

May 7, 1963

E. E. DORKINS ETAL
ROAD WORKING MACHINE

3,088,385

Filed April 11, 1960

4 Sheets-Sheet 1

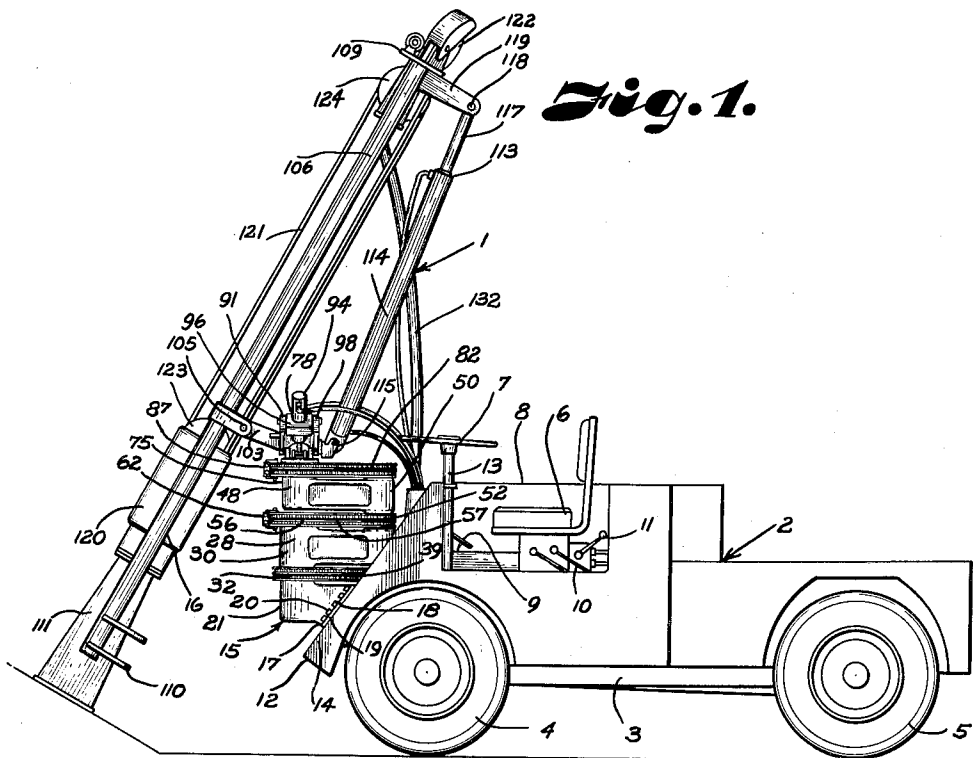


Fig. 1.

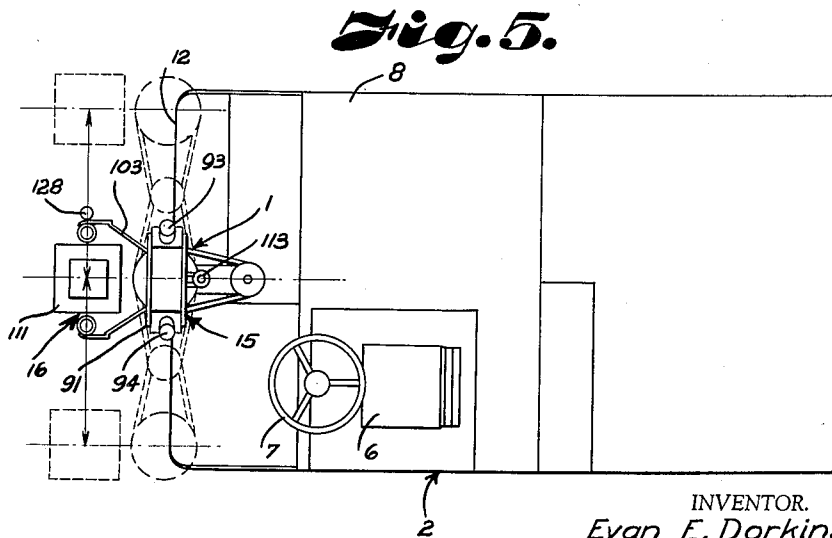


Fig. 5.

