United States Patent [19]

Rymsa

[11] **3,791,753**

[45] **Feb. 12, 1974**

[54] **ROAD CONSTRUCTION APPARATUS**

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[73] Assignee: **Wibau-Westdeutsche Industrie-und Strassenbau-Maschinen-Gesellschaft m.b.H.,** Wilbaustr, Germany

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[21] Appl. No.: **238,432**

[30] **Foreign Application Priority Data**

Mar. 27, 1971 Germany 2115040

[52] **U.S. Cl.** **404/84**

[51] **Int. Cl.** **E01c 19/00**

[58] **Field of Search** 404/84, 118, 105

[56] **References Cited**

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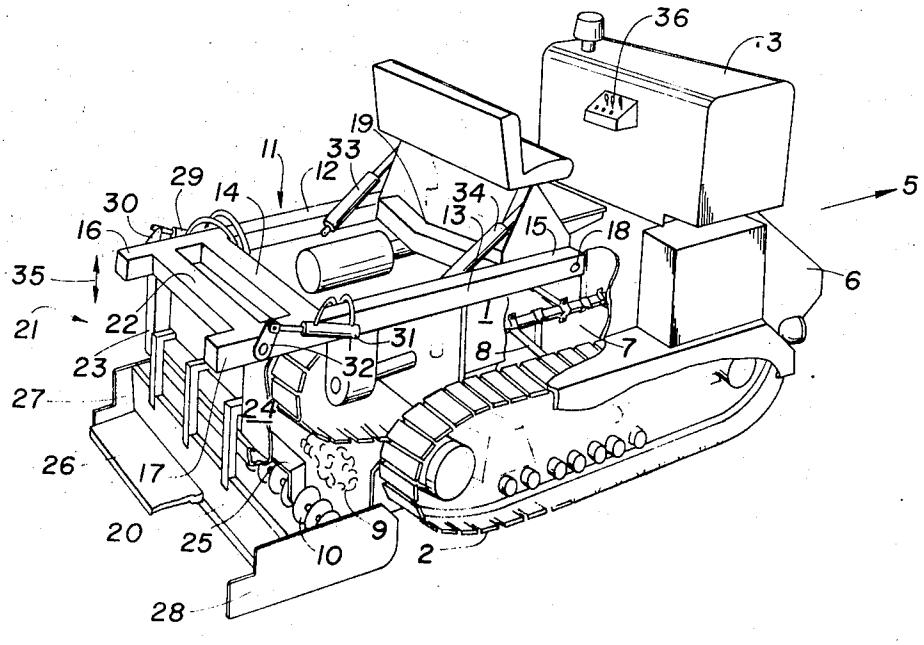
Primary Examiner—Nile C. Byers, Jr.

Attorney, Agent, or Firm—W. G. Fasse

[57] **ABSTRACT**

The present road construction apparatus has a frame supported plank extending across the road to be constructed for installing a road forming composition in a road bed. The frame and installing plank or bar are supported on a carriage and relative to each other in such a manner that the plank may be raised and lowered as a unit or each plank end may be raised and lowered independently of the other plank end. In addition the plank is shiftable back and forth horizontally across the length of the road. The operation of the plank is accomplished by sensor responsive power means which may also be operator controlled.

