

[72] Inventor **Rink, Richard H.**
Huron, S. Dak.
 [21] Appl. No. **752,667**
 [22] Filed **Aug. 14, 1968**
 [45] Patented **July 27, 1971**
 [73] Assignee **Huron Manufacturing Corporation**
Huron, S. Dak.

[56] **References Cited**
UNITED STATES PATENTS
 3,249,026 5/1966 Curlett 94/46
 3,220,323 11/1965 Lewis 94/46
 3,354,801 11/1967 Hanson 94/46

Primary Examiner—Jacob L. Nackenoff
Attorney—John C. Barnes

[54] **SUSPENSION AND LEVELING MECHANISM**
2 Claims, 7 Drawing Figs.
 [52] U.S. Cl. 94/46
 [51] Int. Cl. E01c 19/48
 [50] Field of Search 94/46

ABSTRACT: A grading machine suspension and control system comprising a four-point transport support adjustably attached to said frame at three points and grade-position locators for manual or automatic operation of power means to adjust said frame on the transport support.

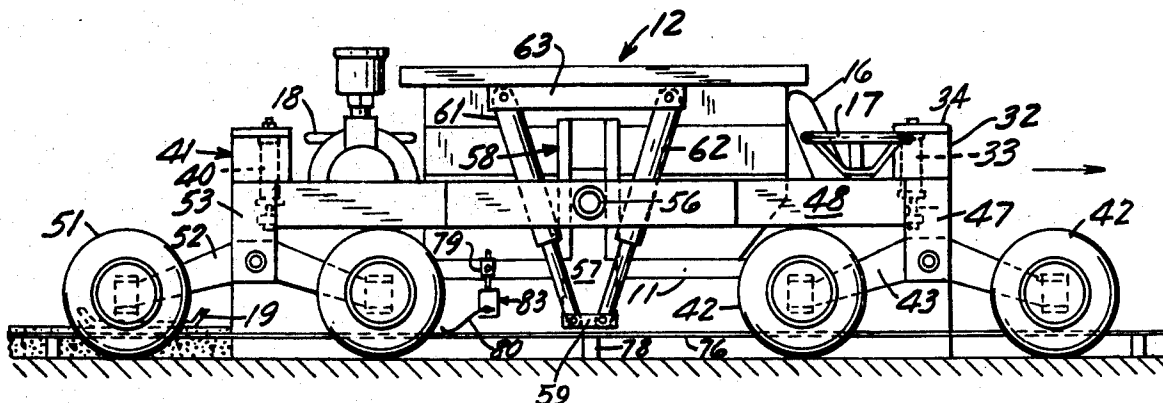
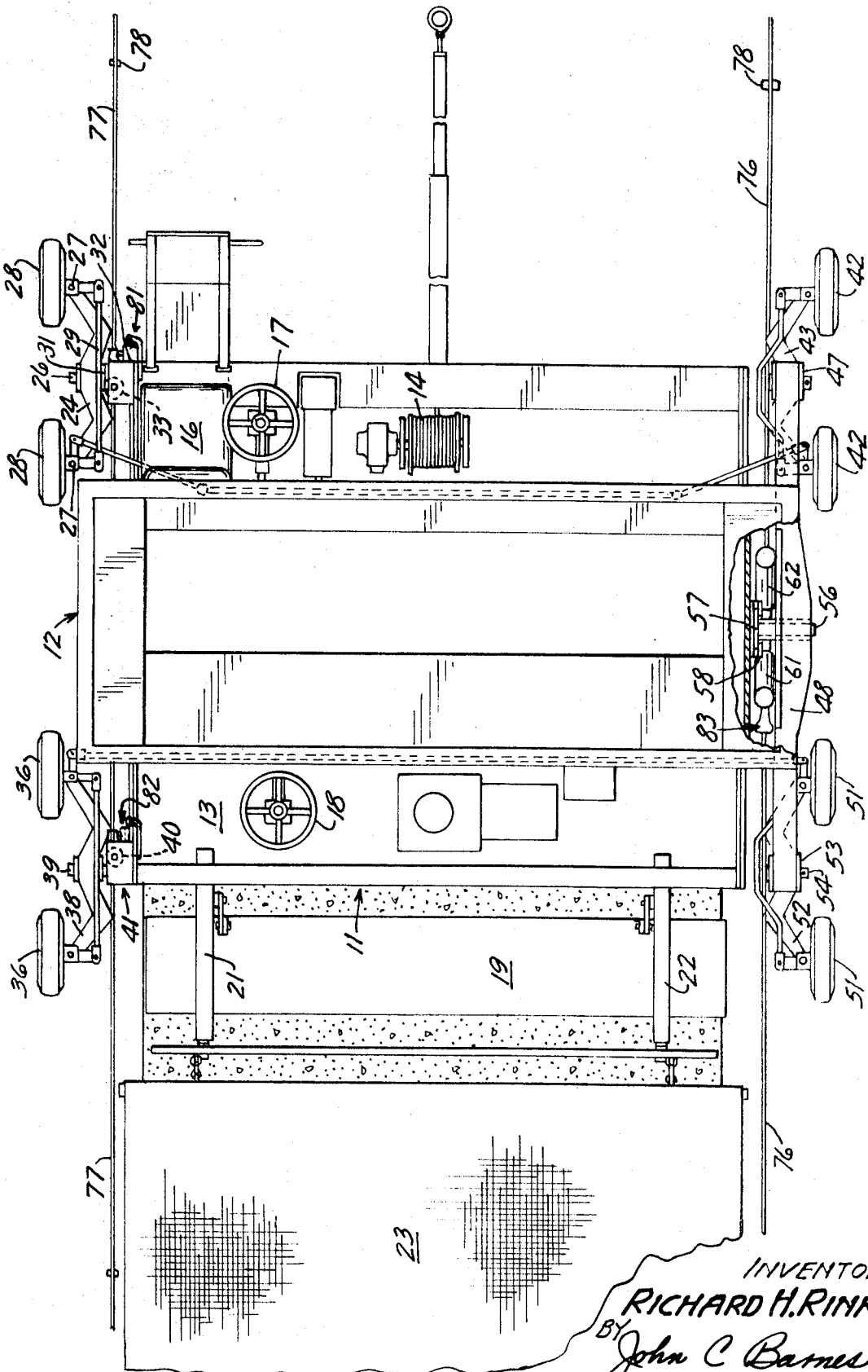


