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F. E. ARNDT

REAR AXLE MOUNTING FOR ROAD GRADERS

Filed March 18, 1924

5 Sheets-Sheet 1

Inventor

F. E. ARNDT,

By *F. E. ARNDT,*
Frederick S. Hill, Attorney

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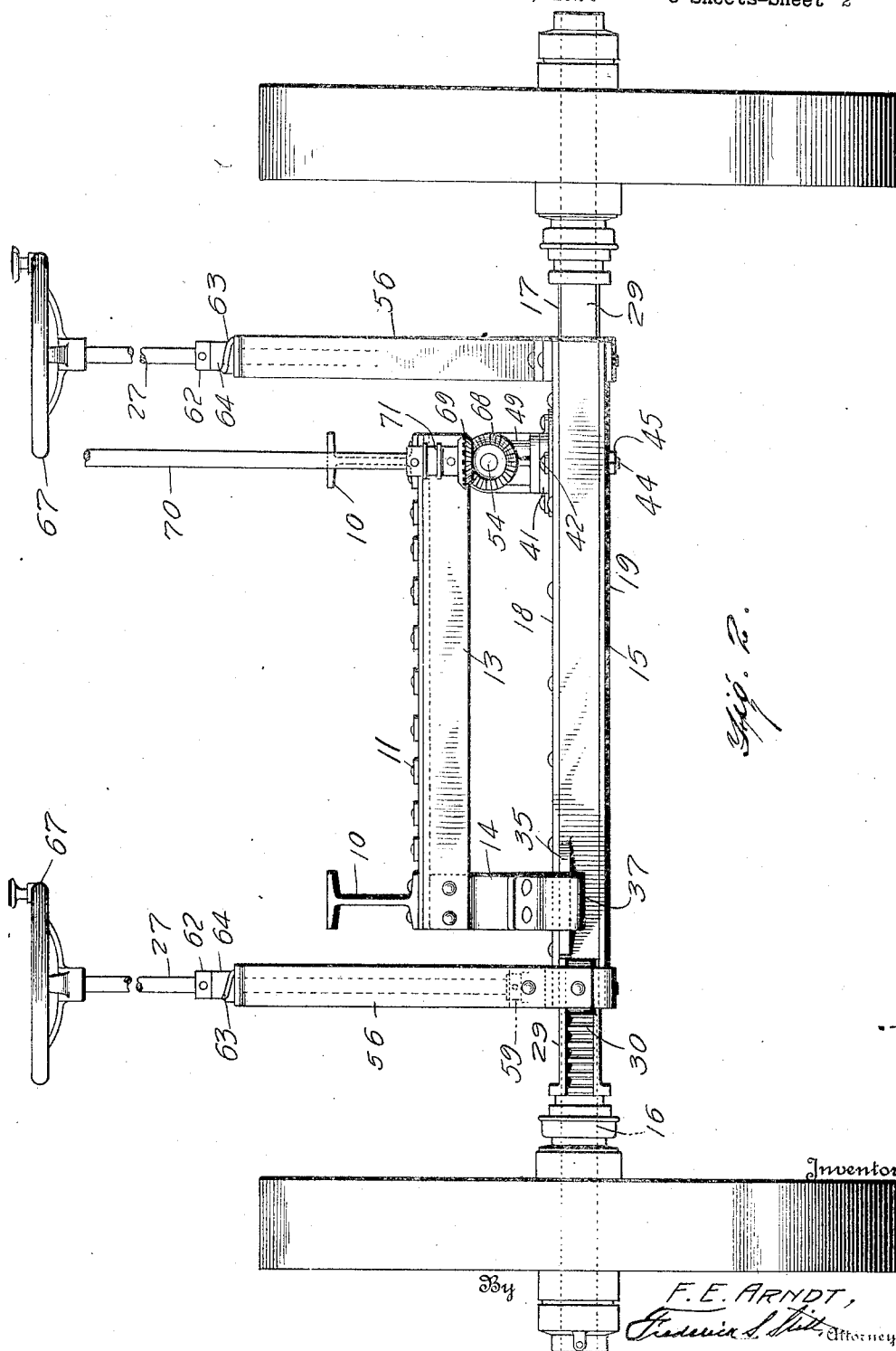
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Attorney