11 Claims, 11 Drawing Figures



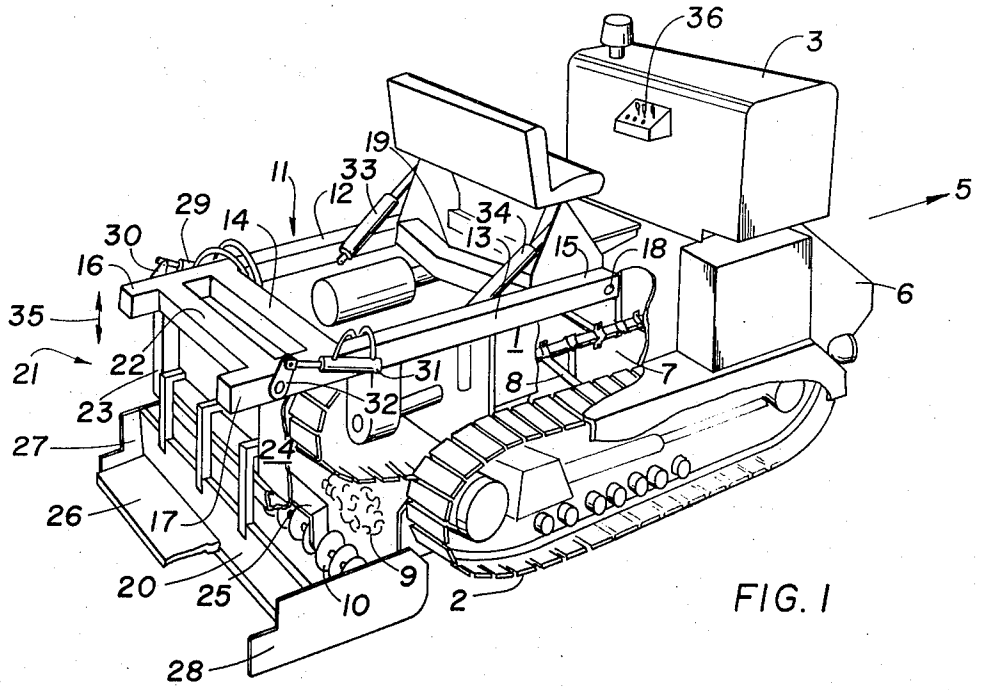

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FIG. 1

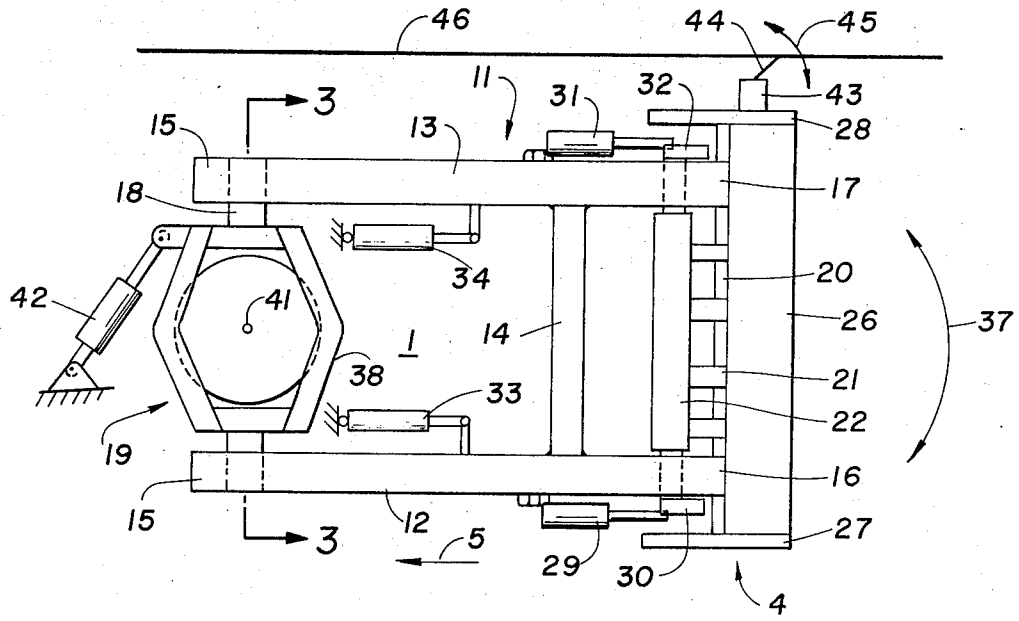
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FIG. 2