FIG. 1



INVENTOR
RICHARD H. RINK
 BY *John C. Barnes*
 ATTORNEY

SUSPENSION AND LEVELING MECHANISM

This invention relates to grading and/or spreading machines as used in construction work and particularly in the grading or paving of roadways, drives, large floors, etc. In one aspect this invention relates to a suspension device for such construction machines and a system for the precise grading or spreading of material to a predetermined grade line while passing over the area with such machines.

The present invention provides an improved suspension system for machines of the class described which affords rapid adjustment of the machine relative to its transport members. The present invention permits rapid adjustment of the machine longitudinally and transversely level or pitch the frame to the plane desired.

The present invention also provides a system for grading to a predetermined plan by the use of a machine as defined herein utilizing preset grade markers adapted to be contacted by indicators carried on the machine and control members to set and adjust the machine position during movement along said grade markers.

The suspension system of the present invention places a pair of transport members on each side of the frame, at least one near each corner, a pivoted beam extending along one side of the frame and connected to the transport members, pivot means connecting the midpoint of the beam to the frame, and adjustable support members on said frame for said pivot means and for said transport members on the side of said frame opposite said one side. The adjustable support members may be operated manually but are preferably operated automatically during operation by position indicators on the frame traveling along grade markers extending along each side of the apparatus.