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4 Sheets-Sheet 2

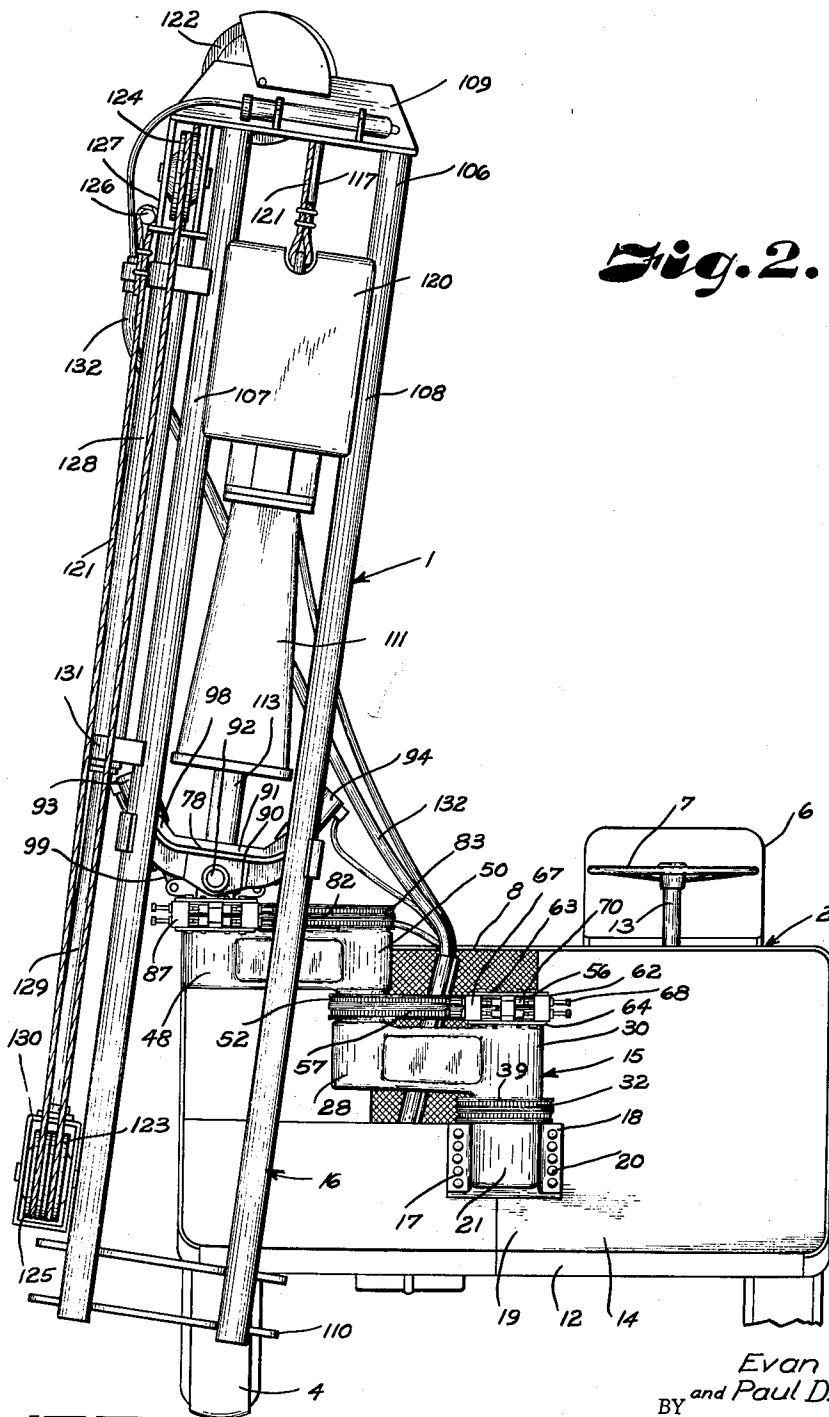


Fig. 2.