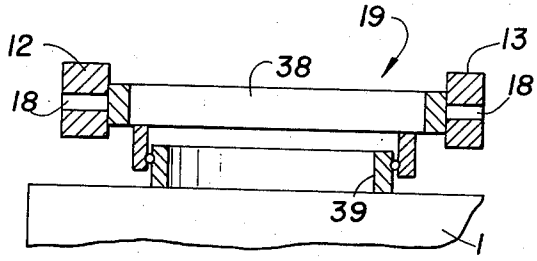


FIG. 3

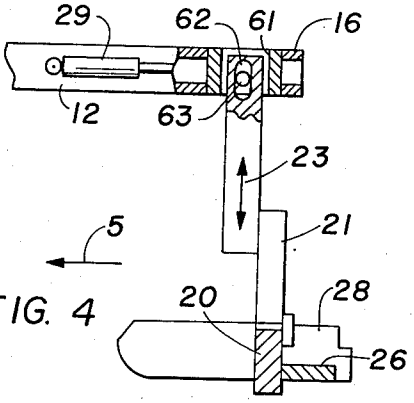


FIG. 4

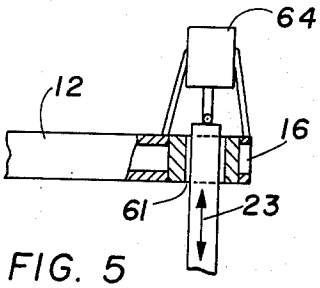


FIG. 5

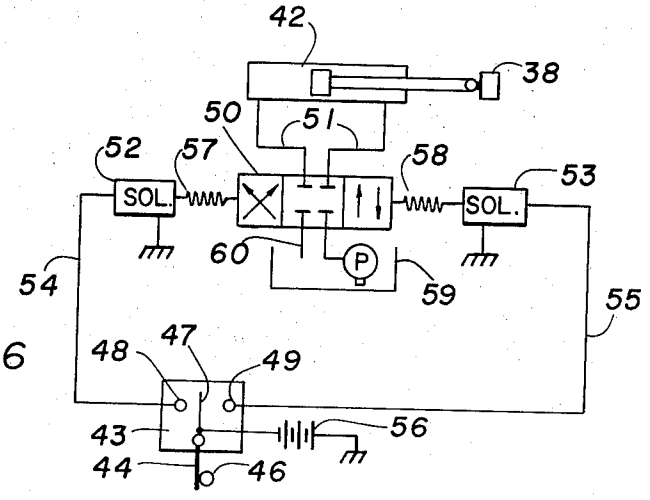


FIG. 6

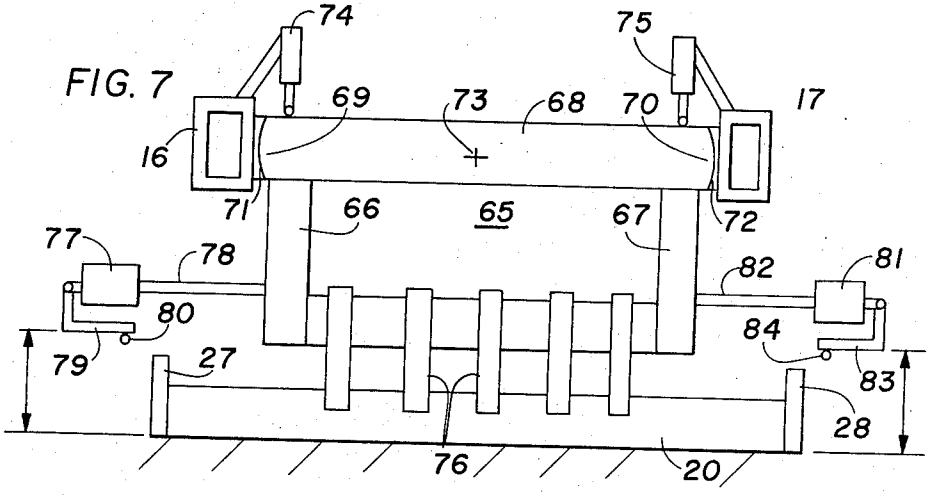


FIG. 7

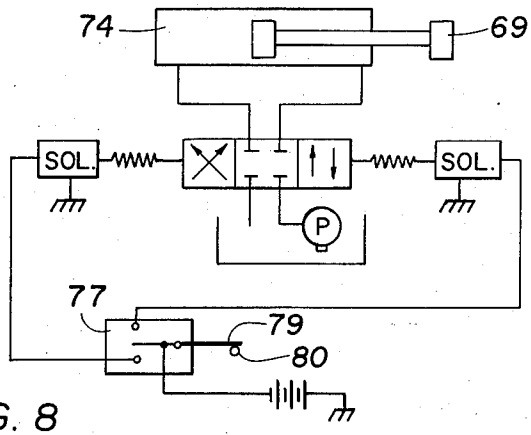


FIG. 8

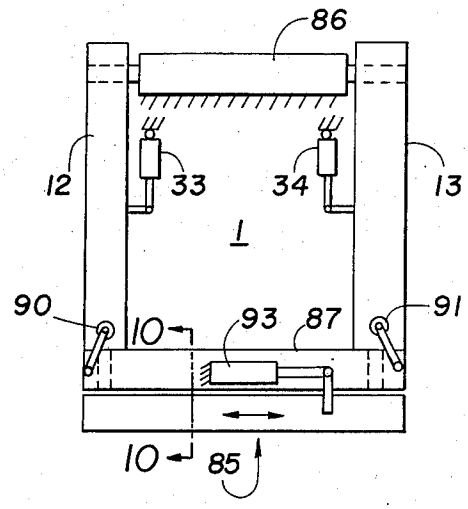


FIG. 9

FIG. 10

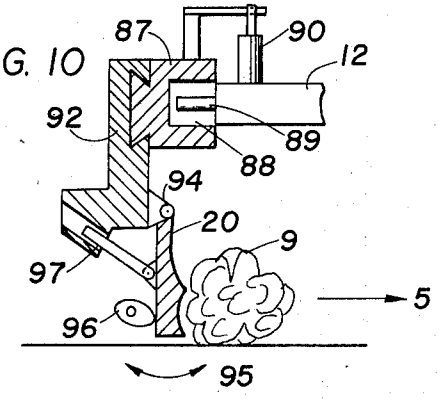
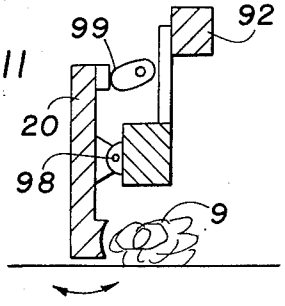


FIG. 11



ROAD CONSTRUCTION APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a road construction apparatus, more specifically, to guide means in such an apparatus for guiding an installing plank or bar carried by the road construction apparatus whereby road forming mixtures such as bituminous mixtures are installed along a predetermined guide or reference line. The installing plank is preferably carried by a caterpillar type of vehicle carriage, although wheeled vehicle carriages are also suitable.

Prior art road construction apparatus for installing road forming mixtures usually comprise a caterpillar or wheel type carriage which supports the drive and steering means as well as a mixture supply bin at the front end of the carriage. The supply bin is usually constructed with side and front walls which may be tilted upwardly by means of a hydraulic piston cylinder arrangement. The carriage further supports conveyor means for removing the mixture from the supply bin and toward the installing plank for deposition in the road bed in front of the plank as viewed in the direction of vehicle advance. In certain circumstances the carriage also supports a worm means for the distribution of the mixture.

These prior art apparatus also comprise two substantially elongated straight or angularly bent carrier arms which are tiltably supported approximately at the center of the caterpillar or wheel type carriage. Opposite the tiltable support of the carrier arms there are arranged devices for the even distribution, the densification, and the smoothing of the mixture. Thus, these devices essentially comprise said mixture distribution worm, tamping means and the vibrating, installing plank or bar. These vibrating, installing planks will be simply referred to as planks or plank means.

