Aug. 22, 1933. F. D. WALLACE ET AL 1,924,055

ELEVATING GRADER

Filed April 20, 1932 2 Sheets-Sheet 1

Fig. 1.

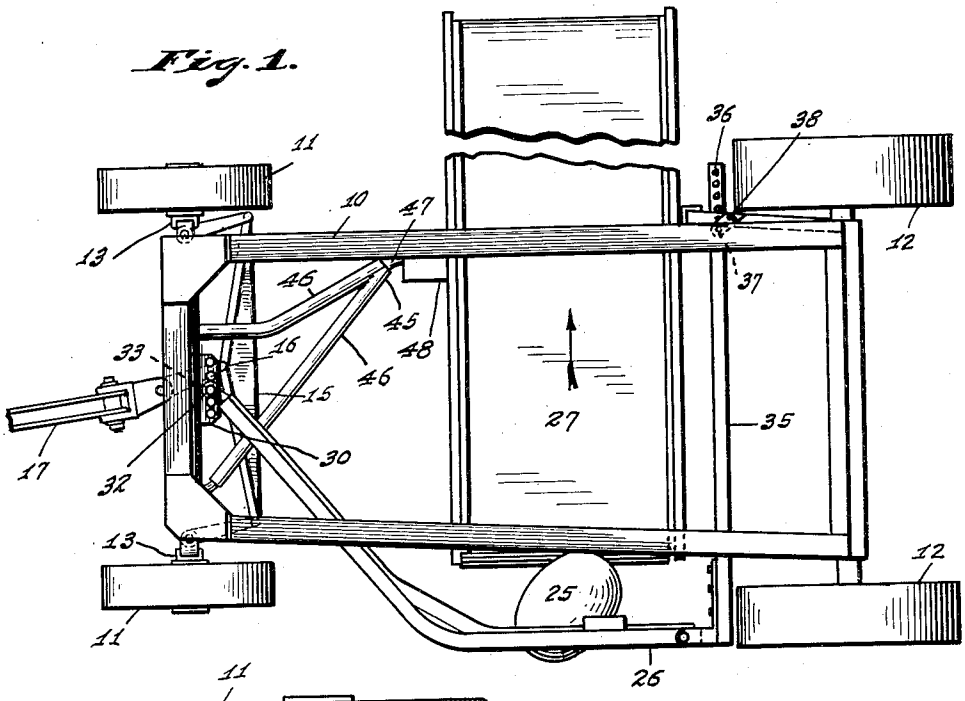


Fig. 2.

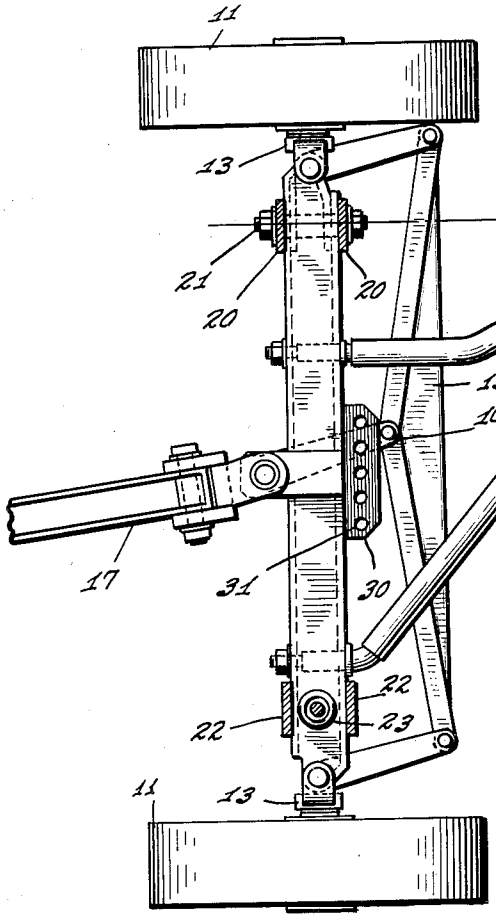
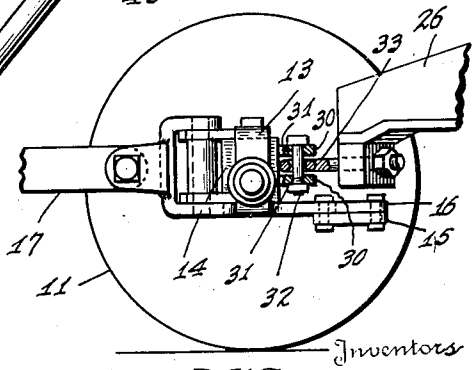