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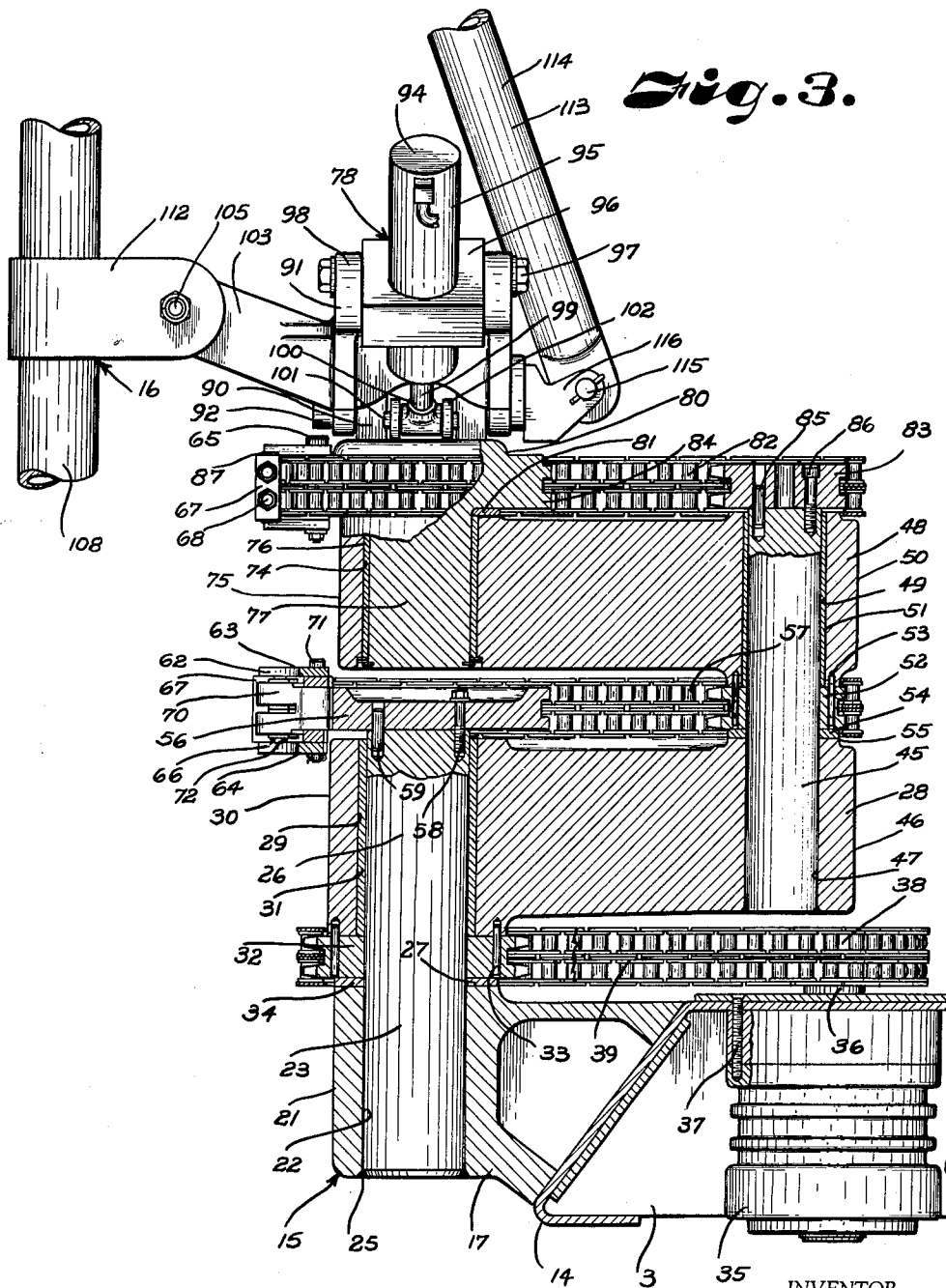
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4 Sheets-Sheet 3



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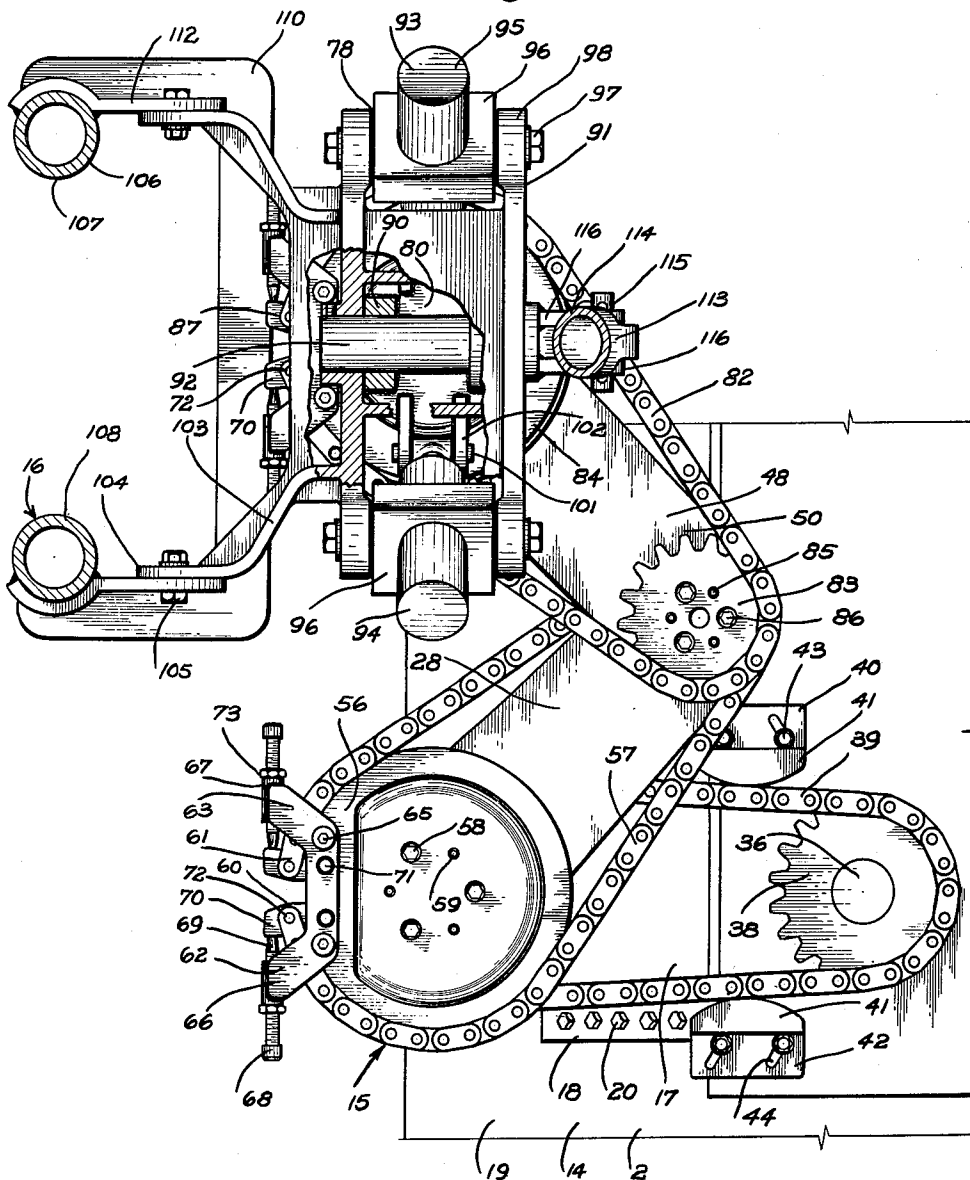
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4 Sheets-Sheet 4

