R. E. ADAMS.

GRADER.

APPLICATION FILED JUNE 12, 1912.

1,133,251.

Patented Mar. 30, 1915.

4 SHEETS—SHEET 1.

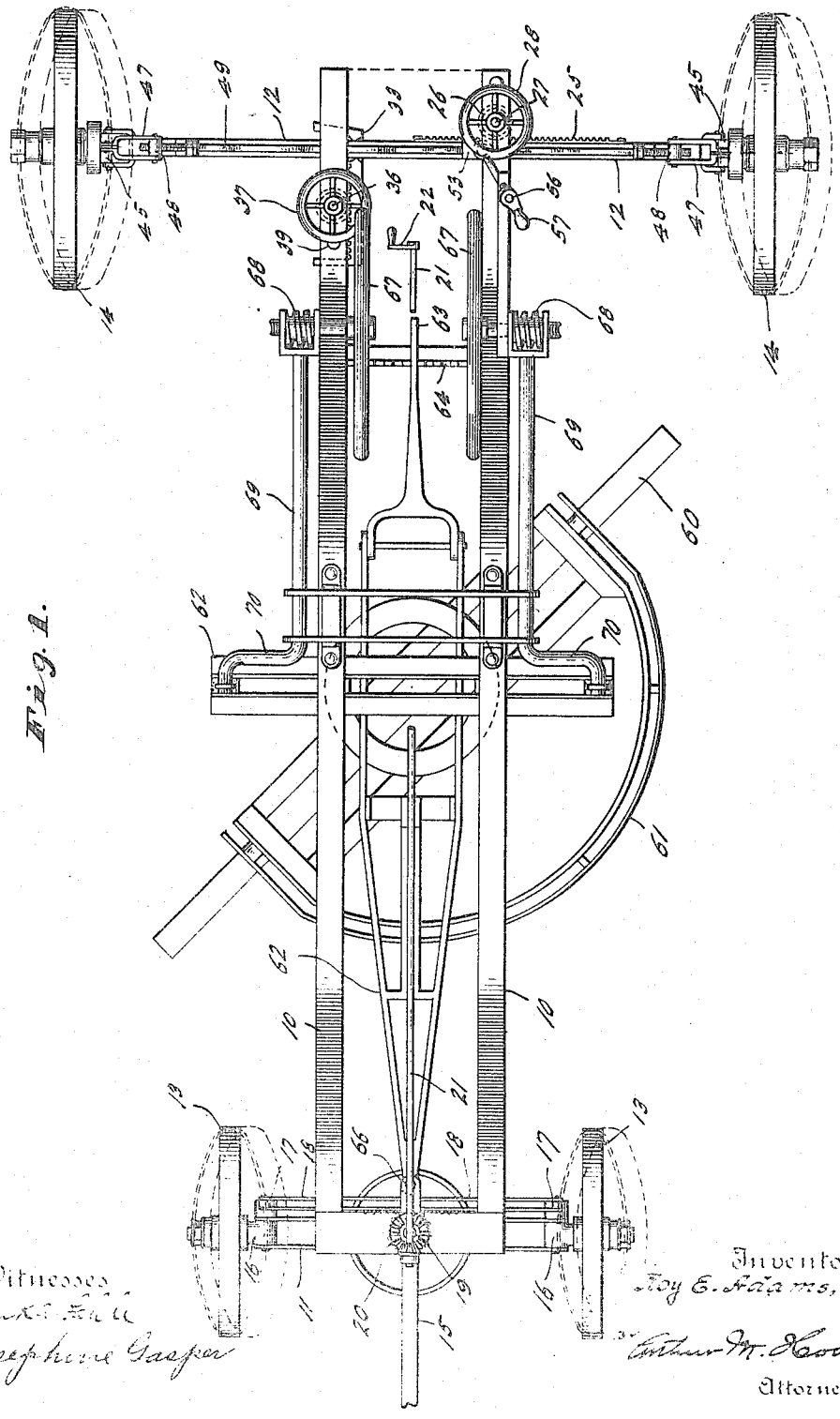


Fig. 1.

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4 SHEETS—SHEET 2.