More recent road construction apparatus adapted for installing poured asphalt comprise instead of the above mentioned mixture bin as it is used in normal blacktop construction apparatus, a container which is surrounded by heating means and which comprises a stirring worm as well as a conveyor worm. Generally, the plank in the normal blacktop construction apparatus densifies the bituminous blacktop mixture. However, the plank in the poured asphalt construction apparatus is not required to densify the poured asphalt.

OBJECTS OF THE INVENTION

The invention aims at achieving the following objects singly or in combination:

- to provide means for automatically guiding the plank means with regard to its elevational position as well as with regard to its position relative to the profile or section of the road being constructed;
- to provide electrohydraulic control means for varying the elevational position of the plank and thus the thickness of the installed road forming mixture, whereby the angle between the longitudinal axis of the plank and the horizontal shall also be automatically adjustable by lifting one or the other end of the plank independently of the opposite plank end;
- to provide means for laterally or substantially horizontally shifting the plank means;

- to provide for rapidly raising and lowering the plank means in response to operator actuated control means;
- to provide means for controlling the instantaneous position of the plank in such a manner that during negotiating a curve including curves with an irregular or uneven curvature, the longitudinal axis of the plank points toward the center of the respective curvature even if the carriage, for example, due to an inadvertance of the operator or due to slippage between the two caterpillar chains, deviates from the precise course out of the curve or into the curve; and
- to avoid guiding the plank merely by the steering of the carriage, that is, merely by the adjustment of the differential speed between the two caterpillar chains.

