Aug. 13, 1968 K. V. JOHNSON 3,396,643

SUBGRADING MACHINE

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FIG. 1

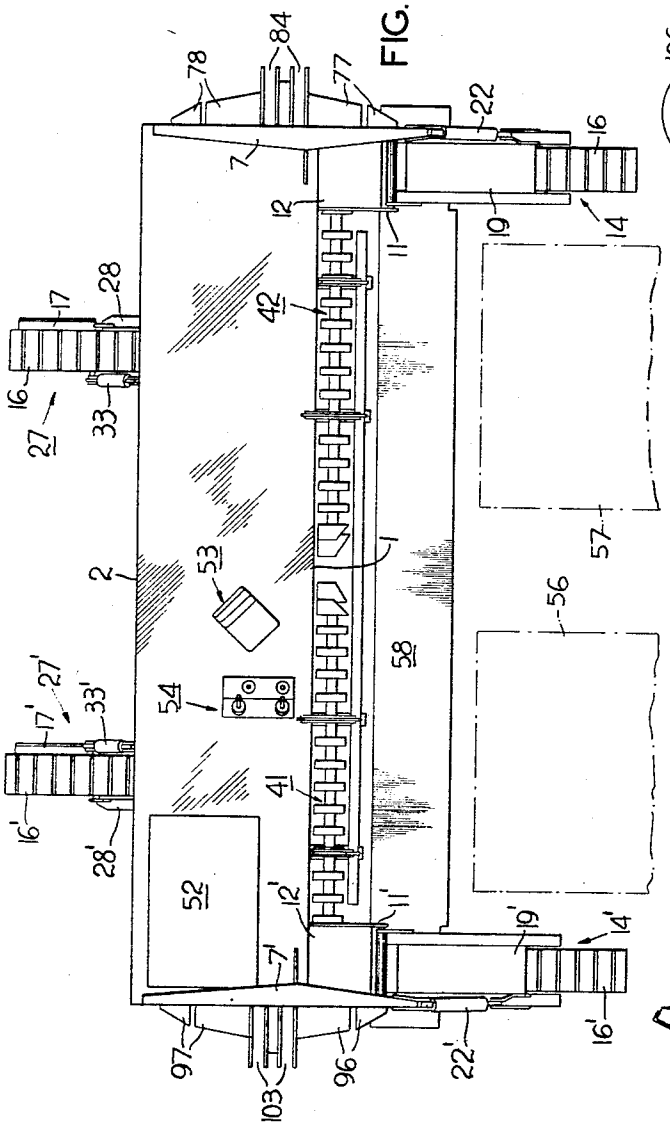
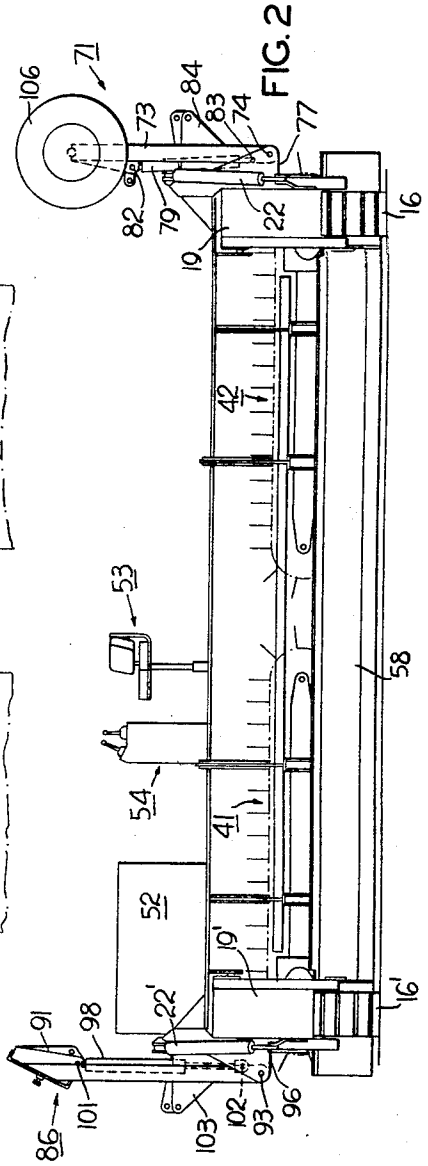