Fig. 4.



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ROAD WORKING MACHINE

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8 Claims. (Cl. 94-49)

This invention relates to mobile machines for road working and ditching, and more particularly to improvements in mechanical movements or motions of operating tool carrying and supporting structures to increase the operative range of the tools.

In order to permit the nature of the invention to be best understood, we have chosen an illustration thereof that is in the drawings, a drop hammer on a vehicle adapted to be self-propelled along a path of use wherein the hammer may perform work such as breaking objects, concrete slabs or other relatively hard surfaces, cutting asphalt pavement, tamping earth, or like fills and ditching wherein the hammer guide is tiltable laterally and fore and aft for selected directions of impact.

The principal objects of the present invention are to provide a motor driven operative tool carrying machine having an operating station including a seat for an operator with controls so the operator without leaving the seat may control the machine operations and have substantially complete view of the work area; to provide a tool carrier and mounting wherein a tool such as a hammer may be maneuvered with ease from side to side with respect to the normal path of travel of the machine and yet be maintained upright or at selected angles of tilt fore, aft and laterally; to provide such a structure wherein the tool can be tilted to desired positions independently of the position of the tool carrier; to provide such a machine with a tool mounting for swinging said tool laterally in a line transversely of the direction of travel of the machine and simultaneously turning the tool to maintain the angular relationship thereof to said line; to provide such a machine and tool carrier wherein the tool is operable independently of the movement of the tool carrier; to provide a plurality of swingable arms and relative rotative members with operative connectors whereby rotative movement is converted to linear movement; to provide such a structure with driving and driven members and flexible power transmitting means trained thereover for swinging said arms; to provide such a structure with chains or belts and chain wheels operatively connecting the arms with chain or belt adjustments for tightening same without altering the angular relationship of the arms and various positions of movement; and to provide a mobile machine with a road working or like tool operative while stationary or when moved along a desired path and that is sturdy in construction, versatile and efficient in operation for performing a wide variety of work.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings, wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a side elevation of a mobile machine embodying the features of the present invention and having a drop hammer as the tool carried thereby.

FIG. 2 is a front elevation of the machine with the hammer guide tilted laterally and at its extreme travel in one lateral direction.

FIG. 3 is an enlarged side elevation of a tool mounting and traverse mechanism with portions broken away to illustrate the structure thereof.

FIG. 4 is an enlarged plan view of the tool carrier

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and traverse mechanism with portions broken away to illustrate the structure thereof.

FIG. 5 is a plan view of the machine with broken lines illustrating the extreme positions of the tool and traverse mechanism.

Referring more in detail to the drawings:

1 designates a multiple purpose tool mechanism and vehicle or carriage 2 adapted to be self-propelled or otherwise moved to locations where work is to be done, and also for movement during actual operation of the tool.

