in which it projects from one (FIG. 2) or the other (FIG. 3) longitudinal side of the machine. The cutting drum suspension

system comprises a supporting arm 22 mounted on the chassis 1 by bearing means in the form of a turntable 21. The supporting arm 22 is connected to the turntable 21 so as to pivot about a horizontal axis 23 which intersects the axis of rotation 20. The supporting arm 22 is of platelike construction and its width is approximately half the track width of the machine. The setting of the supporting arm 22 about the axis 23 is effected by hydraulic rams 24 cylinders of which are anchored to a plate-like supporting arm 25 rigidly attached to the turntable 21 and partly overlying the supporting arm 22. The piston rods of the hydraulic rams 34 are attached to the supporting arm 22 by tubular brackets 26 extending downwards from the supporting arm 22. Two supporting arms 28 mounting bearings 8 for the shaft of the cutting drum 3 are pivoted to one longitudinal edge of the supporting arm 22 about a horizontal axis 27 at right angles to axis 23 and at a distance from the turntable axis 20 approximately equal to the lengths of the supporting arms 28. The setting of the supporting arms 28 which are interconnected by a cross beam 30 is effected by a hydraulic ram 31 the cylinder of which is anchored to supporting arm 32 and the piston rod of which is connected to cross beam 30. The turntable 21 is rotatable by a known drive which is not shown in the drawing.

Hydrostatically driven manoeuvrable heavy duty axles are used for the machine whereby the front axles are equipped with a hydraulic servo-assisted steering mechanism and an emergency manual steering gear whereas the back axles have a castor action and are steerable in a corresponding relationship to the front axle by hydraulic cylinders. The chassis of the machine is covered by standard bodywork and comprises a control cabin 33, and, in addition to the internal combustion driving engine 4, pump 5 and tank 6, also includes a ballast chamber 34. The distribution device in the hydraulic circuit provides for the power output of the internal combustion engine to be transmitted for the most part (preferably up to 90percent) to the motors which are arranged inside the cutting drum 3, and the remainder to the cams and pivot drive of the cutting drum suspension and the driving motors of the driven axles as well as to the other hydraulically operated devices of the machine, particularly the hydraulic power steering.

In use, the machine is driven to the site with the drum positioned as shown in FIG. 1, the ram 31 being retracted so that the drum is spaced from the road surface. The pivot drive is then actuated to swing the drum into the position of FIG. 2. The hydraulic motors of the drum are started so as to rotate the drum in the counter-clockwise direction as viewed in the Figure. The machine is driven forwardly and the drum lowered to its working depth which may be such as to remove up to eight inches of the road surface by a climb-milling action. A path is thereby cut, the width of which may be adjusted by varying the alignment of the drum. At the end of a traverse, the drum is rotated through 180° into the FIG. 3 position so that a return traverse may be carried out. Because of the asymmetrical mounting of the drum, the return traverse cuts out a second path which overlaps by no more than a small amount the path cut during the forward traverse.

Modifications may be made within the spirit and scope of the invention. Thus, the road wheels may be replaced by endless tracks. The cutting drum may be supported so as to be displaceable transversely of the machine when the drum is positioned as shown in FIGS. 2 and 3.

I claim:

1. A machine for removing road surfaces comprising a chassis having a longitudinal axis, forward and rearward rotary support means for said chassis, a rotary cutting device supported by said chassis for rotation about a substantially horizontal axis, said device being provided on its circumference with cutting picks whereby during rotation said device removes the road surface by a milling action, means for varying the height of said cutting device relative to the chassis, said cutting device being freely adjustable about a vertical axis between a transport position in which said axis of rotation extends generally parallel to the longitudinal axis of the chassis and an operating position in which said axis of rotation extends transversely of the chassis.

2. A machine as in claim 1, wherein said cutting device has a width greater than that of the track of the machine.

3. A machine for removing road surfaces comprising a chassis, forward and rearward rotary support means for said chassis, a first support arm, means mounting said first arm to the chassis for rotation in a horizontal plane about a vertical axis, a second support arm disposed below said first arm and rotatable therewith, first pressure operable actuator means interconnecting said first and second arms and actuable to vary the angle between said arms, a support frame pivoted to said second arm, second pressure operable actuator means interconnecting said second arm and support frame and actuable to vary the angle between said support frame and second arm, and a rotary cutting device carried by said support frame for rotation about a substantially horizontal axis, said cutting device being provided on its circumference with cutting picks whereby during rotation said device removes the road surface by a milling action.

4. A machine as in claim 3, wherein the cutting device is disposed between the forward and rearward rotary support means within a space defined below a portal-like structure, said vertical axis being disposed nearer one set of rotary support means than the other, said vertical axis being asymmetrically disposed relative to the length of the cutting device.

5. A machine for removing road surfaces comprising a chassis, forward and rearward rotary support means for said chassis, a first plate-like support member rotatable relative to the chassis about a vertical axis, a second plate-like support member disposed below said first member and pivotable relative thereto about a first substantially horizontal axis, a support frame pivotable relative to said second member about a second substantially horizontal axis perpendicular to the first, means for effecting such pivotal movement, and a rotary cutting device carried by said support frame, for rotation about a substantially horizontal axis, said cutting device being provided on its circumference with cutting picks whereby during rotation said devide removes the road surface by a milling action.

6. A machine as in claim 5, wherein said first horizontal axis intersects the vertical axis.

7. A machine as in claim 5, wherein said second horizontal axis is spaced from said vertical axis.

8. A machine as in claim 5, wherein said cutting device is rotatable about said vertical axis through substantially 180 degrees.

9. A machine for removing road surfaces comprising a chassis, forward and rearward rotary support means for said chassis, a rotary cutting device supported by said chassis for rotation about a substantially horizontal axis, said device being provided on its circumference with cutting picks whereby during rotation said device removes the road surface by a milling action, means for varying the height of said cutting device relative to the chassis, said cutting device being adjustable about a vertical axis between a position in which said axis of rotation extends longitudinally of the chassis and a position in which said axis of rotation extends transversely of the chassis, wherein said vertical axis is adjacent said rearward rotary support means, said vertical axis is located asymmetrically of the length of said drum whereby said drum can be swung to a position in which it projects from one or other side of the chassis, there being a slight amount of overlap between the two positions of the drum.

10. A machine for removing road surfaces comprising a chassis, forward and rearward rotary support means for said chassis, a rotary cutting device supported by said chassis for rotation about a substantially horizontal axis, means rotating said cutting device, said device being provided on its circumference with cutting picks whereby during rotation said device removes the road surface by a milling action, means for varying the height of said cutting device relative to the chassis, said cutting device being rotatable about a vertical axis through about 180° between two operating positions in which said axis of rotation extends transversely of the chassis.

11. A machine as in claim 10, wherein said cutting device is arranged asymmetrically of the said vertical axis to enable it to project from a different side of the chassis in each operating position.

12. A machine for removing road surfaces comprising a chassis, forward and rearward rotary support means for said chassis, drive means for driving said chassis in a predetermined direction of advance, a rotary cutting device supported by said chassis for rotation about a substantially horizontal axis, drive means for rotating the cutting device in a predetermined direction of rotation, said device being provided on its circumference with cutting picks whereby during rotation said device removes the road surface by a milling action, means for varying the height of said cutting device relative to the chassis, said cutting device being rotatable about a vertical axis between two operating positions, in one of which the cutting device is positioned so as to perform a climb-milling operation and in the other of which the cutting device is positioned to perform a plunge-cut milling operation, when said chassis is driven in said predetermined direction of advance and said cutting device is rotated in said predetermined direction of rotation.

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