SUMMARY OF THE INVENTION

According to the invention there is provided a road construction apparatus in which a carriage supports a frame structure at one end thereof wherein the free end of the frame structure has movably attached thereto installing plank means so that the right and left ends of the plank means may be raised and lowered independently of each other or together by separate power means which respond to respective right and left elevation sensing means or to operator actuated control means. The plank or the frame structure is further supported for a horizontal shifting by power means responsive to horizontal, lateral sensing means. The horizontal shifting takes place substantially perpendicularly to the longitudinal direction of the road. Thus, taking the carriage advance into account, the plank is adjustable automatically in the three dimensions of space.

According to the invention there is further provided a method for guiding or adjusting the installing plank by sensing a reference such as a guideline by means of an electronic sensing apparatus known per se whereby upon sensing of a deviation from the reference an electrical impulse is produced which automatically controls the hydraulic pressure of hydraulic piston cylinder arrangements in a correcting sense whereby a rotation about the vertical or a lateral shift is controlled until the plank and thus also the sensing member of the sensing apparatus reaches a zero position. The guideline may, for example, be a rope stretched out between two supporting posts. The amount of rotation or shifting required for correction may be ascertained, for example, by a potentiometer or by pivoting contact means and may be simultaneously indicated to the operator of the vehicle through instruments known as such. Thus, the operator may in addition to the automatic correction correct a steering error while watching the instruments.

BRIEF FIGURE DESCRIPTION

In order that the invention may be clearly understood, it will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective rear side view of an apparatus embodying the present invention;

FIG. 2 is a top view onto the apparatus according to FIG. 1 whereby unessential details have been omitted for the sake of simplification;

FIG. 3 is a sectional view along section line 3—3 in FIG. 2;

FIG. 4 is a partial side view, partially in section as viewed in the direction of the arrow 4 in FIG. 2;

FIG. 5 illustrates a modified embodiment of the illustration of FIG. 4;

FIG. 6 illustrates a schematic hydraulic and electrical block diagram for sensing and controlling a lateral or horizontal deviation of the plank means;

FIG. 7 is a simplified rear view of the apparatus according to FIG. 1 for illustrating the position of elevation sensing means;

FIG. 8 is a schematic, hydraulic and electric circuit diagram for sensing and controlling elevational deviations, whereby two of such circuits will be provided in the actual embodiment, one for each sensing device shown in FIG. 7;

FIG. 9 is a top view similar to that of FIG. 2 but illustrating a modified embodiment for the horizontal shifting of the installing plank;

FIG. 10 is a sectional view along section line 10—10 in FIG. 9; and

FIG. 11 is a view similar to that of FIG. 10 but showing a modification for vibrating the installing plank.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

FIG. 1 illustrates a perspective rear side view of an apparatus embodying the present invention comprising a carriage 1 with drive means 2 driven by an engine 3. The vehicle advances in the direction of the arrow 5.

The vehicle carries at its front end a supply bin 6 which contains the bituminous mixture for forming the road. A chamber 7 is arranged in the carriage 1. Rotating arms 8 move the bituminous mixture 9 from the supply bin 6 through the chamber 7 for deposition in front of a power driven mixture distributing worm 10.

A frame structure 11 comprising left and right side bars 12 and 13 and a cross beam 14 has a carriage supported end 15 and free ends 16 and 17. A pivot pin 18 connects the supported end 15 of the frame structure 11 to bearing means 19 to be described more fully with reference to FIGS. 2 and 3.

An installing plank or bar 20 is movably connected to the frame structure 11 at the free ends 16, 17 thereof by plank support means 21 including a top cross bar 22 and uprights 23 and 24. The distributing worm 10 is also connected to the plank support means 21, for example, by brackets 25.

A stepping board 26 may be attached to the rear face of the plank 20. Lateral boundary walls 27 and 28 are attached to the left and right ends of the plank 20. The ends of the distributing worm 10 may also be supported at the inner surfaces of these walls 27.

Left power means, for example, in the form of a piston cylinder arrangement 29 are connected between the frame structure 11 and the plank support means 21 by means of a cam or crank 30. Right power means 31 are similarly connected between the right side bar 13 of the frame structure 11 and the plank support means 21 by means of a cam or crank 32.

Further power means such as piston cylinder arrangements 33 and 34 are connected between the frame structure 11 and a fixed point for pivoting the frame structure 11 about the journal 18 whereby to raise or lower the free ends 16 and 17 of the frame structure as indicated by the double arrow 35.