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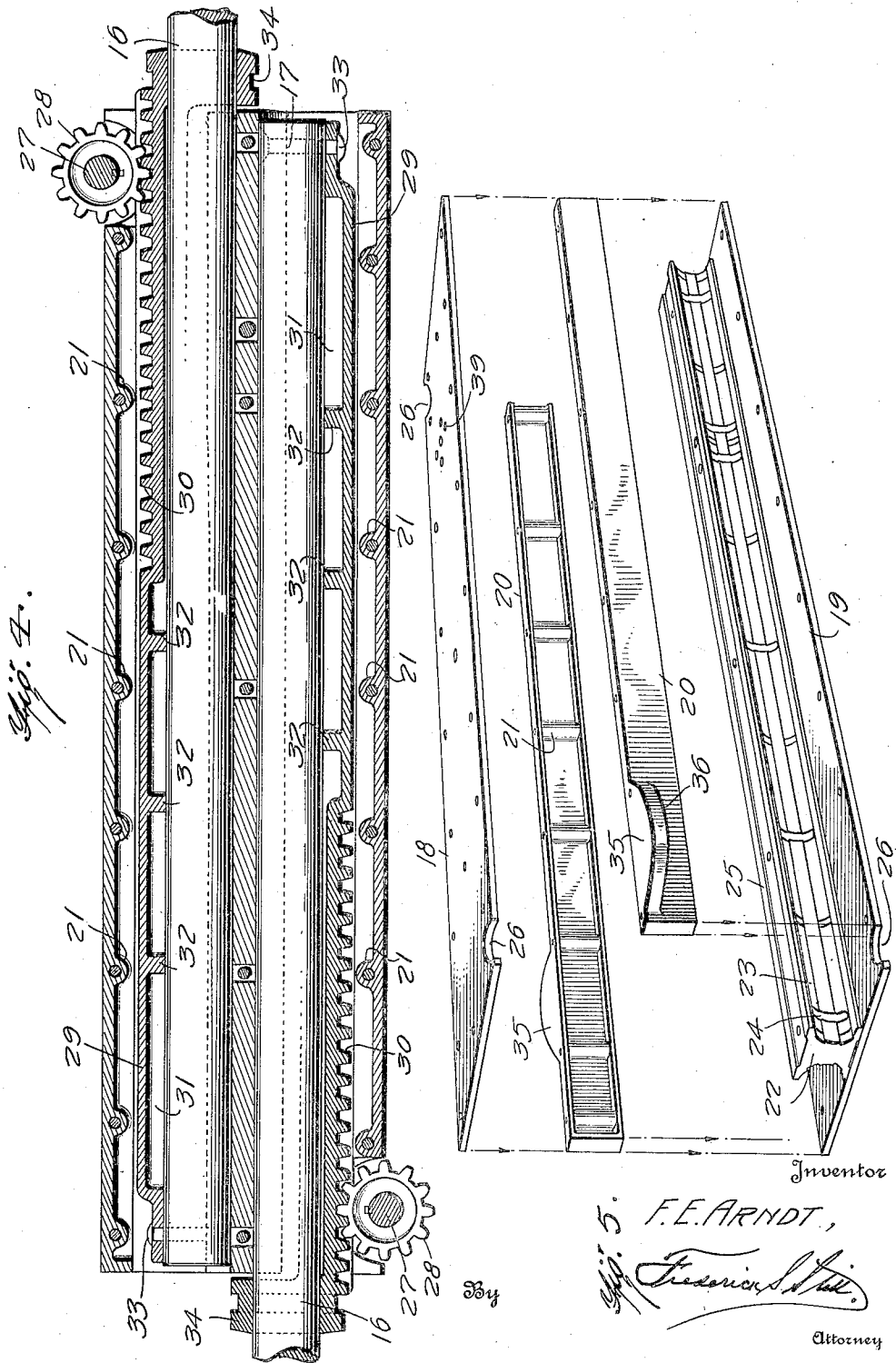
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