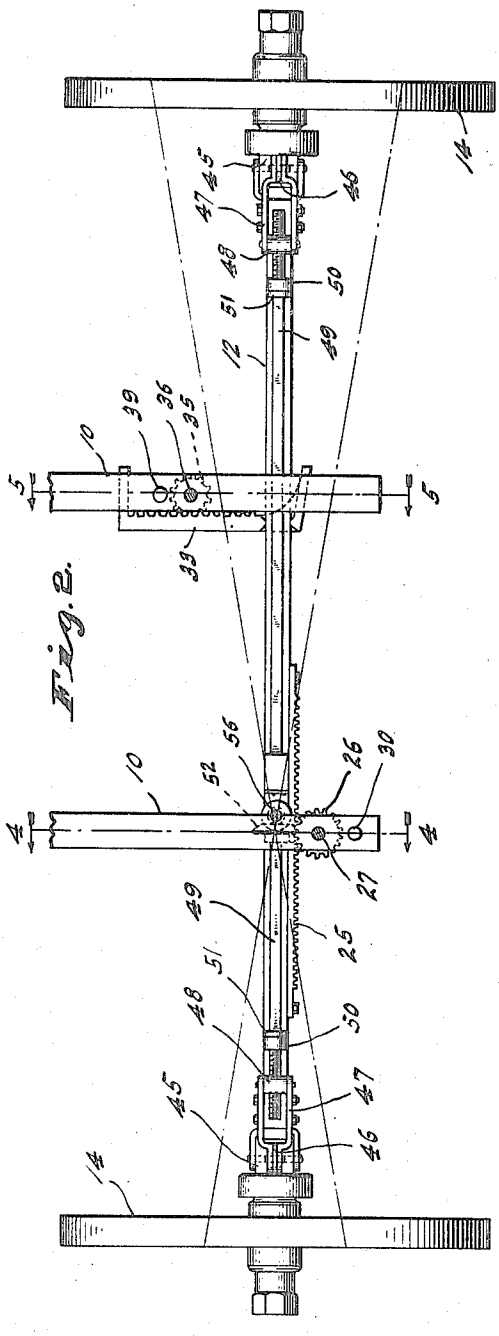


Fig. 2.

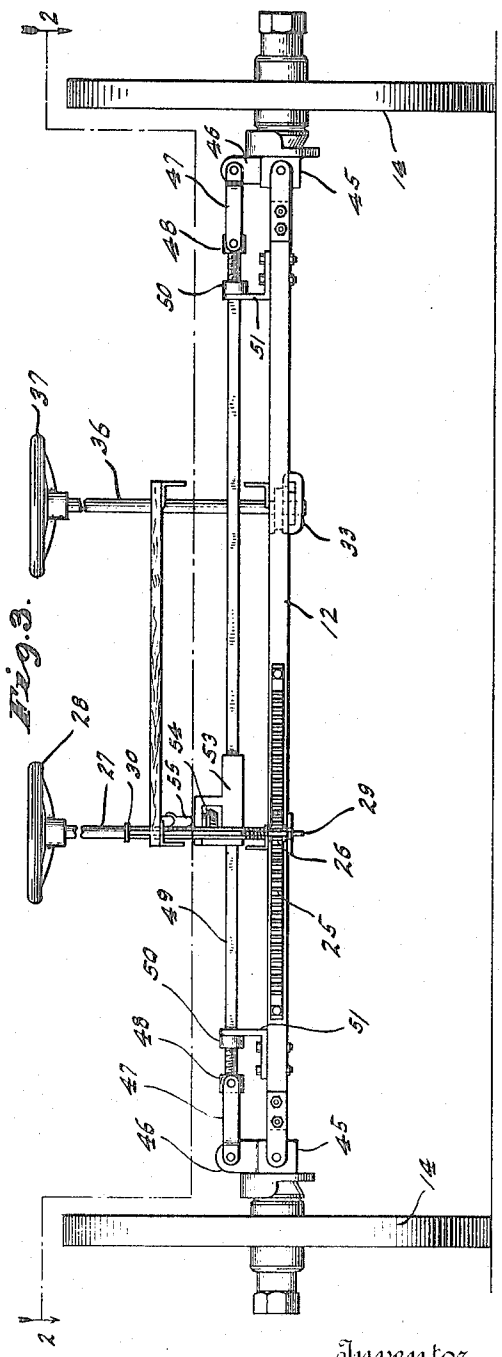


Fig. 3.