The actuation of the piston cylinder arrangements 33 and 34, for example, by an operator actuating the respective controls at the control panel 36 raises and lowers both the free ends of the frame structure as well as the plank support means 21 in unison. However, the actuation of the left and right power means 29 and 31 will result in the individual raising and lowering of the left or right end of the plank 20 as will be described in more detail with reference to FIGS. 7 and 8. The individual lifting of one or the other plank end permits adjusting the angle between the longitudinal axis of the plank and the horizontal.

Referring to FIG. 2 the same elements are provided with the same reference numerals. In order to provide a substantially horizontal shifting of the plank 20 as indicated by the double arrow 37, the frame structure 11 is connected to the carriage 1 by the above mentioned bearing means 19 comprising a frame 38 connected to the journal shaft 18 on which the side bars 12 and 13 are journalled at their supported ends 15. The bearing means further comprise a lower race 39 connected to the carriage 1, for example, by welding and an upper race 40, for example, welded to the frame 38. Thus, the frame structure 11 and with it the installing plank 20 may be shifted substantially horizontally by a rotating movement of the entire frame structure about a vertical axis 41. This horizontal shifting is accomplished by horizontally effective power means 42 connected to the frame 38 and a fixed point on the carriage. The power means, for example, a piston cylinder arrangement 42 are responsive to horizontal lateral sensing means 43 having a sensing probe or feeder 44 which is laterally pivotable as indicated by the arrow 45 as it senses the position of a guideline or rope 46.

The operation of the horizontal shifting mechanism will now be described with reference to FIG. 6 illustrating hydraulic and electric circuit means for controlling the piston cylinder arrangement 42 in response to the sensing apparatus 43 which is known per se, for example, under the trade name "Honeywell Grade Master." Such grade master is symbolized in a simplified manner by the sensing device 43 comprising a contact blade 47 pivotable back and forth between contacts 48 and 49 by means of the sensing or feeler member 44.

The horizontal plank shifting control means shown in FIG. 6 comprise a magnetic control valve 50 connected to the cylinder of the piston cylinder arrangement 42 by hydraulic conduits 51. The valve 50 is actuated by solenoids 52 and 53 depending upon the position of the contact blade 47 in contact with the contact 48 or contact 49 for closing respective electrical circuit means 54 and 55 whereby to energize either solenoid 52 or solenoid 53 through a source 56 of electrical power. Spring means 57 and 58 are provided for returning the valve into its zero or neutral position. Hydraulic power is supplied to the piston cylinder arrangement 42 through the valve 50 from a pump P which draws hydraulic fluid from a tank 59 to which such fluid is returned through a conduit 60.

Referring now to FIG. 4 there is shown one embodiment of means for vertically shifting, for example, the upright 23 and thus the left end of the plank 20 by means of the piston cylinder arrangement 29 and the cam or crank 30. For this purpose the free end 16 of the side bar 12 of the frame structure 11 is provided

with a vertical guide channel 61 in which the upper end of the upright 23 or an extension thereof is received. The side bar 12 is further provided at its inner surface with an elongated hole 62 in which is received a guide pin 63. The cam or crank 30 is connected to the guide pin 63 and by the actuation of the cam or crank 30 by the piston cylinder arrangement 29 the upright 23 may be moved up and down as shown in FIG. 4.

FIG. 5 illustrates a modified embodiment for moving the upright 23 or the upright 24 up and down. Here a piston cylinder arrangement 64 is connected with its piston to the free end 16 of the side bar 12 and the piston rod is pivoted to the upper end of the upright 23 whereby the latter may be moved up and down as shown in FIG. 5.

Separate sensing and control means are provided for the actuation of the piston cylinder arrangements which move the right and left ends of the plank 20 up and down independently of each other. These sensing and control means are shown in FIGS. 7 and 8.

Referring now to FIG. 7 there is shown a symbolized rear end of a modified embodiment of an apparatus according to the invention. The plank 20 is again supported in a movable manner at the free ends 16 and 17 of the frame structure. However, the plank support means 65 differ from the plank supports 21 in that the uprights 66 and 67 are rigidly connected to an upper cross bar 68 having lateral ends 69 and 70 which are guided in respective guide means 71 and 72 whereby the cross bar 68 may be pivoted about a horizontal pivot axis 73 by the actuation of piston cylinder arrangements 74 or 75. These piston cylinder arrangements 74, 75 are rigidly secured to the respective side bar 12 or 13 and connected to the respective cross bar end 69 or 70. The plank 20 is attached to the plank support means 75 by connecting pieces 76 which may include journal means as shown, for example, in FIGS. 10 or 11.