FIG. 2



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FIG. 3

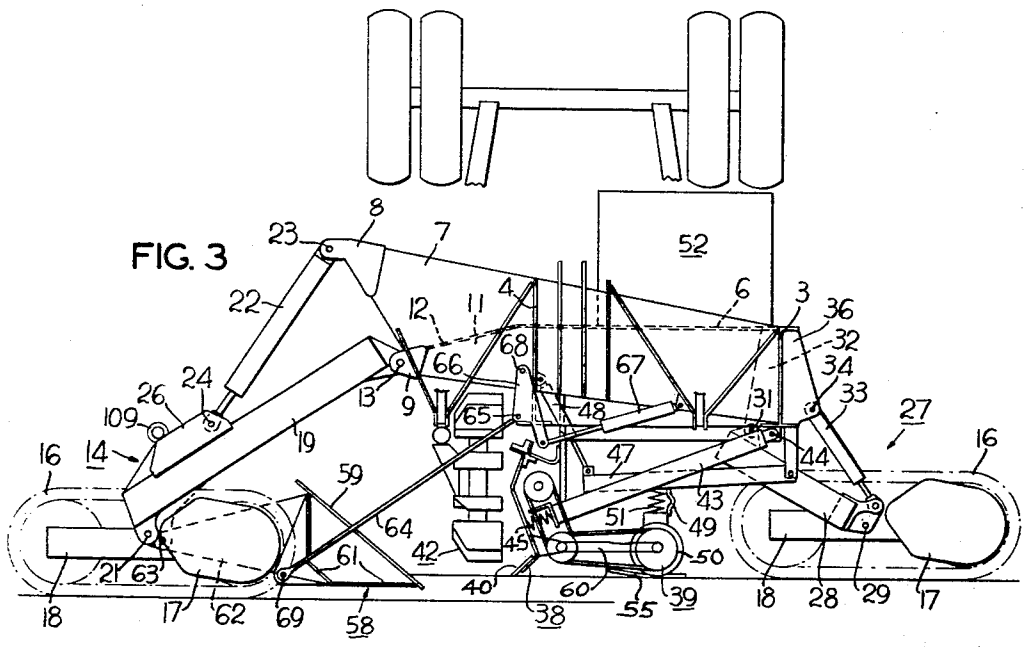
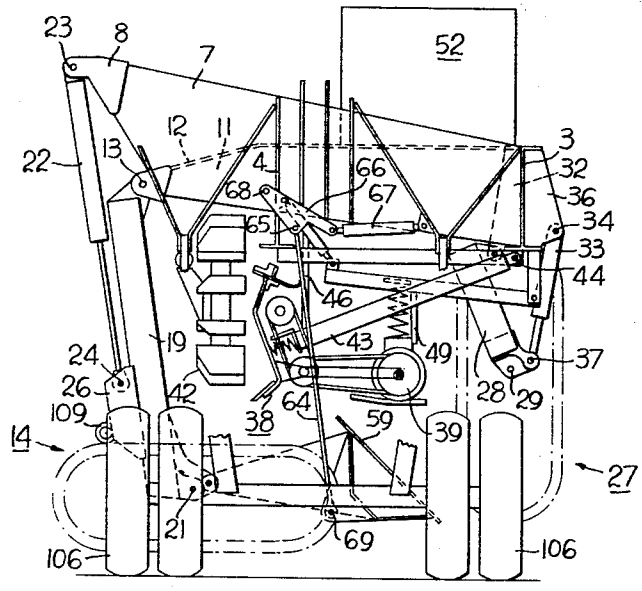