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4 SHEETS—SHEET 3.

Fig. 4.

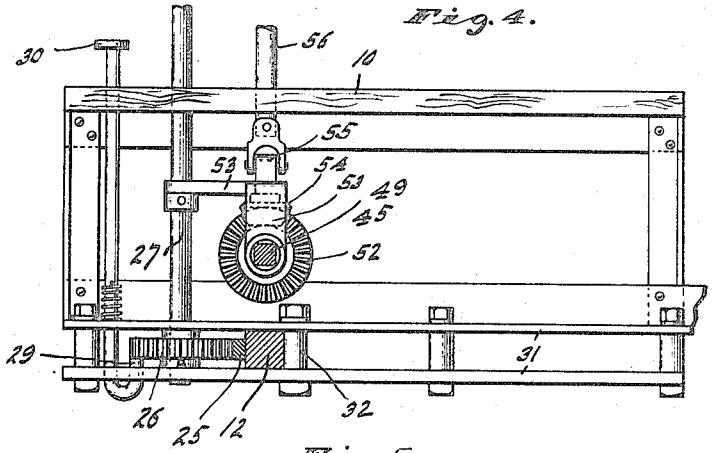


Fig. 5.

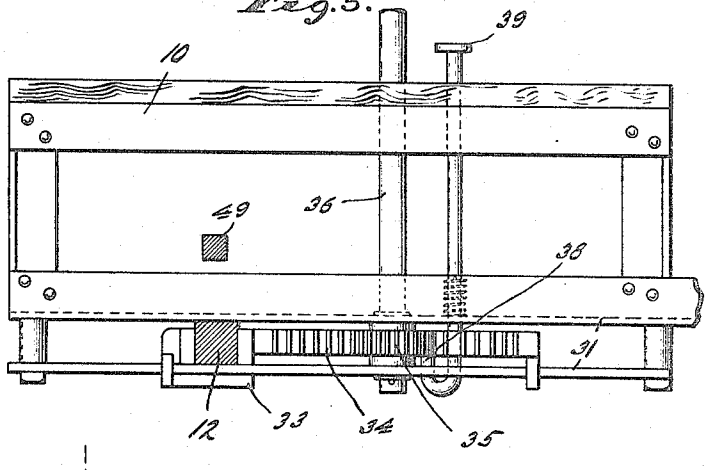
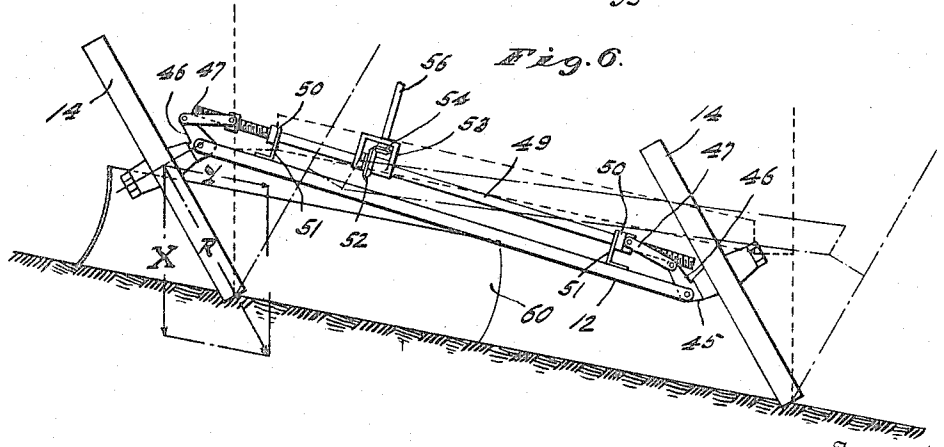


Fig. 6.



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4 SHEETS—SHEET 4.

Fig. 7.