A left elevation sensing device 77 is connected to the plank support means 65 by a bracket 78 for sensing with its feeler 79 an elevational guideline 80. Right elevation sensing means 81 are also connected to the support means 65 by a bracket 82 so that the feeler 83 may sense a further elevational guideline 84.

FIG. 8 illustrates a hydraulic and electrical circuit arrangement for controlling the piston cylinder arrangement 74 in response to the sensing of the elevational guideline 80. The sensing means 77 are arranged so that the feeler 79 is capable of ascertaining the elevational position of the guideline 80. However, otherwise, the circuit and conduit arrangement of FIG. 8 is the same as that described above with reference to FIG. 6. Therefore, it does not appear to be necessary to describe in detail the arrangement and operation of FIG. 8.

Furthermore, an exact duplication of the circuit and conduit arrangement of FIG. 8 will be provided for the sensing means 81. Such additional circuit and conduit arrangement for controlling the piston cylinder arrangement 75 in response to the sensing of the elevational guideline 84 are not shown for simplicity's sake.

Referring to FIG. 9 there is shown a top view similar to that of FIG. 2, however, illustrating a modified embodiment according to the invention for horizontally shifting the plank support means 85 relative to the free end of the frame structure. In this embodiment it may not be necessary to support the supported end of the frame structure by means of a bearing turntable as disclosed in FIGS. 2 and 3. Therefore, the supported end is journalled to the carriage 1 by means of a journal shaft 86, whereby the entire frame structure is again pivotable for raising its free end by means of the piston cylinder arrangements 33 and 34.

A cross bar 87 is secured for up and down movement to the free end of the side bars 12 and 13. A longitudinal aperture or guide groove 88 and a guide member 89 cooperate for properly guiding the cross bar 87 as one or the other of its ends is raised or lowered by respective piston cylinder arrangements 90 and 91 connected between the free end of the side bars 12 or 13 on the one hand and the adjacent end of the cross bar 87 respectively.

The plank support means 85 comprise a further cross bar 92 movably connected to the cross bar 87, for example, by a dovetail groove and guide rail as shown in FIG. 10. A piston cylinder arrangement 93 interconnects the cross bars 87 and 92 and shifts the latter cross bar relative to the cross bar 87 horizontally back and forth. The piston cylinder arrangement 93 may be controlled in the same manner as has been described with reference to the piston cylinder arrangement 42 shown in FIG. 2 and controlled by the hydraulic and electric circuit arrangement shown in FIG. 6.

The plank 20 is connected to the cross bar 92, for example, by hinge means 94 whereby it is possible to oscillate the plank 20 back and forth as indicated by the double arrow 95. Such oscillation may be accomplished by cam means 96. Preferably the plank 20 is guided in its oscillating movement by guide means 97.

FIG. 11 illustrates a view similar to that of FIG. 10. However, the pivot means 98 are arranged in a slightly different manner than the respective pivot means 94. Similar considerations apply to the arrangement of the cam means 99. If desired, spring means may be provided for assuring the continuous engagement of the plank with the cam means 96 or 99.

In view of the above, it will be appreciated that the installing plank 20 is adjustable in the three dimensions of space if one takes into account the direction of movement of the vehicle. Moreover, the plank ends may be raised and lowered independently of each other in response to the sensing of separate elevation guidelines 80 and 84 as shown in FIG. 7. This versatile plank adjustment constitutes a substantial advance in the art since it permits an automatic response to the plank to the instantaneous installing conditions.

Although the invention has been described with reference to specific example embodiments, it is to be understood, that it is intended to cover all modifications and equivalents within the scope of the appended claims.