The vehicle or carriage 2 includes a frame suitably supported on front wheels and rear wheels 4 and 5 respectively. The vehicle 2 has an operator's seat 6 and steering mechanism connected with the front wheels 4 and operated by a steering wheel 7 adjacent the seat 6 for steering of the vehicle. The vehicle also has an engine (not shown) under a cover or housing 8 that is preferably operatively connected to the rear wheels 5 for propelling the vehicle, the movement being under control of the operator through a pedal 9 positioned adjacent to and in front of the seat 6. The vehicle also has a suitable source of hydraulic fluid pressure (not shown) as by a pump driven by the engine, the fluid being controlled through suitable valves operated by levers 10 and 11 all conveniently arranged to the operator's position on the seat 6, as illustrated in FIG. 1. The operator is positioned adjacent the forward end 12 of the vehicle, the end 12 being inclined forwardly and downwardly from adjacent the steering post 13 whereby the operator from the seat 6 can have a view of a surface over which the vehicle is traveling forwardly from adjacent the forward end of the vehicle.

The frame 3 has a forward transverse member 14 to provide rigidity thereto and also to support tool-carrying apparatus 15 for movement of a tool unit 16 relative to the vehicle during operation of the tool. The tool-carrying apparatus supports the tool unit 16 and, in the illustrated structure, provides for movement thereof in a straight line whereby in different positions the tool may perform its work at points in a straight line. This carrying apparatus 15 includes a mechanical movement having swingably mounted arms with portions of the arms and mountings thereof operatively connected for controlled movement of the portions thereof. In the illustrated structure, a bracket member 17 has an inclined end with flanges 18 resting on and secured to an inclined surface 19 of the transverse frame member 14, said bracket being secured to the frame member by suitable fastening devices such as bolts 20. The bracket 17 extends forwardly of the transverse frame member 14 and terminates in a large end 21 provided with a through vertical bore 22 for receiving a shaft 23. The shaft 23 is fixed in the bore 22 as by welding as at 25 whereby the upper portion of the shaft extends upwardly from the bracket to form an upstanding spindle 26 extending from an upper bearing face 27 of the end portion 21 of the bracket.

A main arm 28 has a through bore 29 at one end 30 thereof with a bearing member 31 mounted in said bore 29 and sleeved on the upright spindle 26 to rotatably mount the arm 28 for bodily swinging movement on the axis of said spindle 26. The arm 28 has a driven member 32 fixed thereon for rotating said arm 28. In the illustrated structure, the driven member 32 is a chain wheel or sprocket that is fixed to the lower portion of the end 30 of the arm 28 by means of suitable fastening devices such as pins 33 to key the chain wheel to the arm for rotation therewith. A bearing plate 34 is sleeved on the spindle 26 between the chain wheel 32 and the upper face 27 of the bracket 17 to form a thrust bearing

member between the main arm structure and the bracket 17.

The vehicle is provided with a source of power for effecting swinging movement of the arm 28 which, in the illustrated structure, is an hydraulic torque motor 35 having a driven shaft 36, said motor being secured to the transverse frame member 14 by suitable fastening devices 37 whereby said motor is rearwardly of the bracket and the shaft 36 is parallel with the shaft 23. A driving member 38 is fixed on the shaft 36 in alignment with the driven member 32 of the arm 28 and is operatively connected thereto by a power-transmitting member 39 whereby operation of the motor 35 will effect swinging movement of the arm 28. In the illustrated structure, the driving member 38 is a chain wheel sprocket fixed on the shaft 36 of the motor 35 and the power-transmitting member 39 is a chain trained over and operatively engaged with the driving member 38 and the chain wheel 32 to operatively connect same. The motor 35 is a conventional torque motor of a vane type wherein the vane is fixed to the shaft for rotative movement in the motor cylinder in response to hydraulic pressure applied at one side of the vane, the direction of rotation being opposite to the side at which the pressure is applied. In the particular structure illustrated, the ratio between the effective pitch diameter of the chain wheels 32 and 38 is such that the vane in the motor 35 will move in the cylinder to provide 213 degrees of rotation of the shaft 36 and effect 180 degrees of swinging movement of the arm 28. In the illustrated structure, the arm 28 extends rearwardly from the spindle 26 when at the mid-point of its travel, and at that position of the arm the vane of the motor should be in its mid-point position of its travel whereby fluid pressure from a suitable source thereof on the vehicle applied to the motor 35 under control of the operator may swing the arm 28 through an angle of 90 degrees in either direction from the position illustrated in solid lines, FIG. 5.

The power-transmitting member or chain 39 is preferably endless and is maintained in substantially taut condition by suitable tighteners 40 which, in the illustrated structure, consist of arcuate blocks 41 engaging opposite runs of the power-transmitting member 39 and having flanges 42 resting on the upper surface of the transverse frame member 14 to which the blocks are secured by suitable fastening devices such as bolts 43. The flanges 42 preferably have slotted apertures 44 through which the bolts extend, said slots being in inclined relation to the respective runs of the power-transmitting member 39 whereby when the bolts 43 are loosened the blocks may be moved toward or away from the power-transmitting member runs to provide the desired tension thereon, and the bolts tightened to hold the adjusting blocks in position.