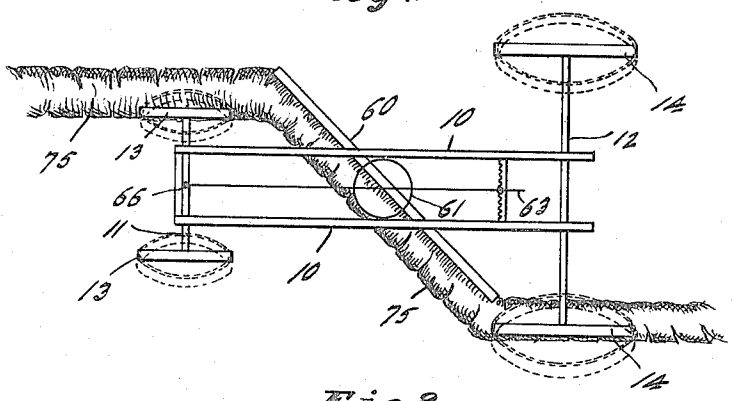


Fig. 8.

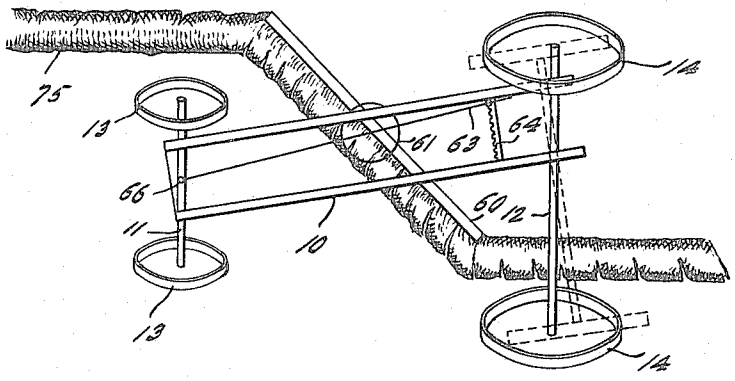
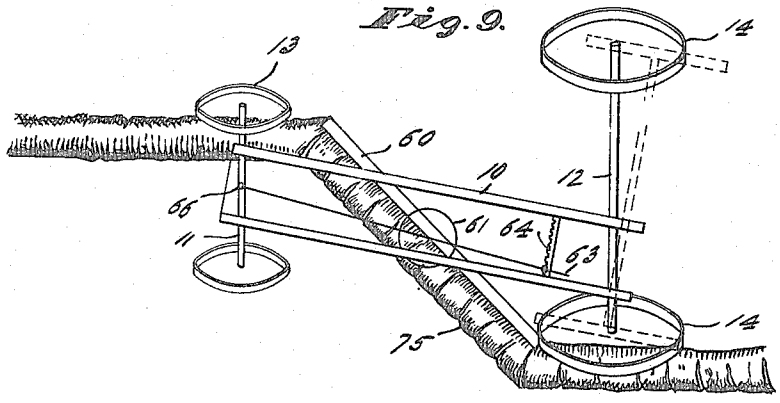


Fig. 9.



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UNITED STATES PATENT OFFICE.

ROY E. ADAMS, OF INDIANAPOLIS, INDIANA.

GRADER.

1,133,251. Specification of Letters Patent. Patented Mar. 30, 1915.

Application filed June 12, 1912. Serial No. 703,126.

To all whom it may concern:

Be it known that I, ROY E. ADAMS, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Grader, of which the following is a specification.

It is the object of this invention to provide a grader in which side draft may be totally eliminated, and in which the relation between the paths of the grader wheels and the dirt-shifting mold board may be varied as desired, to prevent the wheels from traveling in the dirt ridges made by the grader, to obtain maximum lateral shifting of the earth, and for various other purposes hereinafter apparent. To this end I make one of the axles, preferably the rear one, shiftable transversely of the grader frame and skewable to different angles about an axis transverse to the plane of the grader frame; and also make the wheels, preferably on both axles, vertically tiltable relatively to the axles. This combination of movements allows the various adjustments desired to be obtained. In some instances, many of the desired results may be obtained by using only the shifting axle and tilting wheels or the skewable axle and tilting wheels, the tilting of the wheels being essential in all cases in order to prevent side draft.

The accompanying drawings illustrate my invention.

In the drawings, Figure 1 is a plan of a grader embodying my invention, some of the parts being removed for clearness of illustration; Fig. 2 is an enlarged plan view, partly in section on the line 2—2 of Fig. 3, of the rear end of the grader shown in Fig. 1; Fig. 3 is a rear elevation of such grader; Fig. 4 is an enlarged section on the line 4—4 of Fig. 2; Fig. 5 is an enlarged section on line 5—5 of Fig. 2; Fig. 6 is a somewhat diagrammatic rear elevation of the grader with the wheels tilted; and Figs. 7, 8, and 9 are diagrammatic plan views of the grader in operation, showing the effects of the various adjustments.