What is claimed is:

1. In a road construction apparatus having a carriage and a frame structure supported on said carriage, said frame structure having a supported end and a free end including right and left frame side bars, plank means having right and left ends supported by said free end of the frame structure for installing a road forming mixture in a road bed, the improvement comprising plank support means connected to said frame structure and to said plank means for movably suspending said plank means from said free end of the frame structure, right

and left elevation sensing means carried by said apparatus, right and left power means operatively connected to the right and left ends of said plank means adjacent to the respective lateral side bars of the frame structure, right and left control means carried by said apparatus and operatively arranged to respond to the respective one of said right and left elevation sensing means, said right and left control means being operatively connected to the respective one of said right and left power means for lifting and lowering the plank means, horizontal plank shifting control means carried by said apparatus horizontal lateral sensing means also carried by said apparatus, horizontally effective power means carried by said apparatus and operatively arranged for actuation by said horizontal plank shifting control means in response to said horizontal lateral sensing means for horizontally shifting said plank means, and wherein said horizontal plank shifting control means comprise bearing means having a stationary member secured to said carriage and a rotatable member secured to said supported end of the frame structure, said horizontally effective power means comprising piston cylinder means connected between the carriage and said frame structure whereby the frame structure may be rotated horizontally about a vertical axis of said bearing means to laterally shift the free end of the frame structure back and forth.

2. The road construction apparatus according to claim **1**, wherein said plank support means for movably suspending said plank means from said free end of the frame structure comprise right and left ends, and guide means carried by said free ends of said right and left frame side bars for movably guiding the respective right and left end of said plank support means for up and down movement, said right and left power means operatively connected to said plank support means for raising and lowering said plank support means relative to said frame structure.

3. The road construction apparatus according to claim **2**, wherein said plank support means comprise right and left uprights and means for rigidly interconnecting said right and left uprights, said guide means comprising substantially vertical guide channels in said free ends of the frame side bars, journal stud means in said guide channels, and longitudinal apertures in said plank support means, said longitudinal apertures receiving said journal studs to permit relative movement of the plank support means in the guide channels, said right and left power means comprising piston cylinder means operatively connected for raising and lowering said plank support means relative to said free ends of the frame side bars.

4. The road construction apparatus according to claim **2**, wherein said plank support means comprise right and left uprights and means rigidly interconnecting said right and left uprights to each other, said guide means comprising substantially vertical guide channels in said free ends of the frame structure, said right and left power means comprising right and left piston cylinder means connected between said frame structure and said plank support means for raising and lowering the latter relative to the frame structure.

5. The road construction apparatus according to claim **13**, further comprising journal means connecting the supported end of said frame structure to said carriage, and further power means connected between said carriage and said frame structure for raising and lowering the free end of the frame structure by pivoting the supported end of the frame structure about said journal means.

6. The road construction apparatus according to claim **1**, wherein said horizontal plank shifting control means comprise plank support means including a first horizontal cross bar, means movably connecting said first horizontal cross bar to said free end of the frame structure, a second horizontal cross bar, guide means slidably interconnecting said first and second horizontal cross bars, said horizontally effective power means being operatively connected between said first and second horizontal cross bars whereby these cross bars are shiftable back and forth horizontally relative to each other.

7. The road construction apparatus according to claim **6**, wherein said means movably connecting said first horizontal cross bar to said free end of the frame structure comprise a guide member and a longitudinal vertical groove at each end of said first horizontal cross bar, said guide member cooperating with its respective groove for permitting vertical up and down movement of said first horizontal cross bar relative to the free end of the frame structure, said right and left power means being arranged to interconnect the respective end of the first horizontal cross bar and said free end of the frame structure.

8. The road construction apparatus according to claim **6**, wherein said means movably connecting said first horizontal cross bar to said free end of the frame structure comprise a guiding slide bearing means arranged between each end of the first horizontal cross bar and the respective free end of the side bar of the frame structure whereby the first horizontal cross bar may be pivoted so that its ends may be raised and lowered in response to operation of said right and left power means.

9. The road construction apparatus according to claim **1**, wherein said control means for said power means comprise hydraulic valves, solenoid means actuating said hydraulic valves and electrical circuit means interconnecting said solenoid means and the respective sensing means.

10. The road construction apparatus according to claim **1**, further comprising worm means connected to said plank means for movement with said plank means and in front of said plank means as viewed in the direction of carriage advance, power drive means connected to said worm means for distributing said road forming mixture along the installer plank means and in front thereof.

11. The road construction apparatus according to claim **1**, further comprising means operatively connected to said installing plank for vibrating the latter back and forth in a direction extending in the direction of carrier advance.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,791,753 Dated February 12, 1974

Inventor(s) Karl Heinz Rymsa

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

[73] Assignee: Wibau-Westdeutsche Industrie-und Strassenbau-Maschinen-Gesellschaft m.b.H., Rothenbergen, Germany

Column 8, line 2 "claim 13" should read --claim 1--

Signed and sealed this 2nd day of July 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.