FIG. 6



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SUBGRADING MACHINE

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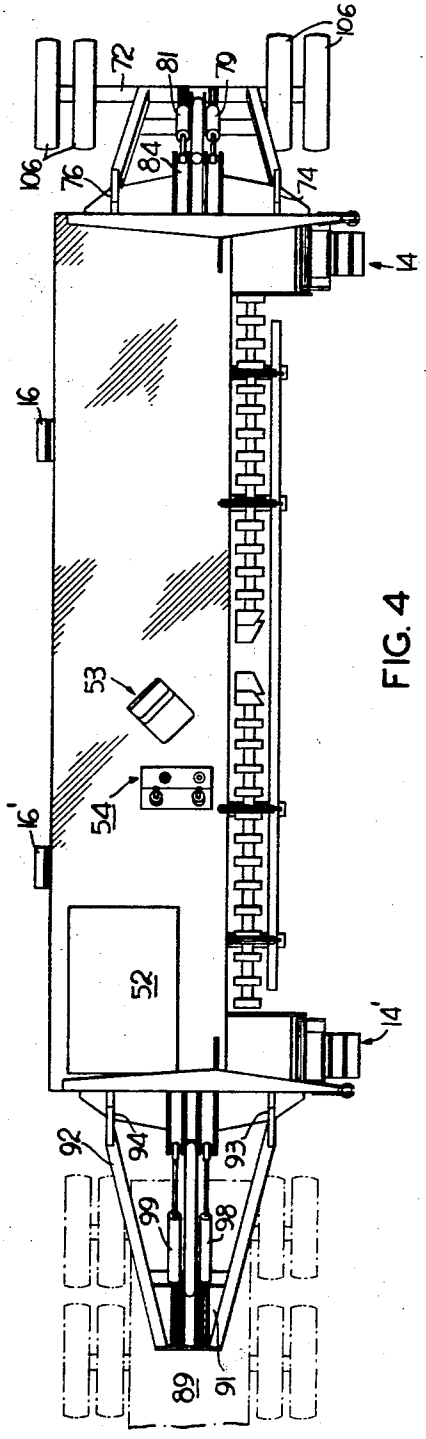


FIG. 4

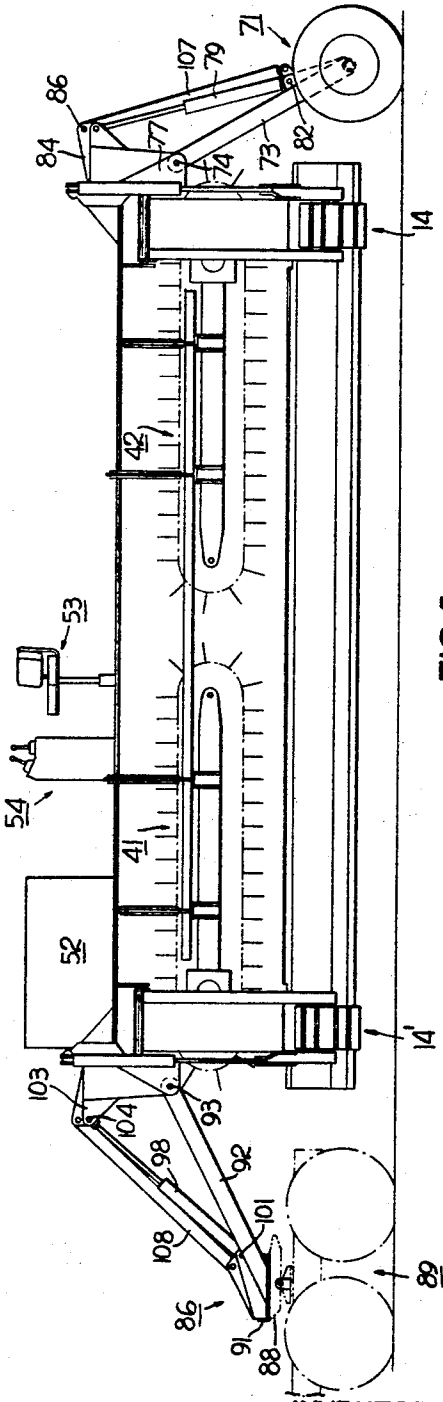


FIG. 5

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United States Patent Office 3,396,643 Patented Aug. 13, 1968

3,396,643

SUBGRADING MACHINE

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Filed Mar. 6, 1967, Ser. No. 620,876
9 Claims. (Cl. 94—39)

ABSTRACT OF THE DISCLOSURE

A subgrading machine for road construction has front and rear running gear on which the main body of the machine is supported for sidewise working travel; and end running gear on which the main body together with the front and rear running gear are supported in compacted, elevated condition for endwise transport travel.

The invention relates to road making machinery, and it is concerned more particularly with a base grader or subgrading machine which will prepare a smooth course of compacted soil, stone or other base material on which a hard pavement is to be laid.