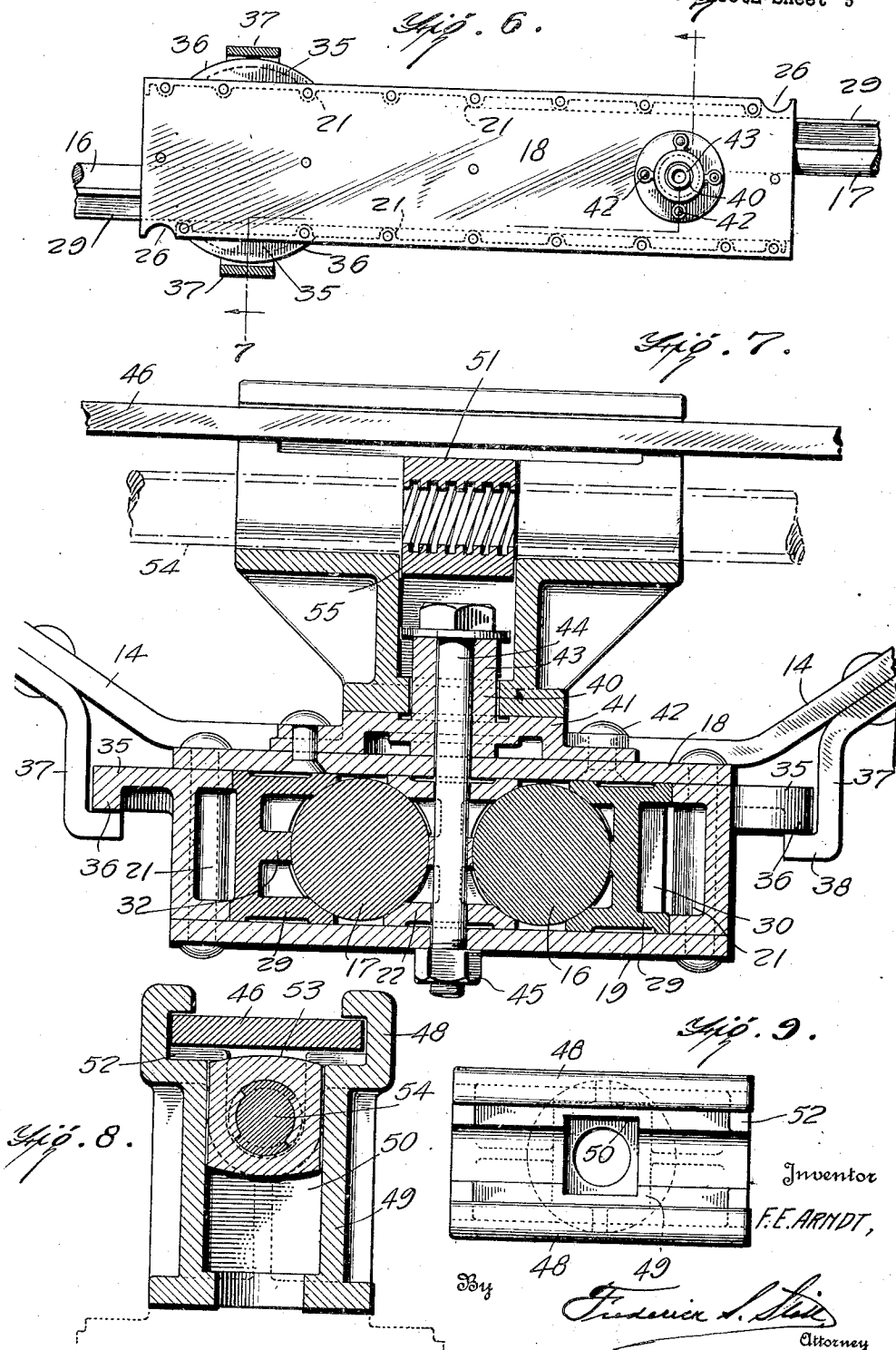
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REAR AXLE MOUNTING FOR ROAD GRADERS