Fig. 5.



Inventors

FLOYD D. WALLACE

WILLIAM A. COST and

JOSEPH W. HARTLEY

By

Attorneys

Aug. 22, 1933. F. D. WALLACE ET AL 1,924,055

ELEVATING GRADER

Filed April 20, 1932 2 Sheets-Sheet 2

Fig. 3.

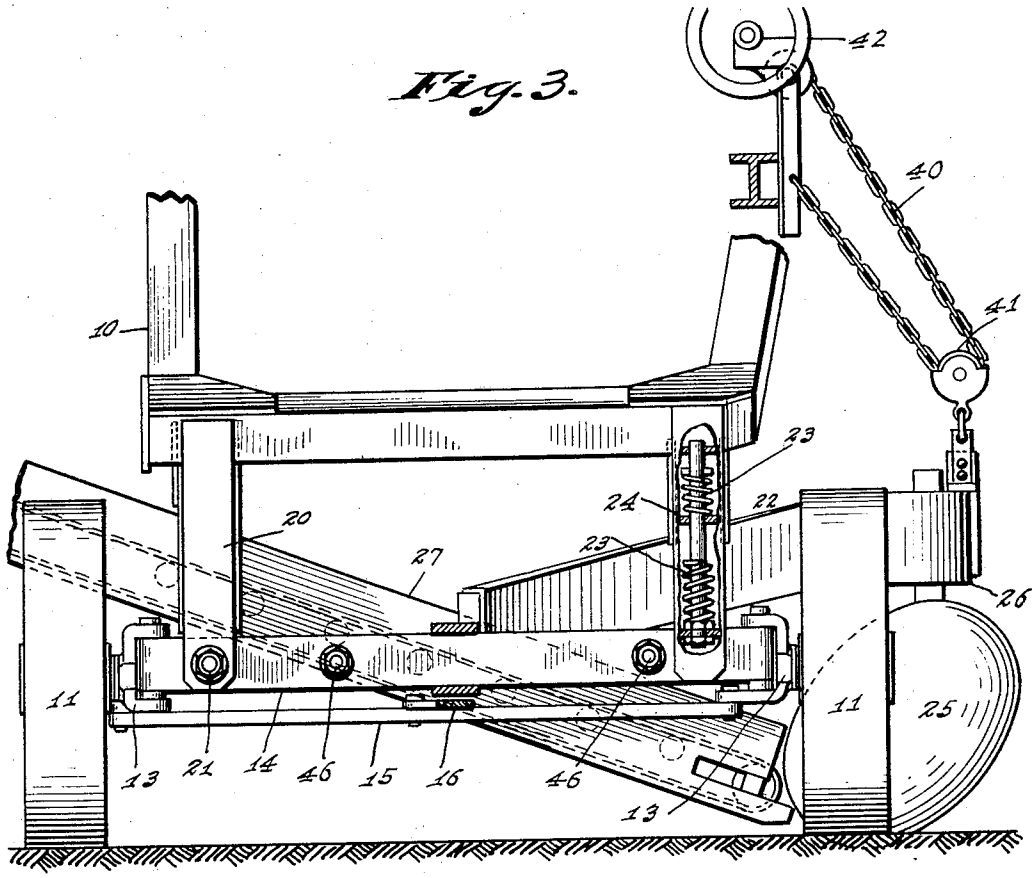
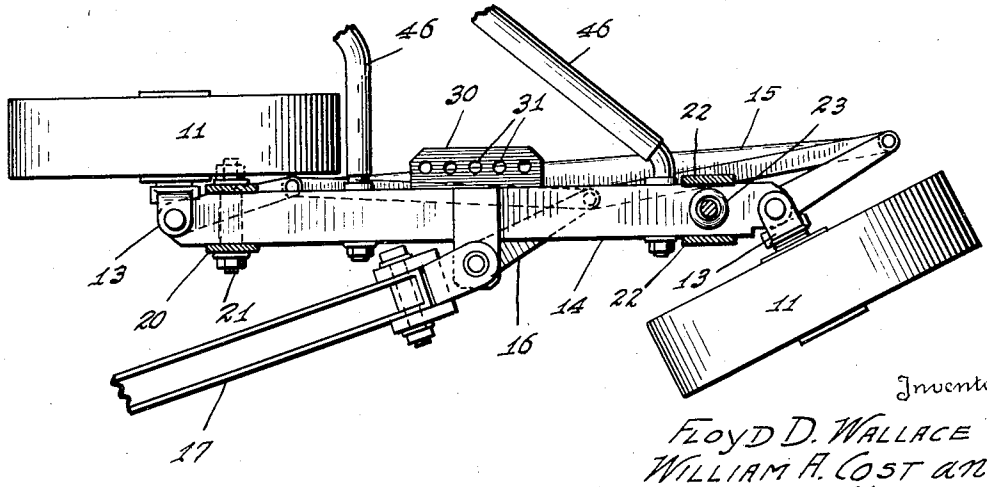