Conventional machines of the mentioned character have heretofore been constructed to span a road area of two lane width or more, but such relatively large machines have presented a problem of transporting them to and from the construction site where they are to be used. In the assembled condition of these large machines their length and width necessarily exceeds permissible dimensions for highway and rail travel, and it has therefore been customary to disassemble them into smaller component units for transport purposes, and to reassemble such units at the construction site.

The principal object of the present invention is to eliminate the burdensome expenditures of time and labor for the mentioned disassembly and reassembly operations.

More specifically, it is an object of the invention to provide an improved subgrading machine which will span a road area of two lane width or more, and which may readily be converted from an expanded working condition into a compacted transport condition without disassembly of its major components, and which in the compacted transport condition does not exceed permissible dimensions for highway or rail travel.

With the foregoing objects in view the invention contemplates a subgrading machine incorporating front and rear running gear on which the machine may move sidewise for working travel, but which may be retracted for transport travel; and end running gear on which the machine may move endwise for transport travel while the retracted front and rear running gear is sustained in an elevated condition above the ground.

A further object of the invention is to provide an improved subgrading machine of the above mentioned character incorporating, in addition to the front and running gear, a back and forth adjustable chute for directing base material from a dump truck into the path of the machine, and wherein such chute is automatically adjusted from a forwardly to a rearwardly adjusted position when the machine is converted from its working to its transport condition.

These and other objects and advantages are attained by the present invention various novel features of which will be apparent from the disclosure herein of a preferred embodiment of the invention and will be pointed out by the appended claims.

Referring to the accompanying drawings:

FIG. 1 is a top view of a subgrading machine incorporating the invention and being expanded for sidewise working travel along a road site;

FIG. 2 is a front elevation of the machine shown in FIG. 1, end running gear and a hitch not shown in FIG. 1 being shown in FIG. 2 in upwardly adjusted condition;

FIG. 3 is an elevational view of the right end of the machine shown in FIG. 2;

FIG. 4 is a top view of the machine shown in FIGS. 1–3, but being compacted for endwise transport travel;

FIG. 5 is a fornt elevation of the machine shown in FIG. 4; and

FIG. 6 is an end elevation similar to FIG. 3 and showing the machine in conpacted condition for endwise transport travel.

As shown in FIGS. 1 and 4, a generally rectangular vehicle frame has longitudinal front and rear sides **1** and **2** at a relatively short horizontal spacing from each other, the rear side **2** being formed by an I-beam **3** (FIG. 3), and the front side **1** being similarly formed by another I-beam **4**. An operator's deck **6** and suitable bracing (not shown) extend between the I-beams and hold them in rigid, parallel relation to each other. A transverse end member **7** of the vehicle frame is shown at the right of FIG. 1 and projects forwardly beyond the I-beam **4** in a generally upward direction as shown in FIGS. 3 and 6. A hanger bracket **8** is secured to the upper forward corner of the end member **7**, and another hanger bracket **9** is mounted on the end member **7** in downwardly and rearwardly spaced relation to the hanger bracket **8**. As shown in FIGS. 1 and 3, a generally triangular bracket plate **11** is secured to the I-beam **4** and extends forwardly therefrom at the axially inner side of the end member **7** from which it is spaced a substantial lateral distance by a plate brace **12**.

Pivotally mounted between the hanger bracket **9** and the bracket plate **11** for swinging movement on a horizontal axis **13** is a forward running gear unit generally designated in FIGS. 1 and 3 by the reference character **14**. As schematically indicated in FIG. 3, the running gear unit **14** comprises a self-laying track mechanism including an endless track belt **16**, a hydraulically powered drive mechanism **17** for the track belt, and a track frame **18** mounting the drive mechanism **17**. The track belt **16** and the track frame **18** are straddled by the forked forward end of a support arm **19** which has a horizontal pivot connection **21** with the track frame. At its rear end, the support arm **19** is fitted between the bracket **9** and bracket plate **11** and is pivotally supported thereon on the axis **13**. The angular position of the arm **19** about the axis **13** is controlled by a double acting hydraulic ram **22** which is operatively interposed between the vehicle frame and the supporting arm on centers in radially spaced relation to the pivot axis **13**, the cylinder of the ram **22** being pivoted at **23** to the hanger bracket **8**, and the piston rod of the ram **22** being pivoted at **24** to a bracket **26** on the upper side of the support arm **19**.