The present invention will be more fully described herein with reference to the accompanying drawing wherein:

FIG. 1 is a plan view of a slip-form paving machine having a suspension system constructed in accordance with the present invention and positioned for operation between parallel grade markers;

FIG. 2 is a side elevational view of the machine showing part of the suspension system;

FIG. 3 is a side elevational view partly in section of a position indicator;

FIG. 4 is a plan view of the indicator of FIG. 3;

FIG. 5 is a schematic circuit diagram of the automatic control system;

FIG. 6 is a side elevational view of a modified indicator device; and

FIG. 7 is a plan view of the indicator of FIG. 6.

The machine illustrated in the drawing is a slip-form paver for receiving a supply of mixed concrete, dispensing the mix and forming a ribbon of concrete. The machine, except for the transport and suspension system, is described and claimed in my copending application Ser. No. 679,763, filed Nov. 1, 1967, now U.S. Pat. No. 3,477,354. The machine comprises a main frame 11, generally rectangular in plan view, upon which is mounted a transversely extending hopper 12 for receiving premixed concrete, a forming tunnel 13 of uniform cross section which communicates at the front with the open bottom of the hopper and extends to the rear of the frame; propelling means 14 in the form of a driven wench drum, a driver's set 16 located on the forward left corner, and steering wheels 17 and 18 connected to suitable linkage for steering the transport members positioned along each side adjacent each corner. A screen 19 is drawn behind the frame and depends from two longitudinally extending beams 21 and 22 which also serve to draw a drag 23.

The lead-supporting and transport members in the illustrated embodiment comprise a set of tandem pneumatic tires carried on pivoted spindles at opposite ends of a yoke adjacent each corner of the frame 11. The pair of transport members along the left side of the frame (the top of FIG. 1) are independently adjusted with relation to the frame 11. The forward

transport member of this pair comprises a yoke 24 pivotally mounted at its center on a stub shaft 26 and carrying pivoted spindle assemblies 27 at each end upon which are mounted wheels and tires 28. A connecting rod 29 joins the assemblies 27 and the rearmost assembly is connected to a steering rod controlled from the wheel 17. The stub shaft 26 is connected to a plate 31 movable upward and downward in a channel frame 32 under the operation of a hydraulic ram 33 connected to the plate 31 and to a horizontal plate 34 fixed at the top of the channel frame 32. The frame 32 is fixed to the side of the main frame 11. The rear transport member on the left side also comprises tandem wheels 36, on a yoke 38 which is pivoted on a shaft 39. The shaft 39 is vertically adjustable relative to a frame 41 secured to the side of the main frame 11 by a hydraulic ram 40 similar to the front transport. The rear transport wheels 36 are steered from wheel 18 mounted at the back of the machine.

The pair of transport members at the opposite side of the frame 11 are also formed of a set of tandem wheels disposed adjacent the corners of frame 11. The wheels 42 of the front transport member are mounted by pivoted spindle assemblies to a yoke 43. The spindles are joined and receive steering control from the wheel 17. The yoke 43 is pivotally mounted by a pin 46 to a depending bracket 47 at one end of a beam 48 extending along and parallel to the side of the main frame 11. The rear transport wheels 51 are mounted by spindles from a yoke 52 and are driven from the steering wheel 18. The yoke 52 is pivotally mounted on a bracket 53, depending from the beam 48, by a pin 54. The brackets 47 and 53 comprise spaced plates depending from each side of the beam 48, with the plates on each side of the yokes.

The beam 48 affords means for connecting the transport members on one side of the machine for operation by a single control member. The beam 48 is pivotally mounted intermediate its front and rear ends, preferably at the center, on a stub shaft 56 extending horizontally from a vertically positioned and slidably mounted plate 57. Plate 57 is supported along opposite vertical edges in opposed channel members of a frame generally designated 58 rigidly supported on one side of the main frame 11. Secured at the lower end of plate 57 is an outwardly projecting bracket 59 adapted to connect with power means affording sliding movement of the plate relative to the frame 58 and of course main frame 11. As shown the plate 57 is moved vertically relative to the frame 11 by power means such as hydraulic motors or rams 61 and 62 connected between the bracket 59 and a bracket 63 secured to the main frame on the right end of hopper 12. Operation of the rams 61 and 62 afford upward or downward movement of the plate 57 to adjust main frame 11 relative to the beam 48 and the grade.