Fig. 4.



Inventors

FLOYD D. WALLACE
WILLIAM A. COST and
JOSEPH W. HARTLEY,

By Ellis & Mack

Attorneys

Patented Aug. 22, 1933 1,924,055

UNITED STATES PATENT OFFICE

1,924,055

ELEVATING GRADER

Floyd D. Wallace, William A. Cost, and Joseph W. Hartley, Indianapolis, Ind., assignors to J. D. Adams Manufacturing Company, Indianapolis, Ind., a Corporation of Indiana

Application April 20, 1932. Serial No. 606,368

9 Claims. (Cl. 37—110)

Our invention is concerned with elevating graders. Such machines customarily include a wheel-supported frame, a plow, and a conveyor or carrier adapted to receive earth turned by the plow and to convey such earth to an elevated point of discharge.

The carrier or elevator projects laterally on one side of the frame beyond the supporting wheels and, because of the weight of the projecting carrier, these machines are relatively unstable, and have a marked tendency to tip toward that side on which the carrier projects.

Because elevating graders operate on uneven surfaces, it has generally been considered necessary to provide for the grader frame a three-point or an approximately three-point suspension in order to decrease as much as possible the imposition of torsional stresses on the main frame resulting from the passage of the machine over uneven ground surfaces. This three-point suspension tends to decrease the stability of the already comparatively unstable grader. As a result of these considerations, the front-axle mounting employed on commercial types of elevating graders has usually been a compromise between a pure three-point suspension desirable for the purpose of eliminating the imposition of torsional stresses on the main frame and a four-point suspension desirable from the standpoint of stability of the machine.

In all commercial forms of elevating graders of which we are aware, steering is effected by swinging the front axle about a vertical pivot at its center. Thus, even when machines embodying a four-point suspension are used the decrease in effective front axle tread base-length which results when the axle is swung in turning the grader, is highly objectionable in respect to the resultant decrease of stability.

It is the primary object of our invention to produce a front-wheel mounting for an elevating grader which will not render the grader unstable and which, at the same time, will provide for the substantial elimination from the main frame of torsional stresses which would otherwise result from the passage of the machine over ground of an uneven character. A further object of our invention is to provide an elevating grader which will have a short turning-radius and which will not suffer a marked decrease in stability when being turned sharply.