Another forward running gear unit which is a duplicate of the one at the right is mounted at the left end of the vehicle frame and generally designated by the reference character **14'**. Parts at the left of FIG. 1 which correspond to parts at the right are designated by the same reference numerals primed, and the descriptions and explanations hereinbefore with reference to the construction and mounting of the right forward running gear unit **14** analogously apply to the left forward running gear unit **14'**.

Spaced along the rear side **2** of the vehicle frame, as shown in FIG. 1, are left and right rear running gear units **27** and **27'**. Referring to FIG. 3, the rear running gear unit **27** comprises a self-laying track mechanism the same as the self-laying track mechanisms of the front running gear units, corresponding parts being designated by the same reference numerals. The track belt **16** and the track frame **18** of the running gear unit **27** are strad-

dled by the forked rearward end of a support arm **28** which has a horizontal pivot connection **29** with the track frame. Geometrically, the pivot connection **29** lies midway between the longitudinally opposite ends of the self-laying track unit but due to the weight of the drive mechanism **17** the unit is unbalanced, its center of gravity and the axis of the pivot connection **29** being relatively offset so as to bias the rear end of the unit downward with respect to the arm **28**. This relationship is significant as will be explained more fully hereinbelow.

At its forward end, the arm **28** has a horizontal pivot connection **31** with a bracket **32** which is mounted on and extends forwardly from the I-beam **3**. The angular position of the arm **28** about the axis of the pivot connection **31** is controlled by a double acting hydraulic ram **33** which is operatively interposed between the vehicle frame and the supporting arm **28** on centers in radially spaced relation to the pivot axis **31**. One of the reaction centers of the ram **33** is afforded by a horizontal pivot connection **34** of the ram cylinder with a bracket **36** which is mounted on and extends rearwardly from the I-beam **3**. The other reaction center of the ram **33** is afforded by a horizontal pivot connection **37** of the ram piston with a bracket on the rear end of the arm **28**.

The rear running gear unit **27'** is a duplicate of the running gear unit **27**, and corresponding parts are designated by the same reference numerals primed. The descriptions and explanations hereinbefore with reference to the construction and mounting of the right rear running gear unit **27** analogously apply to the left rear running gear unit **27'**.

Road working tools below the vehicle frame comprise a vibratory cutting mechanism **38** and a vibratory tamping mechanism **39**. A supporting arm **43** for the cutting mechanism has a rearward horizontal pivot connection **44** and a forward lift connection **46** with the vehicle frame. A grader blade **40** is flexibly suspended from the forward end of the arm **43** and bears rearwardly against a compression spring assembly **45** thereon. A vibrator housing **50** is suitably actuated for gyratory movement about a virtual axis extending horizontally in right angle relation to the working travel of the machine. A screed **55** is secured to the under side of the housing **50**, and a compression spring **51** reacts between the housing **50** and a link **47** which is swingable up and down about a pivot connection with the vehicle frame by a hydraulic ram **48**. A lift strap **49** connects the housing **50** with the link **47**. The vibrator housing **50** has a thrust transmitting connection **60** with the blade **40** which causes the blade to vibrate generally in the direction of vehicle travel while the screed is vibrated by the gyratory movement of the housing **50**.

Two paddle type base material spreading mechanisms **41, 42** are mounted at the forward side of the machine as shown in FIGS. 1 and 2.

A housing **52** at the left end of the vehicle frame encloses a power plant (not shown) including an internal combustion engine and hydraulic pump assembly for supplying pressure fluid for the drive mechanisms **17** of the front and rear running gear units **14, 14'** and **27, 27'**; for the spreading mechanisms **41, 42**, and for various hydraulic rams including the front and rear running gear rams **22, 22'** and **33, 33'**, the link suspension ram **48** and others which are located at the longitudinally opposite ends of the vehicle frame as will be described more fully hereinbelow. An operator's seat **53** and a control console **54** are mounted on the operator's deck **6** as indicated in FIGS. 1 and 2.