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UNITED STATES PATENT OFFICE.

FRANKLIN E. ARNDT, OF GALION, OHIO, ASSIGNOR TO THE GALION IRON WORKS & MFG. CO., OF GALION, OHIO, A CORPORATION OF OHIO.

REAR AXLE MOUNTING FOR ROAD GRADERS.

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This invention relates to road graders, and particularly to that type of grader wherein the rear axle is laterally extensible and is pivotally connected with the frame so that the rear axle may be adjusted to different work to be done.

One of the necessities of structures of this character is that the mechanism shall be strong, positive in its action, and readily manipulated.

The general object of the present invention is to provide a construction which secures these results, and a further object is to provide axle supporting means in which the parts are entirely housed so that no dirt can enter into the gearing.

A still further object is to provide means for firmly locking the axle in its extended position against any sidewise thrust.

Another object is to provide an improved form of box with means for holding the two shafts or spindles in the box in proper spaced relation against bending strain and which will have as little contact as possible with the spindles or racks to thereby reduce friction as much as possible.

Still another object is to provide improved means whereby the box, holding enclosed the overlapping portions of the axle spindles and their racks, may be pivotally supported on the frame for swinging movement in a horizontal plane, and to provide means for shifting this box which is of such character that it will hold the box from further swinging movement in either direction.

Other objects have to do with the details of construction and arrangement of parts as will appear more fully hereinafter.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a top plan view of the rear portion of a road grader constructed in accordance with my invention;

Figure 2 is a rear elevation of the construction illustrated in Figure 1;

Figure 3 is a section on the line 3—3 of Figure 1;

Figure 4 is a horizontal longitudinal section through the box within which the respective axle spindles and their respective racks are housed;

Figure 5 is a perspective view of the axle housing box showing the various parts separated;

Figure 6 is a top plan view of the axle housing box;

Figure 7 is a section on the line 7—7 of Figure 6;

Figure 8 is a transverse section through the slide which connects the swinging end of the spindle box to the operating screw.

Figure 9 is a top plan view of the construction illustrated in Figure 8;

Figure 10 is a perspective view of one of the locking clutches for one of the operating shafts;

It will be seen that I have illustrated only so much of a grader as is pertinent to my present invention, it being understood that the invention applies to road graders such as are used for heavy work and which are normally drawn by tractors.

Referring to the drawings, 10 designates the frame beams of the machine, these beams being shown as parallel and as supporting a platform 11 of any suitable character, this platform 11 in turn being supported by transverse beams 13, these being riveted to the extremities of the beams 10 and being supported thereby. To these transverse beams 13 are attached the downwardly and centrally extending supporting brackets 14.

Operatively supported upon these brackets 14 is a box, designated generally 15, which box is pivotally connected at one end of the supporting frame, as will be later stated, and at its other end is free to swing. This box is adapted to contain the axles 16 and 17, these axles being illustrated particularly in Figure 4. The box, as shown in Figure 5, consists of a top plate 18, a bottom plate 19, and the opposed side plates 20. These side plates are formed channel-shaped in cross section and at intervals are formed with rounded bosses 21, through which the bolts pass which hold the top plate, and bottom plates and the side plates together.

Attached to the bottom plate 19 and extending longitudinally thereof and disposed along the middle thereof is the spacer 22 which is bolted to the bottom plate, there being bolts passing through the top plate and thus through this spacer. This spacer, as shown in Figure 7, has vertically concave side faces and longitudinally extending slots 23 with vertical concavely opposed rods 24 so that the spacer only touches the convex face of the axle at intervals. The upper

and under faces of the spacer 22 are longitudinally recessed, as at 25. The spacer has a length equal to the length of the plates 18 and 19. Each of these plates 18 and 19 is cut away at its diametrically opposite corners, as at 26, for the passage of the shafts 27 which carry the pinions 28, as shown in Figure 4. The space between each concave face of the spacer 22 and the side wall 21 is sufficient to accommodate any connection with each shaft and rack 29. This rack, as shown most clearly in Figure 4, has a length somewhat greater than the length of the box within which the rack operates and each rack is formed adjacent one end with the outwardly confronting rack teeth 30. The remainder of the rack is formed upon its inner face with recesses 31 intersected by transverse and longitudinal ribs 32 so that the rack, while having a plurality of points of contact with the axle spindle 16 or 17, as the case may be, only bears at intervals against the axle spindle but is sufficiently engaged therewith to prevent any tendency of the axle spindle and the rack to buckle with relation to each other. The purpose of making these recesses 31 is to lighten the racks without any undue loss of strength.

Each rack is attached to the axle spindle at its outer end by means of a bolt, rivet or the like 33, while the opposite end of each rack extends laterally to provide an eye 34 through which the axle spindle passes. The pinions 28 mounted upon the shafts 27 engage the teeth of the rack and by turning these wheels it is obvious that the racks will be shifted inward or outward and that each rack and its corresponding axle spindle may be shifted independently of the other rack and spindle.

The detailed means whereby the axle spindles are shifted inward or outward having been described, I will describe the manner in which the box is mounted for swinging movement. As shown in Figure 5, the side members 20 are provided each adjacent one end with an outwardly projecting flange or web 35 which is approximately semi-circular in form and has a downwardly depending marginal flange 36, this marginal flange 36 being arcuate in form. The brackets 14 which are bolted to the top plate 18 have bolted to them the vertically extending irons 37 having inwardly extending terminal ends 38 which bear against the under faces of the arcuate flanges 36, as illustrated in Figure 7, and thus support the box for rotative movement.