The main arm 28 has a shaft 45 extending therefrom in spaced relation to the spindle 26 and parallel thereto. In the illustrated structure, the end portion 46 of the arm 28 remote from the spindle 26 has a through bore 47 and the shaft 45 has a lower end portion fixed in said bore 47 whereby the shaft 45 extends upwardly from the arm 28 or is disposed oppositely thereof from the bracket 17.

A second arm 48 has a through bore 49 at one end 50 thereof with a bearing member 51 mounted in said bore and sleeved on the upright shaft 45 to rotatably mount the arm 48 for bodily swinging movement on the axis of said shaft 45. The arm 48 has a driven member 52 fixed thereon for rotating said arm 48. In the illustrated structure, the driven member 52 is a suitable wheel such as a chain wheel or sprocket that is fixed to the lower portion of the end 50 of the arm 48 by means of suitable fastening devices such as pins 53 to key the sprocket 52 to the arm 48 for rotation therewith. A bearing plate 54 is sleeved on the shaft 45 between the sprocket 52 and the upper face 55 of the end portion 46 of the arm 28 to form a thrust bearing between the arm 48 and the arm 28. Swinging movement of the arm 48 in response to swing-

ing movement of the arm 28 is effected by a driving member 56 fixed on the spindle 26 in alignment with the driven member 52 with said driving member operatively connected to the driven member by a power-transmitting member 57 which is a flexible member preferably in the form of a roller chain that extends over the sprocket 52 and around the driving member 56 which, in the illustrated structure, is also a chain wheel that is secured and keyed to the spindle 26 by means of suitable fastening devices such as bolts 58 and pins 59 whereby the chain wheel 56 is stationary relative to the spindle 26.

The arm 48 extends forwardly from the shaft 45 when at the mid-point of its travel where it overlies the arm 28 which is also the mid-point position of the vane of the motor 35. The chain wheel 56 is larger in diameter than the sprocket 52, the ratio of the diameters determining the ratio of the angle of movement of the arm 48 relative to the movement of the arm 28. In the illustrated structure, the chain wheel 56 has an effective pitch diameter that is twice that of the sprocket or driven member 52 whereby when the motor 35 is operated to swing the arm 28 through an angle of 90 degrees in either direction from the position illustrated in solid lines, FIG. 5, the operative connections of the power-transmitting member 57 and driven member 52 and driving member 56 will effect 180 degrees of swinging movement of the arm 48 relative to the arm 28 whereby the arms will be positioned as illustrated in broken lines in FIG. 5.

The flexible drive member or chain 57 preferably extends around the driven member or sprocket 52 and has its ends 60 and 61 secured relative to the chain wheel 56 by means of a combined tightener and adjuster 62 which is located on the chain wheel 56 in diametrically opposite relation to the position of the motor 35 or the position of the shaft 45 when the arm 28 is in the mid-point of its travel. The adjuster and connector 62 preferably consists of upper and lower plates 63 and 64 secured to the chain wheel 56 by suitable fastening devices such as screws 65. The plates 63 and 64 have outwardly diverging extensions 66 with axially aligned bosses 67 secured therebetween in spaced relation to the sprocket whereby the chain 57 extends between the bosses and the sprocket. The bosses 67 have threaded bores in which are screwed adjusting screws 68 having ends 69 engaging arms 70 pivotally mounted on the plates 63 and 64 by suitable bearing members such as pins 71, the arms 70 being between the extensions 67 and having the ends 60 and 61 of the chain pivotally connected to the respective arms as by suitable bearing pins 72. The chain wheel 56 is notched out in the center portion of the plates 63 and 64 to provide for mounting and movement of the pivoted arms 70. When the chain 57 is loose, lock nuts 73 on the adjusting screws 68 are loosened, and said adjusting screws turned to urge the arms 70 toward each other to tighten said chain. After the chain is tightened, the lock nuts 73 are tightened to hold the adjusting screws in selected position. It is preferred the adjusting screws both be adjusted at the same time to maintain the relative positioning and movement of the arms 28 and 48. However, if there should be a minor variation in the relative angular position of the arms 28 and 48 from the mid-point to either extreme of their travel, the adjusting screws 68 can be moved by backing off one side and moving the other side inwardly to provide a slight variation in the relative positioning of the chain 57 and the chain wheels 52 and 56 to effect a slight change in the relative angularity of the arms 28 and 48, whereby at the end of the swinging movement the arms will be in alignment as shown in broken lines in FIG. 5.