The lateral spacing between the front running gear units **14, 14'** is wide enough to accommodate two rear dump trucks side by side as symbolically indicated by the dash-dotted outlines **56** and **57** in FIG. 1 and from which base material, such as crushed stone, may be discharged into the path of the machine in front of the spreaders **41, 42** and tool units **38, 39**. In order to build up a desirable accumulation of such material ahead of the spreaders and tool units as the machine advances along the base course, a chute generally designated in FIGS. 1 and 2 by the reference numeral **58** is mounted at the forward side of the vehicle frame. Referring again to FIG. 3, the chute **58** comprises a rearwardly facing inclined wall **59** and stiffening walls **61** at the forward under side of the wall **59**. The length of the chute in the longitudinal direction of the vehicle frame is somewhat greater than the span between the running gear units **14, 14'**, and end portions of the chute extend slightly beyond the self-laying track units of the front running gear units as shown in FIG. 1. A supporting arm **62** (FIG. 3) extends forwardly from the chute below the support arm **19** of the right running gear unit **14**, and the forward end of the arm **62** has a horizontal pivot connection **63** with a depending bracket at the forward end of the arm **19**. Another chute supporting arm (not shown) corresponding to the arm **62** has a horizontal pivot connection with the forward end of the left running gear support arm **19'**.

The angular position of the chute **58** about its pivot connection with the running gear supporting arms **19, 19'** is controlled by adjustable suspension connections with the vehicle frame at the longitudinally opposite ends of the latter. The connection at the right end of the vehicle frame is shown in FIGS. 3 and 6 and comprises a rod **64**, a rocker **66** and a double acting hydraulic ram **67**. The rocker **66** has a pivot connection **68** with the end member **7** of the vehicle frame, and the ram **67** is mounted to react between a center on the end member **7** and the free end of the rocker **66** so as to swing the latter back and forth about its pivot center **68** by contraction and expansion of the ram **67**. The rod **64** has a pivot connection **65** at its upper end with a midportion of the rocker **66**, and its lower end is connected in lift force transmitting relation with the chute **58** on a horizontal pivot **69** at a rearward spacing from the forward pivot connection **63**.

The adjustable suspension connection of the chute **58** with the left end of the vehicle frame is constructed and arranged in the same manner as the hereinbefore described suspension connection at the right.

The front running gear unit **14**, the chute **58**, and the suspension linkage **64, 66** are pivotally interconnected in generally quadrilateral relation to each other, the average spacing between the pivot centers **13, 65** being approximately the same as the spacing between the pivot centers **63, 69**, and the spacing between the pivot centers **13, 63** being approximately the same as the spacing between the pivots **65, 69**. As a result of this quadrilateral relationship the support arm **19** and the suspension link **64** will be kept approximately parallel to each other when the support arms **19, 19'** are swung back and forth by expansion and contraction of the rams **22, 22'**, and such swinging movement will effect substantially translatory forward and rearward movement of the chute **58** relative to the vehicle frame.

At the right end of the vehicle frame, as shown in FIGS. 2, 4 and 5, an end running gear unit, generally designated **71**, is swingably mounted for downward movement upon, and for upward movement from the ground. The unit **71** comprises a wheeled axle **72**; a supporting yoke **73** for the axle; horizontal pivot connections **74, 76** (FIG. 4) between the yoke **73** and end brackets **77, 78** on the end structure **7** of the vehicle frame, and a pair of double acting hydraulic actuating rams **79, 81**. The rams **79, 81** are pivoted side by side on the axle **72** at **82**, and they are connectable with the vehicle frame either on a lower part of the end structure **7** at **83** as shown in FIG. 2, or with a rearwardly extending dual bracket **84** (FIG. 1) on an upper part of the end structure **7** by a pivot **86** as shown in FIG. 5.

At the left end of the vehicle frame as shown in FIGS. 2, 4 and 5, a hitch unit, generally designated **86**, is swing-

ably mounted for downward movement upon, and for upward movement from the fifth wheel structure **88** of a standard towing truck **89** partly outlined in FIGS. 4 and 5. The hitch unit comprises a king pin mounting pad **91**, supporting yoke **92** for the pad; horizontal pivot connections **93, 94** (FIG. 4) between the yoke **92** and end brackets **96, 97** on the end structure **7'** of the vehicle frame; and a pair of double acting hydraulic actuating rams **98, 99**. The rams **98, 99** are pivoted side by side on the pad **91** at **101**, and they are connectable with the vehicle frame either at a lower part of the end structure **7'** at **102** as shown in FIG. 2, or with a forwardly extending dual bracket **103** (FIG. 1) on an upper part of the end structure **7'** by a pivot **104**, as shown in FIG. 5.