The opposite end of the box has mounted upon its upper surface by means of rivets or bolts passing through the holes 39 in the plate 18 the bearing member 40. This bearing member, as illustrated in Figure 7, is formed with a circular base flange 41 which

is riveted, bolted or otherwise attached to the upper plate 18 by bolts 42 passing through the perforations 39 and has a central hub 43, which at its lower end bears upon the upper face of the plate 18.

Passing through this central hub 43 is the king bolt 44 which extends downward through an aperture in the separator 23 and, of course, downward through the two plates 18 and 19, this bolt having a head at one end and a nut 45 at the other. Extending longitudinally of the machine and immediately above this member 40 is a guide bar 46 which is attached at its ends in any suitable manner to the transversely extending angle irons 13, and upon this guide bar there is mounted a slide 47 which is illustrated in detail in Figures 7 and 8. As shown in Figure 8, the slide is formed with the lateral flanges 48 which embrace the side edges of the guide 46 and are adapted to slide thereon. The side and end walls 49 of this slide define a rectangular opening 50 within which is disposed a nut 51. The end walls 52 of the member 47 are downwardly recessed or cut away at 53, as shown in Figure 8, for the passage of a worm shaft 54. This worm shaft passes through the nut engaging with the thread 55 thereof, and obviously as the worm shaft is rotated it will act to shift the nut longitudinally along the shaft and will thus cause the slide 47 to move longitudinally along the guide bar 46 and thus shift the free end of the box. Of course, it is obvious that under these circumstances the longitudinal axis of the box will change its angular relation to the shaft 54 and to the guide bar 46, and it is to this end that the slide has swivel engagement with the upwardly projecting hub portion 43 of the box, as illustrated in Figure 7. It will be obvious also that as the shaft 54 is rotated in one direction or the other, the box will be swung upon its center and thus the axle will be disposed at any desired inclination to the line of draft, the nut 51 being held from any longitudinal movement relative to the slide and from any rotary movement.

For the purpose of operating the shafts 27 which carry the pinions, each shaft, as illustrated in Figure 3, is upwardly extended, and the pinion is splined upon the shaft so that the shaft is vertically movable with relation to the pinion 28. The shaft is mounted in an upstanding U-shaped frame 56, through which the shaft passes. The shaft is urged downward by means of a spring 57 bearing at its upper end against the upper end of the frame 56 and at its lower end against a collar 58. The lower end of the shaft carries upon it a collar 59 having downwardly directed clutch teeth which are adapted to engage with upwardly directed clutch teeth 60 mounted upon an

angle iron 61, as illustrated in Figure 10, this angle iron being bolted to the frame. Thus it is obvious that when the shaft 27 is forced downward by the spring 57, the clutch teeth on the collar 59 will engage with the clutch teeth 60 to hold the shaft and, therefor, hold the pinion from rotation.

For the purpose of lifting the shaft 27 out of its engagement with the fixed clutch teeth 60, I provide upon the shaft 27 above the upper end of the frame or stand 56, the collar 62 and mount upon the upper face of the stand 56 the cam member 63 having a cam whose face is concentric to the axis of the shaft 27, this face being spiral or helical.

Disposed between the collar 62 and this cam member 63 is a rotatable cam member 64, the under face of which is helical and fits the helical face of the cam 63. This cam member 64 is provided with the outstanding arm 65 whereby this cam may be rotated. Obviously upon a rotation of the cam in one direction, the shaft 27 will be raised so as to free it from the clutch teeth 60 and, therefore, the shaft may be rotated by means of the wheel 67 or through other suitable means to that end. On the other hand, when the handle 65 is turned in the opposite direction, the shaft 27 will be lowered and engaged from any rotative movement, thereby locking the pinions 28 and locking the spindles 16 and 17 and their coacting racks.

It will be seen from Figure 2 that there are two of these shafts 27 located at opposite ends of the box 15 and thus each axle spindle may be shifted outward or inward independently of the other axle spindle and thus both wheels may be shifted outward to increase the transverse wheel base of the vehicle or one may be shifted outward and the other left in its normal position. The purpose of thus shifting these wheels outward is to permit one of the wheels, for instance, to operate beyond the earth which has been cast up by the grader from a ditch or to permit one wheel to travel upon the road itself while the other wheel travels upon the bank at the side of the road. There are a large variety of circumstances which demand this independent adjustment of the two rear wheels and this mechanism puts these two rear wheels under the complete control of the operator so that they may be adjusted at any time with a minimum of effort.