The arm 48 preferably has a through bore 74 in the end portion 75 remote from the end portion 50. The bore 74 is preferably axially aligned with the axis of the spindle 26 when the arm 48 is positioned over the main arm 28 at the midpoint of their relative swinging movement. A suitable bearing member 76 is preferably arranged in

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the bore 74 to rotatably mount a post 77 of a tool carrier mechanism 78 on which is mounted an operative tool unit 16 which, in the illustrated structure, is a drop hammer, as later described.

The tool carrier post 77 is rotated relative to the arm 48 during swinging movement thereof to maintain a desired relationship between the path of the operating tool 16 and the path of travel of the post 77. In the illustrated structure, the post 77 has an enlarged head 80 above the end 75 of the arm 48 with a bearing plate 81 sleeved on the post 77 between the head 80 and the arm 48 to form a thrust bearing member between the post head 80 and the arm. The periphery of the head 80 is arranged to be engaged by a power-transmitting member 82 which connects with a driving member 83 secured to the shaft 45. In the illustrated structure, the periphery of the head 80 forms a chain wheel and has spaced annular ribs 84, and the power-transmitting member 82 is a roller chain engaged with teeth of the driving member such as a chain wheel or sprocket 83 which is aligned with the ribs 84 on the head 80 above the arm 48. The sprocket or driving member 83 is secured to the shaft 45 in fixed relation thereto by means of pins 85 and screws 86 as illustrated in FIG. 3. The chain wheel portion of the head 80 is cut away and the ends of the chain 82 are connected to said head by a connector and adjusting device 87 which is identical in structure to the connector and adjusting device 62 whereby the chain 82 may be tightened and also the position of the chain relative to the chain wheels varied to adjust the angularity of the tool carrier to the arm 48. The cut-away portion of the chain wheel or head 80 and the location of the connecting and adjusting device 87 is preferably immediately above the position of the connecting and adjusting member 62 when the arm 48 overlies the arm 28 in alignment therewith, and the axis of the post 77 is in alignment with the axis of the spindle 26. It is also preferable that the ratio of the effective pitch diameters of the driving member 83 and the driven member or chain wheel portion of the head 80 be the same as the ratio of the chain wheel or sprocket 52 to the chain wheel 56, namely, 1 to 2 ratio, whereby the relative movement of the post 77 is 90 degrees while the arm 48 is being rotated through 180 degrees relative to the arm 28.

In the structure illustrated, the tool carrier structure includes spaced upstanding ears 90 on which a rocker frame 91 is mounted by means of a rocker shaft 92, said shaft extending substantially longitudinally relative to the direction of travel of the vehicle whereby the rocker frame is rocked laterally of said vehicle. The lateral rocking of the rocker frame is accomplished by means of extensible members 93 and 94 preferably in the form of hydraulic jacks each having cylinders 95 secured to collars 96 which are pivotally mounted by bearing pins or screws 97 on spaced ears 98 extending laterally of the rocker frame. The piston rods 99 of the jacks each have an end 100 pivotally connected as at 101 to spaced upstanding ears 102 on the post head 80 in laterally spaced relation to the rocker shaft 92 whereby hydraulic fluid pressure can be selectively applied to the hydraulic jacks 93 and 94 to effect the rocking movement of the rocker frame. The rocker frame has spaced forwardly extending arms 103 terminating in end portions 104 on which an operating tool 16 is pivotally mounted as by pivotal connections 105 whereby the operating tool can be swung fore and aft relative to the vehicle.

In the illustrated structure, the operating tool is a drop hammer having a trackway 106 having spaced parallel track members 107 and 108 connected at their upper ends by a head member 109 and at their lower ends by means of ties 110 which extend rearwardly between the upright members to provide room for passage of the hammer 111 during operation. The upright members 107 and 108 each have rearwardly extending arms 112 which are pivotally connected to the end portions 104 of the arms

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103 by the pivot members 105. Fore and aft tilting of the trackway is effected by an extensible member 113 in the form of an hydraulic jack having a cylinder 114 with one end thereof pivotally mounted as at 115 to rearwardly extending ears 116 on the rocker frame 91. A piston rod 117 extends from the other end of the cylinder and is pivotally connected as at 118 to rearwardly extending ears 119 at the head 109 of the trackway, whereby contraction of the extensible member will tilt the upper portion of the trackway rearwardly or aft and extension of the extensible member will tilt the upper portion of the trackway forwardly, this fore and aft tilting being independently of the lateral tilting as the extensible member 113 extends from the rocker frame to the ear 119 fixed on the trackway.