The grader frame 10 is mounted on a front axle 11 and a rear axle 12, which are provided with front wheels 13 and rear wheels 14, respectively. The front axle 11, to which is attached the wagon tongue 15, is movable relatively to the frame 10 about an axis perpendicular to the plane of such frame, in the usual manner. The wheels 13 are mounted on knuckles 16 pivoted to the axle 11 on axes transverse to such axle and to the axis on which the axle is pivoted to the frame 10, and the knuckles 16 are provided with upwardly projecting arms 17 joined by a connecting rod 18. This rod 18 may be shifted longitudinally by suitable connections from a shaft 19 on the pivotal axis of the front axle 11, said shaft 19 being operated in a suitable manner, as by a bevel gear 20, from an operating shaft 21 which extends substantially to the rear of the frame 10, where the operator's seat (not shown) is mounted, and is there provided with an operating handle 22.

The rear axle 12, which is conveniently of square cross section to prevent it from rotating, is provided on its rear surface with a rack 25 meshing with a gear 26 on the lower end of a shaft 27 mounted in the frame 10, the upper end of the shaft being provided with a hand wheel 28 whereby the shaft and gear may be turned to shift the axle 12 lengthwise. A spring-pressed locking finger 29 normally holds the gear 26 from turning, but may be released by depressing the knob 30. In order to allow the shifting of the axle 12, it is mounted between the frame 10 and two bars 31 parallel to and below such frame and extending longitudinally thereof. The gear 26 is mounted between the frame and one of these bars 31, the rack 25 being held in engagement with said gear by means of a vertical pin 32, extending between the said bar and the frame. The axle 12 where it passes between the frame 10 and the other bar 31 is mounted in a frame 33, which engages the axle in front and rear, said frame 33 being mounted on the adjacent bar 31 and provided with a rack 34 which meshes with a gear 35 mounted on the lower end of a vertical shaft 36 provided at its upper end with a hand wheel 37. By turning the wheel 37, the angle between the shaft 12 and the longitudinal axis of the frame 10 may be varied, as indicated by the dotted lines in Fig. 2. The gear 35 may be locked against movement by a spring finger 38, which may be released by a depressing knob 39. The rear wheels 14 are mounted on knuckles 45 pivoted to the axle 12 on substantially horizontal axes transverse to the axle. The knuckles 45 have upwardly projecting arms

46 connected by links 47 to nuts 48 coöperating with threads on the ends of a bar 49. This bar is fixed longitudinally of the axle 12, as by being provided with collars 50 which bear against opposite sides of brackets 51 fixed on the axle. The bar 49 is square between the brackets 51, and passes through a square central opening in a bevel gear 52 mounted in a frame 53 pivoted on the shaft 27. The bevel gear 49 meshes with a bevel pinion 54 also mounted in the frame 53, said bevel pinion 54 being connected by a universal joint 55 to the lower end of a shaft 56 provided at its upper end with an operating handle 57. By turning the handle 57, the rod 49 is rotated about its axis to produce similar shifting movements of the nuts 48, which in turn tilt the wheels 14.

The mold board or scraping blade 60, by which term is included any practical means for moving dirt transversely of the direction of movement, is mounted on a turn table 61 rotatable about an axis approximately perpendicular to a mold board frame 62, which is mounted on the frame 10 and may be shifted crosswise thereof in any suitable manner, as by a pivoted operating handle 63 which may be dropped into any one of a series of notches in a notched cross bar 64. To allow this shifting, the front end of the mold board frame 12 is conveniently pivoted to the frame 10 near the front end thereof, as at 66. The mold board frame 62 may be tilted, to raise and lower the ends of the mold board 60 relative to each other and to the plane of the frame 10, by hand wheels 67 connected by worm gears 68 to shafts 69, provided at their ends with cranks 70 respectively connected to opposite sides of the frame 62 in a common manner.