In carrying out our invention we pivotally interconnect the front axle to the main frame of the machine on a horizontal axis located as far as practicable toward that side of the machine from which the carrier or conveyor projects. The front wheels, instead of being mounted on spindles rigid with the front axle, are mounted on steering knuckles which are interconnected with each other and with the draft tongue of the machine, which draft tongue is pivotally mounted on a vertical axis near the center of the front axle.

The accompanying drawings illustrate our invention: Fig. 1 is a plan view of an elevating grader embodying our invention; Fig. 2 is a detail view illustrating in plan the construction of the front axle; Fig. 3 is a front elevation of the elevating grader; Fig. 4 is a fragmental view similar to Fig. 2 illustrating the wheels in the position they occupy when the grader is being turned sharply to the right; and Fig. 5 is an end elevation of the front axle.

The grader illustrated embodies a generally rectangular main frame 10 supported by front wheels 11 and rear wheels 12. The front wheels, in accordance with our invention, are mounted on steering knuckles 13 which are pivoted on vertical axes respectively to the opposite ends of a front axle 14. The operating arms of the steering knuckles 13 are interconnected by a tie rod 15 to an intermediate point on which there is pivotally connected one end of an arm 16. This arm 16 is in turn pivoted at an intermediate point to the front axle on a vertical axis, and its front end is attached to the draft tongue 17 by means of which the grader is drawn.

As previously indicated, we contemplate that the front axle will be pivotally connected to the main frame on a horizontal axis. In the standard form of elevating graders, the elevator or carrier projects to the right beyond the right-hand side of the frame 10 and even beyond the right-hand wheels, thus creating a tendency for the grader to tip to the right. In accordance with our invention, therefore, we arrange the point of pivotal interconnection between the axle and main frame as near as practicable to the right-hand end of the front axle 14. To this end we secure to the main frame adjacent the front right-hand corner thereof a downwardly projecting leg 20 to the lower end of which the front axle 14 is pivoted as by means of a pivot bolt 21.

The left-hand end of the front axle is guided for vertical movement between two guide bars 22 which project downwardly from the main frame 10 near the front left-hand corner thereof. Bumper springs 23 associated with the left-hand end of the front axle 14 and co-operating with an abutment 24 carried by the main frame serve

yieldingly to limit excessive vertical swinging of the front axle.

The plow 25, which is usually in the form of a dished disk, may be mounted in any desired manner, but we prefer to secure it to a plow-beam 26 which extends generally forwardly and inwardly from the plow 25 and is connected at its front end to the front axle 14. The plow 25 is disposed opposite a carrier or belt-conveyor 27 which receives earth turned by the plow and carries it to an elevated point of discharge beyond the right-hand side of the machine.

For the purpose of attaching the front end of the plow beam 26 to the front axle, we may provide on the front axle two spaced horizontal plates 30 which are provided with a series of alined holes 31 any of which may receive a bolt or pin 32 passing through the eye of an eye bolt 33 that is pivotally mounted on the front end of the plow-beam 26.

The rear end of the plow beam may be supported by a transversely extending thrust-bar 35 which extends across and beneath the main frame to the right-hand side thereof where it is adjustably secured to the main frame as by being provided with a series of holes 36 adapted to receive selectively a pin 37 carried by a bracket 38 mounted on the main frame.

In order that the plow 25 may be adjusted vertically, we may secure to the frame 10 one end of a chain 40 which passes around a sheave 41 carried by a plow beam 26 and thence to winding mechanism 42.

The arrangement of the plow and plow beam just described forms no part of our present invention and constitutes the subject matter of the co-pending application of Floyd D. Wallace, Serial No. 601,351, filed March 26, 1932. Our invention may be used with any desired form of plow-beam or plow-beam mounting.

For the purpose of relieving the leg 20 and the axle guides 22 of horizontal stresses, we may embody in the construction of the machine a radius rod 45. This radius rod preferably has two legs 46 which are secured to spaced points on the front axle and which converge rearwardly to join with each other and with a trunnion 47 which is received in a bearing 48 suitably supported from the main frame 10. The axis of the trunnion 47 is in substantial alinement with the axis of the pivot bolt 21 in order that the front axle and the radius rod may swing as a unit.