For the purpose of swinging the box 15 which supports the two axle spindles, I provide the screw shaft 54, this shaft being supported in suitable bearings 67, and the shaft carries at its extremity the beveled gear wheel 68 which meshes with a beveled gear wheel 69 carried at the lower end of a vertical operating shaft 70 which is supported in a suitable bracket 71 which extends upward and is provided with a hand

wheel 72. This shaft 70 is disposed at the rear end of the machine, as illustrated in Figure 1. Inasmuch as the shaft 54 is screw-threaded and operates on a nut, it is obvious that it in itself locks the box 15 in its adjusted position, and it will further be obvious that this screw-threaded shaft 54 and the nut together give a very powerful action upon the box 15 to shift it and that this is increased by the fact that this nut is operatively connected to that end of the box 15 remote from the pivotal center thereof.

The purpose of shifting the rear axle composed of the box 15 and the wheel spindles 16 and 17 is to adjust the axle to whatever kind of work is being done. Thus when widening a road or cutting down a bank beside the road, the grader has a tendency to slide away from the work, but by pivoting the axle the operator compels the grader to crowd against the work and hold it in its proper place. In this way the work is done quickly and well. The pivot axle is used not only to overcome the side draft but to guide the machine, it being shifted just enough to hold the machine exactly where desired. By using a pivoted axle, the front and rear trucks of a grader can always be kept in perfect alignment and thus the rear end of the grader is prevented from sliding sidewise, which causes heavy draft and an uneven wear on the spindles. If the axle is shifted just enough to overcome the side draft, the wheels will wear evenly on the spindles, thus insuring a much lighter pull.

It will be seen that a mechanism constructed in accordance with this invention is very simple and yet strong, that the action is positive, and that the parts are locked in their adjusted position. The rear axle may be readily assembled.

While I have illustrated a construction which in its general form and in details has been found to be particularly effective for heavy duty road graders as well as light duty road graders, I do not wish to be limited to the details as it is obvious that these might be changed in many ways without departing from the spirit of the invention as defined in the appended claims.

I claim:

1. A grader including a supporting frame, a rear axle comprising an open ended box, two wheel spindles having racks and extending into opposite ends of the box, pinions mounted in the ends of the box and engaging said racks, a shaft for each pinion splined therein and adapted to have longitudinal movement through the corresponding pinion, a supporting member for each shaft, a clutch member mounted on said supporting member, a clutch-toothed member fixed on the shaft and confronting the opposed clutch member, and springs urging said shafts in a direction to carry the

clutching members into engagement with each other.

2. A grader including a supporting frame and a rear axle comprising an open-ended box and a medially disposed separator forming part of the box and extending down the middle thereof, this separator being transversely concave on its opposed faces, the side walls of the box being recessed, a pair of axle spindles mounted within the box and extending inward from opposite ends thereof and each axle spindle extending the entire length of the box, the spindles bearing against the concave faces of the separator, racks operatively attached to the axle spindles upon the outer face thereof and bearing against the side walls of the box, pinions disposed within the box and engaging said racks, and manually operable means for rotating each of said pinions independently of the other.

3. A grader including a supporting frame and a rear axle comprising an open-ended box and a medially disposed separator forming part of the box and extending down the middle thereof, this separator being transversely concave on its opposed faces, the side walls of the box being recessed, a pair of axle spindles mounted within the box and extending inward from opposite ends thereof and each axle spindle extending the entire length of the box, the spindles bearing against the concave faces of the separator, racks operatively attached to the axle spindles upon the outer face thereof and bearing against the side walls of the box, pinions disposed within the box and engaging said racks, and manually operable means for rotating each of said pinions independently of the other, each of said racks being longitudinally recessed upon its inner face whereby to touch the shaft at a plurality of points in the length thereof.

4. A grader including a supporting frame, a rear axle comprising a casing, manually extensible wheel spindles mounted therein, means for swingingly supporting the casing adjacent one end for movement in a horizontal plane, means for manually oscillating the other end of the casing including a longitudinally extending worm, and a nut carried thereby, the nut being swivelly connected to the casing.