When the grader is operating to move a ridge of dirt 75 transversely of the grader, it often happens that the wheels 13 and 14, or some of them, tend to run in the ridge of dirt before or after it is shifted, as shown in Fig. 7, which shows in dotted lines how the wheels must be tilted in order to avoid side draft. To overcome this tendency, the axle 12, by proper operation of the hand wheel 28, may be shifted transversely of the frame 10 to bring it either to the position, relative to the frame, shown in dotted lines in Fig. 8 or that shown in Fig. 9; and also, by proper operation of the hand wheel 37, may be skewed relatively to the frame 10 to bring it to the position shown in full lines in Fig. 8 or Fig. 9, so as to bring the axle at right angles to the desired direction of movement of the grader while frame 10 is at an oblique angle to such direction. In order to prevent side draft, or side slipping of the wheels 13 and 14, such wheels are given the proper tilting out of the vertical plane, the amount of tilting being such that the plane of any wheel will substantially coincide with the resultant R of the force of gravity X and the side pressure Y from the mold board 60 on any wheel, as indicated by the parallelogram of forces shown at the left of Fig. 6. By thus eliminating side draft, both the work required to operate the grader and the wear on the grader are greatly diminished. In some cases less than all of the wheels may be made tiltable, or some or all of the wheels may be given a permanent tilt equal to the average of the proper theoretical tilts desirable. If necessary or desirable, the mold board frame 62 is also adjusted crosswise of the frame 10 and tilted, and the turn table 61 is adjusted about its axis, to keep the mold board 60 in the proper position relative to the ridge of dirt 75 to be moved, though the wheels 13 and 14 are very considerably changed in position relative to such ridge. Thus the mold board 60 is shown in the same position relative to the ridge of dirt 75 in Figs. 7, 8, and 9, though all other parts of the grader are shown in different positions in said figures. Ordinarily in practice the various adjustments are made as nearly simultaneously as possible, and are continually being changed, in whole or in part, to suit the varying conditions encountered.

By reason of the combination of adjustments provided, many desirable results can be obtained which are not otherwise obtainable. The shifting of the rear axle 12 transversely of the frame 10 allows the mold board 60 to be shifted into or out of line with either wheel 14, so that such wheels may be made to travel any path desired within the limits of adjustment, side draft being prevented by the proper tilting of the wheels. This advantage is augmented by making the axle 12 at the same time skewable relatively to the frame 10, as thereby the frame may be put at an angle to the direction of travel of the grader while the axles may still be perpendicular to such direction of travel. Similarly the shifting of the axle may be used to cause one wheel 14 to bear against the side of a ditch when the grader is used for lifting material out of the ditch, thus giving the wheel an additional bearing to prevent side draft. This is of advantage when the side of the road is quite steep, and as a result the wheels cannot be tilted far enough entirely to eliminate side draft. The long axle 12 also allows the higher wheel 14 in the last named operation to be farther up on the crown of the road, where the road is more nearly flat, so that the angle of the shaft 12 to the horizontal may be lessened. The skewing of the axle 12, even without shifting it, is of advantage in putting the point of the mold board into a bank, as in widening a road, and also enables the full width of the mold board to be

used at all times. Of course, in all these operations, the wheels 13 and 14 should be tilted to the proper angle to prevent side draft. Many other operations are also rendered possible by the combination of movements provided, in some cases it being necessary to use only the skewing and tilting adjustments and in others only the shifting and tilting adjustments. The various operations and adjustments are facilitated by the transverse shiftability of the turn table 61 of the mold board 60.

I claim as my invention:

1. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and shiftable transversely thereof.

2. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of the said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame.

3. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axle, and a mold board carried by said frame and shiftable transversely thereof.

4. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axles, and a mold board carried by said frame.

5. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and shiftable transversely thereof.

6. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame.

7. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and adjustable about an approximately vertical axis to different angles relative to the frame.

8. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axles, and a mold board carried by said frame and adjustable about an approximately vertical axis to different angles relative to the frame.

9. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and adjustable about an approximately vertical axis to different angles to the frame.

10. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and having its two ends relatively adjustable in height.

11. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and some of the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axles, and a mold board carried by said frame and having its two ends relatively adjustable in height.

12. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and some of the wheels being tiltable to different vertical angles relative to their

associated axles, and a mold board carried by said frame and having its two ends relatively adjustable in height.

13. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and some of the wheels being tilted, and a mold board carried by said frame.

14. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and some of the wheels being tilted, such tilting being independent of any movement of said axles, and a mold board carried by said frame.

15. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and some of the wheels being tilted relatively to their supporting axles, and a mold board carried by said frame.

16. A grader, comprising a frame, supporting wheels therefor, one of the supporting wheels being skewable, transversely shiftable, and tiltable relatively to the frame, said adjustments being obtainable independently of one another, and a mold board carried by said frame.

17. A grader, comprising a frame, supporting wheels therefor, one of the supporting wheels being skewable, transversely shiftable, and tiltable relatively to the frame, and a mold board carried by said frame.

18. A grader, comprising a frame, a pair of supporting wheels therefor, said supporting wheels as a unit being skewable, transversely shiftable, and tiltable relatively to said frame, and a mold board carried by said frame.

19. A grader, comprising a frame, a pair of supporting wheels therefor, said supporting wheels as a unit being skewable and tiltable relatively to said frame, said two adjustments being obtainable independently of each other, and a mold board carried by said frame.

20. A grader, comprising a frame, a pair of supporting wheels therefor, said supporting wheels as a unit being tiltable and transversely shiftable relatively to said frame, and a mold board carried by said frame.

21. A grader, comprising a frame, a pair of front supporting wheels and a pair of rear supporting wheels therefor, said rear supporting wheels as a unit being skewable, transversely shiftable, and tiltable relatively to said frame, and said front supporting wheels as a unit being tiltable relatively to said frame, and a mold board carried by said frame.

22. A grader, comprising a frame, a pair of front supporting wheels and a pair of rear supporting wheels therefor, said rear supporting wheels as a unit being shiftable and tiltable relatively to said frame, said two adjustments being obtainable independently of each other, and said front supporting wheels as a unit being tiltable relatively to said frame, and a mold board carried by said frame.

23. A grader, comprising a frame, a pair of front supporting wheels and a pair of rear supporting wheels therefor, said rear supporting wheels as a unit being tiltable and transversely shiftable relatively to said frame and said front supporting wheels as a unit being tiltable relatively to said frame, and a mold board carried by said frame.

24. A grader, comprising a frame, a pair of front supporting wheels and a pair of rear supporting wheels therefor, said rear supporting wheels as a unit being skewable, transversely shiftable, and tiltable relatively to said frame, and a mold board carried by said frame.

25. A grader, comprising a frame, a pair of front supporting wheels and a pair of rear supporting wheels therefor, said rear supporting wheels as a unit being skewable and tiltable relatively to said frame, said two adjustments being obtainable independently of each other, and a mold board carried by said frame.

26. A grader, comprising a frame, a pair of front supporting wheels and a pair of rear supporting wheels therefor, said rear supporting wheels as a unit being tiltable and transversely shiftable relatively to said frame, and a mold board carried by said frame.

27. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and shiftable transversely thereof.

28. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of the said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame.

29. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles rela-

tive to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axle, and a mold board carried by said frame and shiftable transversely thereof.

30. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axles, and a mold board carried by said frame.

31. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and shiftable transversely thereof.

32. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame.

33. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and adjustable about an approximately vertical axis to different angles relative to the frame.

34. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axles, and a mold board carried by said frame and adjustable about an approximately vertical axis to different angles relative to the frame.

35. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and adjustable about an approximately vertical axis to different angles to the frame.

36. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and having its two ends relatively adjustable in height.

37. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles independently of any movement of said axles, and a mold board carried by said frame and having its two ends relatively adjustable in height.

38. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and all the wheels being tiltable to different vertical angles relative to their associated axles, and a mold board carried by said frame and having its two ends relatively adjustable in height.

39. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame and the rear axle being skewable to different angles relative to the frame, and all the wheels being tilted, and a mold board carried by said frame.

40. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, the rear axle being skewable to different angles relative to the frame, and all the wheels being tilted, such tilting being independent of any movement of said axles, and a mold board carried by said frame.

41. A grader, comprising a frame, front and rear axles on which said frame is mounted, supporting wheels for each axle, one of said axles being shiftable transversely of the frame, and all the wheels being tilted relatively to their supporting axles, and a mold board carried by said frame.

In witness whereof, I have hereunto set my hand at Indianapolis, Indiana.

ROY E. ADAMS.

Witnesses:

JOSEPHINE GASPER,

G. B. SCHLEY.