To obtain the shortest possible turning-radius with a front-axle construction of the type illustrated it is necessary that the steering knuckle on the inside of the turn assume a position at 90° to the position it occupies when the grader is traveling a straight path. Because of the necessity for providing clearance and avoiding dead-center positions of the steering knuckles 13 and tie rod 15 it is impracticable to swing the steering knuckles through respective arcs of 180° (90° on either side of a normal position); and as a result of this, it is impracticable to obtain the minimum turning radius for turns in both directions. The greatest necessity for sharp turns in the practical operation of an elevating grader arises in the case of turns to the right; and in order to obtain a minimum turning radius for right-turns, therefore, we arrange the parts in such a way that the right-hand steering knuckle 13 can swing rearwardly substantially through a full 90° from its normal position occupied in forward movement of the grader. To this end, we dispose the operating arm of the right-hand steering knuckle 13 at somewhat less than a right-angle to the spindle on which its associated wheel 11 is mounted. We find that the desired result can be secured by arranging the operating arm of the right-hand steering knuckle 13 at an angle of about 75° to its associated wheel-spindle.

In order to avoid skidding of one or the other of the front wheels 11 during a turn, it is necessary that the axes of both front wheels intersect at a point which lies in the vertical plane containing the axes of the rear wheels 12. Any tendency to skid is most noticeable and most objectionable in a sharp turn, and in order to eliminate it in sharp turns to the right, we so arrange the parts that in right turns the left-hand steering knuckle 13 swings through a smaller angle than does the right-hand steering knuckle. The preferred method of accomplishing this purpose is to make the operating arm of the left-hand steering knuckle 13 slightly longer than the operating arm of the right-hand steering knuckle 13.

In a grader where the distance between the vertical axes of the two steering knuckles is approximately 73 inches, we find that the desired results just indicated can be obtained by making the operating arm of the right-hand steering knuckle 15 inches in length and the operating arm of the left-hand steering knuckle 15¾ inches in length. The effective length of the arm 16 between its points of pivotal connection respectively to the front axle 14 and the tie rod 15 is substantially the mean of the lengths of the operating arms of the steering knuckles.

When the grader is being moved forwardly in a straight line, the arm 16 and the operating arms of the steering knuckles 13 are substantially parallel, as illustrated in Fig. 2. Upon a turn to the right, the left-hand steering knuckle 13 swings through a smaller angle than does the right-hand steering knuckle, because of the greater length of its operating arm. The position of the steering knuckles and the arms 16 for the shortest possible turn to the right is illustrated in Fig. 4.

We claim as our invention:

1. In an elevating grader having a main frame and a carrier projecting from one side thereof, front and rear wheels for supporting said main frame, a front axle on which said front wheels are mounted, means for pivotally interconnecting said front axle and main frame on a substantially horizontal axis displaced from the center of the front axle toward that side of the main frame from which said carrier projects, said axle being connected to the frame at the opposite side of the center for free vertical oscillation and means for steering said front wheels.

2. In an elevating grader having a main frame and a carrier projecting from one side thereof, front and rear wheels for suporting said main frame, a front axle, steering knuckles pivotally mounted on said front axle near the ends thereof, said front wheels being mounted respectively on said steering knuckles, means for pivotally interconnecting said front axle and main frame on a substantially horizontal axis displaced from the center of the front axle toward that side of the main frame from which said carrier projects, said axle being connected to the frame at the opposite side of the center for free vertical oscillation above and below said horizontal axis and means for steering said front wheels.

3. The invention set forth in claim 1 with the

addition of guides engaging said front axle at a point spaced from the axis of pivotal interconnection of said front axle and main frame to guide the front axle for vertical swinging movement about said axis, and buffer springs for yieldingly limiting excessive swinging movement of said front axle.