Control of the rams 33, 40, 61, and 62 is afforded by operation of suitable valves connected in a hydraulic fluid system and controlled electrically. A separate electrically controlled valve is connected to ram 33, to ram 40, and to the two rams 61 and 62. Control of the valves may be manual or automatic.

Automatic control during operation to spread, form and smooth a strip of concrete on a predetermined grade, or manual control is easily and readily accomplished with this three-point suspension between the frame 11 and transport members. The system of automatic control comprises setting in grade marking members which extend along the surface to be paved, graded etc. and operating off the grade marking members to control automatically the operation of the control valves. As illustrated, for example, to place a single or the first strip of pavement along a surface, two parallel elongate markers are placed along the surface and spaced a width greater than that of the frame 11 but less than the width of the transport members. As shown these markers comprise two nonelastic wires 76 and 77 or other suitable strands positioned along the surface and held at a predetermined level by stakes 78 positioned beneath the wires at intervals of approximately 20-25 feet placed in the surface to the desired height by normal engineering techniques.

Indicator means are supported from the main frame to travel along the grade markers 76 and 77 and are located adjacent each adjustable suspension member. Thus three similar indicators 81, 82, and 83 travel along the markers and each comprises a bracket 79 supported on the main frame to adjustably support a rod to which is affixed a switch assembly operated by a feeler 80 riding on the marker 76 or 77 and secured to an operating rod extending from the switch assembly. The automatic switch assembly is illustrated in FIGS. 3 and 4 and comprise an operating rod 84 rotatably mounted in the lower portion of a boxlike frame 86 and having one end extending outwardly from the box and connected to the feeler. Within the box a wand 87 of electrically conductive material is attached to the rod 84 and extends upward to a position between spaced contacts 88 and 89.

The wand 87 is suitably connected to ground and the contacts 88 and 89 are connected by leads to a control box mounted on the machine and in which there are three identical circuits, one for each indicator 81, 82, and 83, including electrically energized power means to control the hydraulic motors. One of the circuits is disclosed in FIG. 5 of the drawing. A source of power such as a storage battery 91 is connected to a main fused switch 92 for energizing the circuits in the control box. One side of the switch 92 is therefore connected to the battery and the other side of the switch is connected to a pair of bus bars 93 and 94 and to a pair of relay switches 96 and 97. The bus bar 93 will be indicated as the bar affording upward movement of the frame relative to the wheels by actuating the suitable solenoid controlled plunger valve 98 in the fluid system to direct hydraulic fluid to the upper portion of the ram associated with a transport member, and the other bus bar 94 will be designated as the down bus bar and is associated with the solenoid-operated valve 98 to place fluid in the lower portion of the respective ram causing the transport member to move toward the frame. The bus bar 93 is thus connected to a solenoid 101 at one end of the sliding plunger valve 105 by a lead 102 and the solenoid 101 is also connected to ground through a manually operatable switch 103 or the contacts of the relay switch 96. The down bus bar 94 is connected by a lead 104 to the other solenoid 106 of the sliding valve, which solenoid 106 is also connected to ground through a manually operated switch 107 or the relay 97. The manually operated switches 103 and 107 would preferably be positioned adjacent to the respective feeler such that manual operation of the cylinders adjacent the transport adjustment member may be made by the operator adjacent these points. This is particularly true in the manual control for positioning the frame which will be hereinafter discussed. The feeler 80 of each indicator 81, 82 and 83 which operates and the wand 87 is a fan-shaped member with a small end 111 to the extended end of the operating rod 84. The broad end 112 of the feeler 80 is positioned to ride on the top of a guide member. In operation, a variation in the position of the frame 11 in relationship to the guide member 76 or 77 from a predetermined position causes the feeler 80 to rotate the operating rod 84 to move the wand 87 into contact with one or the other of the contacts. This will cause a raising or lowering of the suspension member attached to the frame to return to said predetermined position.