FIGS. 1, 2 and 3 show the subgrading machine in its expanded working condition in which its vehicle frame is supported on the transversely extended upwardly adjusted front and rear running gear **14, 14'** and **27, 27'** for sidewise travel while the end running gear **71** and the hitch **86** are raised. In order to prepare the machine for transport to or from a road construction site the vehicle frame and the front and rear running gear thereon are raised in their entirety to an elevated position in which the track units of the front and rear running gear clear the ground at a substantial height such as a foot or more. For that purpose the end running gear unit **71** is lowered upon the ground from the raised position in which it is shown in FIG. 2, by expansion of the rams **79** and **81**. The vehicle frame is at this time sustained on the front and rear running gear units, and the rams **81, 79** swing about their pivot connections with the vehicle frame at **83**. After the wheels **106** of the end running gear have come to rest on the ground, the rams **79, 81** are detached at **83**, and they are then reconnected to the vehicle frame at **86**. Upon such reconnection the rams will have sufficient leverage to raise the right end of the vehicle frame to the elevated position shown in FIG. 6, while the wheels **106** roll on the ground toward the right end of the vehicle frame under the expanding force of the reconnected rams **79, 81**. As shown in FIG. 5 a brace rod **107** may be installed between the axle **72** and the bracket **84** to lock the end running gear **71** in its fully lowered position independently of the rams **79, 81**.

An analogous procedure is followed to raise the left end of the vehicle frame as shown in FIG. 5. That is, the hauling truck **89** and the hitch unit **86** are suitably maneuvered to engage the king pin mounting pad **91** of the hitch with the fifth wheel **88** of the truck while the body of the machine is sustained on the front and rear running gear. The pad **91** is lowered about the pivot axis **93** by expansion of the rams **98, 99** which are pivoted at **102** to the vehicle frame and the truck **89** may be backed up slightly to bring its fifth wheel under the lowered mounting pad **91**. After the load transmitting connection between the vehicle frame and the truck has been established by engagement of the pad **91** with the fifth wheel **88** while the weight of the vehicle frame is sustained on the front and rear running gear, the rams **98, 99** are detached at **102** (FIG. 1) and reattached at **104** to the vehicle frame. They will then have enough leverage to raise the left end of the vehicle frame to the elevated position shown in FIG. 6, while the machine moves endwise slightly toward the truck on the lowered end running gear **71**. As shown in FIG. 5, a brace rod **108** may be installed between the pad **91** and the bracket **103** to lock the hitch **86** in its fully lowered position independently of the rams **98, 99**.

Raising of the vehicle frame by the described lowering of the end running gear **71** and hitch **86**, permits rearward swinging of the front running gear units **14, 14'** by expansion of the rams **22, 22'**, as illustrated in FIG. 6 for the running gear unit **14**. Due to the weight of the drive mechanisms **17** for the track belts **16**, the rear ends of the forward track units tend to swing downward. However, such tendency is resisted by a stop **109** (FIGS. 3 and 6) on the bracket **26** of the right forward running gear unit **14**, and by a corresponding stop on the left running gear unit. The track mechanism, of the forward running gear units will thus extend lengthwise in generally horizontal directions below the forward side of the vehicle frame when they are swung to their rearward positions by extension of the rams **22** and **22'**. At the same time the chute **58** will be moved back to a position substantially below the cutting and tamping mechanism **38, 39**.

Raising of the vehicle frame by the described lowering of the end running gear **71** and hitch **86** also permits forward swinging of the rear running gear units **27, 27'** by expansion of the rams **33** and **33'**, as illustrated in FIG. 6 for the running gear unit **27**. Due to the weight of the drive mechanism **17** for the track belts **16**, the rearward track units will swing into lengthwise vertical positions in close proximity to the rear side of the vehicle frame when they are swung to their forward positions by extension of the rams **33, 33'**.