4. The invention set forth in claim 1 with the addition of guides engaging said front axle at a point spaced from the axis of pivotal interconnection of said front axle and main frame to guide the front axle for vertical swinging movement about said axis.

5. In an elevating grader having a main frame and a carrier projecting from one side thereof, front and rear wheels for supporting said main frame, a front axle, provisions interconnecting said front axle and main frame and permitting movement of said front axle in a vertical plane relative to said main frame, steering knuckles pivotally mounted near the ends of said front axle, each of said steering knuckles including a spindle on which one of said front wheels is mounted and an operating arm extending generally rearwardly, the operating arm on that steering knuckle nearest the side of the main frame from which said carrier projects being disposed at an angle less than ninety degrees to its associated spindle, the other operating arm having a length greater than the first named operating arm and being disposed at an angle of greater than ninety degrees to its associated spindle, a tie bar interconnecting said operating arms, and a draft tongue pivotally attached to said front axle on a vertical axis intermediate the ends thereof, said draft tongue being provided with an arm extending rearwardly and pivotally connected to said tie bar.

6. In an elevating grader having a main frame and a carrier projecting from one side thereof, front and rear wheels for supporting said main frame, a front axle, provisions interconnecting said front axle and main frame and permitting movement of said front axle in a vertical plane relative to said main frame, steering knuckles pivotally mounted near the ends of said front axle, each of said steering knuckles including a spindle on which one of said front wheels is mounted and an operating arm extending generally rearwardly, the operating arm on that steering knuckle nearest the side of the main frame from which said carrier projects being disposed at an angle less than ninety degrees to its associated spindle, the other operating arm having a length greater than the first named operating arm and being disposed at an angle of greater than ninety degrees to its associated spindle, a tie bar interconnecting said operating arms, and means for moving said tie bar to swing said steering knuckles jointly about their respective axes.

7. In an elevating grader having a main frame and a carrier projecting from one side thereof, front and rear wheels for supporting said main frame, a front axle, provisions interconnecting said front axle and main frame and permitting movement of said front axle in a vertical plane relative to said main frame, steering knuckles pivotally mounted near the ends of said front axle, each of said steering knuckles including a spindle on which one of said front wheels is mounted and an operating arm extending generally rearwardly, the operating arm on that steering knuckle nearest the side of the main frame from which said carrier projects being disposed at an angle less than ninety degrees to its associated spindle, the other operating arm being disposed at an angle of greater than ninety degrees to its associated spindle, a tie bar interconnecting said operating arms, and a draft tongue pivotally attached to said front axle on a vertical axis intermediate the ends thereof, said draft tongue being provided with an arm extending rearwardly and pivotally connected to said tie bar.

8. In an elevating grader having a main frame and a carrier projecting from one side thereof, front and rear wheels for supporting said main frame, a front axle, provisions interconnecting said front axle and main frame and permitting movement of said front axle in a vertical plane relative to said main frame, steering knuckles pivotally mounted near the ends of said front axle, each of said steering knuckles including a spindle on which one of said front wheels is mounted and an operating arm extending generally rearwardly, the operating arm on that steering knuckle nearest the side of the main frame from which said carrier projects being disposed at an angle less than ninety degrees to its associated spindle, the other operating arm being disposed at an angle of greater than ninety degrees to its associated spindle, a tie bar interconnecting said operating arms, and means for moving said tie bar to swing said steering knuckles jointly about their respective axes.

9. In an elevating grader having a main frame and a carrier projecting from one side thereof, rear frame-supporting wheels mounted in fixed position relative to said frame, front wheels, a front axle on which said front wheels are mounted, means for pivotally interconnecting said front axle and main frame on a substantially horizontal axis displaced from the center of the front axle toward that side of the main frame from which said carrier projects, said axle being connected to the frame at the opposite side of the center for free vertical oscillation, and means for steering said front wheels.

FLOYD D. WALLACE.
WILLIAM A. COST.
JOSEPH W. HARTLEY.