An indicator adjacent each point of attachment of one of the three suspension members affords rapid adjustment of the frame 11 in its transport members. The three points of adjustment during movement of the main frame permit longitudinal and transverse adjustment relative to the prescribed grade eliminating diagonal tipping or drag which can cause dips or highs to develop in the treated surface or formed strip.

For manual control, an indicator is again positioned adjacent each adjustable suspension member. The indicator 119, illustrated in FIGS. 6 and 7, comprises a rod 121 adjustably supported in a bracket 122 which rod has a transversely extending lower leg 113. A feeler 114 is pivotally mounted intermediate its ends on the leg 113 and has a fan-shaped trailing end which rides on the grade marker 76 or 77, and a generally

horizontally positioned leading end upon which a leveling bubble tube 116 is mounted. The bubble in the tube 116 provides a visual indication of movement of the main frame 11 relative to the grade markers. Upon movement of the bubble off the center mark an operator may operate an appropriate one of the two switches 103 and 107 to operate a valve in the hydraulic system and adjust through a ram the adjacent suspension member in the appropriate direction to return the main frame 11 to the desired position. With this feeler 114, as with the previous indicator, small movements departing from the grade are indicated to permit rapid adjustment.

The tandem wheel transports permit travel over small variations in the terrain without having any equivalent variation in the frame position. This effect is further multiplied by the suspension member including beam 48 attached to at the mid-point of the right side of the frame.

Either the visual or automatic sensor together with the three-point suspension for the frame affords rapid and true adjustment of the frame to grade.

Having thus described the present invention with reference to the accompanying drawing, what I claim is:

1. A suspension and leveling mechanism for a spreading and/or grading apparatus having a generally rectangular frame with a working member extending from side to side of said frame, comprising

first transport suspension means connected to one side of said frame and including

pivot means mounted on said frame substantially midway on said one side and vertically adjustable relative to said frame,

a longitudinally extending beam connected intermediate its ends to said pivot means, and

rotatable support means mounted on each end of said beam at positions transversely spaced and opposite vertically adjustable additional transport suspension means on the other side, said rotatable support means comprising

a yoke pivotally connected intermediate its ends to a bracket depending from said beam, said yoke carrying a spindle at each end of said yoke, and wheels mounted on each spindle to travel along the surface to be worked,

said additional transport suspension means connected to said frame near each corner of said frame on the side opposite said one side, and

control means affording adjustment of said frame relative to said pivot means and said additional suspension means independently of each other and simultaneously to permit rapid transverse and/or longitudinal position adjustment of said frame relative to a grade.

2. A control system for spreading a material to a predetermined grade comprising

a spreading mechanism for receiving, dispensing, and grading, said mechanism comprising

rectangular frame means having opposed sides and ends for supporting grading means,

load-supporting and transport means adjacent each corner of said frame means,

vertically adjustable pivot means disposed on one side of said frame means intermediate the ends thereof,

a beam mounted on said pivot means and supported at each end by said transport means adjacent two corners, independently adjustable suspension means for connecting said transport means at the other two corners of said frame means,

parallel elongate grade marking members positioned along two sides of said frame means and generally parallel to said beam,

indicator means supported from said frame means adjacent each of said independent adjustable suspension means and supported adjacent said pivot means, said indicator means including feeler means adapted to ride on said marking members and movable relative to said frame

5

means to indicate vertical movement of said frame means relative to said marking members, and control means for adjusting the position of said pivot means and said inde-

6

pendently adjustable suspension means to move said frame means back to the desired relationship between said frame means and said marking members.

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75