The described transverse retraction of the front and rear running gear units **14, 14'** and **27, 27'** and the accompanying rearward adjustment of the chute **58** reduce the over-all fore- and aft dimension of the machine to a permissible limit for highway travel and rail transport. For transport travel on a highway the compacted machine may be pulled endwise by the truck **89**, and for transport travel by rail the compacted machine may be loaded lengthwise on a flat car.

Upon arrival of the compacted machine at a road construction site it may readily be reconverted from its transport condition to its working condition by appropriate reversal of the described compacting procedure.

It should be understood that it is not intended to limit the invention to the herein disclosed details of construction and that the invention includes any modified constructions within the scope of the appended claims.

It is claimed and desired to secure by Letters Patent:

1. A subgrading machine comprising, a vehicle frame having longitudinal front and rear sides at a relatively short horizontal spacing from each other; front and rear running gear connected with said vehicle frame for up and down and transverse back and forth adjustment relative thereto; actuating means selectively operable to present said front and rear running gear in a transversely extended condition of upward adjustment, or in a transversely retracted condition of downward adjustment relative to said vehicle frame at said front and rear sides, respectively, of the latter; road working tool means mounted on said vehicle frame for up and down movement in unison therewith relative to the ground in response to adjustment of said front and rear running gear by said actuating means; up and down adjustable end running gear operatively connected with said vehicle frame; and actuating means selectively operable to lower and raise said end running gear upon and from the ground, whereby said vehicle frame will be supported on said transversely extended upwardly adjusted front and rear running gear for sidewise working travel while said end running gear is raised, and whereby said vehicle frame and tool means will be supported for endwise transport travel on said lowered end running gear while said front and rear running gear is sustained above the ground in its transversely retracted condition of downward adjustment relative to said vehicle frame.

2. A subgrading machine as set forth in claim **1** and further comprising up and down adjustable hitch means operatively connected with said vehicle frame, and actuating means selectively operable to lower and raise said hitch means upon and from a draft vehicle.

3. A subgrading machine as set forth in claim **1** wherein said front running gear comprises two units operatively mounted at the opposite ends, respectively, of said vehicle frame in forwardly and upwardly, and in rearwardly and downwardly swingable relation thereto, and a chute structure extending between and connected to said front running gear units so that it will be positioned forwardly of

said tool means when said forward running gear units are in their forwardly and upwardly adjusted positions, and so that said chute structure will be positioned below said tool means when said forward running gear units are in their rearwardly and downwardly adjusted positions.

4. A subgrading machine as set forth in claim 3 and further comprising suspension elements for said chute structure operatively mounted on said vehicle frame for up and down adjustment relative thereto; said chute structure having forward pivotal supporting connections with said forward running gear units, and lift force transmitting connections with said suspension elements rearwardly of said forward supporting connections.

5. A subgrading machine as set forth in claim 4 wherein said vehicle frame, front running gear units chute structure and suspension elements are pivotally interconnected in generally quadrilateral relation to each other so that adjustment of said front running gear units by said actuating means will effect substantially translatory forward and rearward movement of said chute structure relative to said vehicle frame.

6. A subgrading machine as set forth in claim 1 wherein said front and rear running gear comprises two front units, one at each end of said vehicle frame, and two rear units spaced from each other in the longitudinal direction of said vehicle frame; each of said front and rear units comprising a running element, a supporting arm for said running element, horizontal pivot means swingably connecting said supporting arm with said vehicle frame; and a hydraulic ram operatively interposed between said vehicle frame and supporting arm on centers in radially spaced relation to the axis of said horizontal pivot means.

7. A subgrading machine as set forth in claim 6 wherein said running element of each of said front and rear units comprises a self-laying track mechanism having a horizontal pivot connection intermediate its ends with the free end of its associated supporting arm.

8. A subgrading machine as set forth in claim 7 wherein the pivot connections of the rearward track mechanisms with their respective supporting arms, and the centers of gravity of said rearward track mechanisms are relatively offset so as to bias the rear ends of said rearward track mechainsms downward with respect to their respective supporting arms.

9. A subgrading machine as set forth in claim 7 and further comprising stop means mounted on the supporting arms for the forward track mechanisms and cooperable with the latter upon movement of said front running gear units to their transversely retracted condition of downward adjustment relative to said vehicle frame, so as to position said forward track mechanism on the elevated vehicle frame in lengthwise generally parallel relation to the ground.

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