5. A grader including a supporting frame and a rear axle comprising a casing, manually extensible wheel spindles mounted therein, means for swingingly supporting the casing adjacent one end for movement in a horizontal plane, means for manually oscillating the other end of the casing including a nut swivelly connected to the casing at one end thereof, a worm extending through the nut and including manually operable means whereby the worm may be

rotated, and a transversely extending guide for the nut.

6. A grader including a supporting frame and a rear axle, a casing within which the rear axle is disposed, the casing being mounted adjacent one end upon the frame for oscillation in a horizontal plane, a member rotatably mounted upon the other end of the casing, a nut loosely carried by said member but held from rotation, the member extending above the nut, a worm passing through the upward extension of said member and through said nut and operatively engaging the latter, and a guide passing through the upper end of said member and fixed upon the supporting frame.

7. A grader including a supporting frame, a transversely extending open-ended casing swingingly supported at one end upon the frame, said supporting frame permitting longitudinal movement of the casing laterally of the frame, laterally extending wheel spindles mounted in the casing, a member having an upwardly extending hub, a nut carrying member rotatably supported upon the casing for oscillation around said hub, a nut loosely supported in said member, a worm engaging said nut, and a fixed guide carried by the supporting frame and with which said member engages.

8. A grader including a supporting frame, a transversely extending open-ended casing swingingly supported at one end upon the frame, said supporting frame permitting longitudinal movement of the casing, laterally extensible wheel spindles mounted in the casing, manually operable means for independently shifting each of said wheel spindles, a member having an upwardly extending hub and mounted upon said frame adjacent the end remote from the first named point of support, a nut carrying member supported upon the casing concentric to the hub and oscillatable around the latter, means holding said nut carrying member from detachment from the hub but permitting vertical play, a nut loosely carried by said member, and a manually operable worm extending through the member and through said nut.

9. A grader including a supporting frame, a transversely extending open-ended casing swingingly supported at one end upon the frame, said support permitting longitudinal movement of the casing, laterally extensible wheel spindles mounted in the casing, manually operable means for independently shifting each of said wheel spindles, a member having an upwardly extending hub and mounted upon said frame adjacent the end remote from the first named point of support, a nut carrying member supported upon the casing concentric to the hub and oscillatable around the latter, means holding said

nut carrying member from detachment from the hub but permitting vertical play, said member being formed to provide a nut socket and laterally disposed, upwardly extending walls on each side of said socket, the walls at their upper ends defining a passage, a manually operable worm extending through the space between said walls and through said nut and engaging the latter, and a fixed guide rod operatively mounted upon the supporting frame and passing through the space between said side walls and above the nut.

10. A grader including a supporting frame, a transversely extending open-ended casing having at one end laterally projecting ears, each of said ears being approximately semi-circular, members carried by the supporting frame and extending beneath each of said ears and supporting the casing to thereby permit oscillatory movement of the casing, a hub extending upward from the opposite end of the casing, a bolt passing through the hub and having a washer projecting out beyond the hub, a member having a longitudinally extending passage and a downwardly extending, hollow, central portion into which said hub projects to thereby mount said member upon the hub for oscillation therearound, the upper end of said hollow portion being formed to provide a nut seat, a nut carried in the seat, a worm extending through said member and through the nut, a guide extending through said member above the nut and mounted upon the supporting frame, and manually operable means for rotating said worm in one direction or the other.

11. A grader including a supporting frame, a transversely extending open-ended casing mounted at the rear thereof, the casing having laterally projecting, semi-circular ears and the frame having downwardly extending members extending beneath the ears and forming means for swingingly supporting the casing, longitudinally shiftable axle spindles mounted within the casing, racks attached to said axle spindles, manually operable pinions disposed within the casing and engaging said racks whereby the axle spindles may be independently shifted in one direction or the other, the opposite end of the casing being formed to provide an upwardly extending hub-like portion, a nut carrying member having a downwardly projecting, central, tubular, hollow base oscillatably mounted upon the hub-like member, a bolt passing through the casing and through the hub and having an outwardly projecting washer permitting limited vertical movement of the nut carrying member and rotary movement of the nut carrying member around the hub, the nut carrying member being formed to provide a socket for a nut, upwardly extending side walls having inwardly extending flanges at their upper ends, a manually operable worm passing through the space between said walls and through said nut and operatively mounted upon the supporting frame, and a transversely extending guide bar mounted upon the supporting frame, and extending between said walls and immediately beneath said flanges.

In testimony whereof I affix my signature.
FRANKLIN E. ARNDT.