The hammer member 111 has portions engaging the upright track members 107 and 108 to form a guiding engagement therewith. The upper portion 120 of the hammer member is connected to a cable 121 that extends over a pulley 122 on the head 109 and then downwardly under a pulley 123 and upwardly and over a pulley 124, downwardly and under a pulley 125, and then upwardly with the upper portion connected as at 126 to the frame 127 carrying the pulley 124 which is located at the upper end of an extensible member in the form of an hydraulic jack having a cylinder 128 arranged alongside of the track member 107 with a piston rod 129 extending from said cylinder and having a frame 130 carrying the pulleys 123 and 125 on the lower end thereof. The cylinder 128 is fixed by brackets 131 to the track member 107. Supply of hydraulic fluid to the cylinder 128 to effect extension of same will cause the hammer 111 to be raised. Then, the cylinder 128 is communicated through a large fluid line 132 to a reservoir for discharge of fluid from the cylinder 128 with substantially no resistance whereby the hammer will have substantially free falling as in the hammer structure disclosed in the Simmonds Patent No. 2,476,390 issued July 19, 1949. While the operating tool illustrated and described is a drop hammer, other suitable operating tools may be mounted on the tool carrier as, for example, drills and the like.

In operating a structure constructed and assembled as described, and with the arms 28 and 48 and the tool carrier positioned as shown in solid lines in FIG. 5, the vehicle may be moved to a place for performing work and then slowly moved along a desired path. During such movement, a lever is actuated to position the tool upright or at fore and aft or lateral tilt, as desired. Then, the valve lever is operated to effect raising and dropping of the hammer 111 to perform tamping operations and, as said tamping operations are being performed, fluid pressure is supplied to the hydraulic motor 35 to rotate same in a counter-clockwise direction, when viewed from above, whereby the driving member or sprocket 38 is rotated in a counterclockwise direction, FIG. 4, to move the power-transmitting member or chain 39 and rotate the driven member or sprocket 32 to effect bodily swinging movement of the arm 28 also in a counter-clockwise direction, FIG. 4. The spindle 26 remains stationary relative to the swinging movement of the arm 28 whereby swinging movement of the arm 28 planetates the driving member 52 or sprocket around the chain wheel 56, and since said chain wheel 56 is fixed relative to the spindle 26, said planetary movement will rotate the driving member or sprocket 52 in a clockwise direction to swing the arm 48 in a clockwise direction, FIG. 4, about the shaft 45. The driving member or sprocket 83 being fixed to the shaft 45 and the chain wheel portion of the head 80 being planetated around the axis of the shaft 45, causes the tool carrier mechanism 78 to be rotated in a counter-clockwise direction relative to the arm 48, FIG. 4. In the illustrated structure, the ratio of the chain wheels provides for bodily swinging movement of the arm 48 through an angle of rotation relative to the arm 28 that is twice the angle of rotation of the arm 28 relative to the brackets

17, and the angle of rotation of the tool carrier to be one-half the angle of rotation of the arm 48, whereby during swinging movement of the arms 28 and 48 from one extremity to the other, the hammer trackway or operating tool will be moved in a plane which is, in the illustrated structure, a straight line transversely of the direction of travel of the vehicle, as illustrated in FIG. 5. With this arrangement, the arms can be swung to move the operating tool back and forth transversely of the direction of travel of the vehicle, and the operating tool continuously operated as, for example, with a hammer to tamp the ground, and such operations can be continued during tilting of the operating tool fore and aft and laterally to provide a variety of angles of the impact of the tool. This arrangement provides for a wide traverse of the operating tool, such as a drop hammer, or any portion thereof as, for example, the tool can be moved from the mid-center portion as shown in solid lines in FIG. 5 to either side and back again to the center portion or to any part of the extremities of lateral movement to tamp desired widths within the limits of the traverse movement of the tool.

It is to be understood that while we have illustrated and described one form of our invention, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

What we claim and desire to secure by Letters Patent is:

1. A mechanical movement of the character described comprising, a main arm having one end portion, means fixed on said one end portion for connection with a source of power for bodily swinging said arm so that another end thereof swings through an arcuate path, a shaft rotatable in said one end portion of said main and having a wheel fixed thereto, a second shaft fixed in said main arm in spaced relation to the first-named shaft, a second arm on said second shaft and swingable on the axis of said second shaft and relative to the main arm, a second wheel about the second shaft and fixed to the second arm and in alignment with said first-named wheel, and a flexible power-transmitting member trained over and operatively engaging said second wheel with ends connected to the first-named wheel whereby when said main arm is operated by the source of power the arms are swung simultaneously, said first and second wheels being of different diameters with the first-named wheel being the larger whereby the angle of swinging movement of the second arm relative to that of the main arm is of the same ratio as the diameter of the first-named wheel to the diameter of the second-named wheel.

2. A mechanical movement of the character described comprising, a main arm having one end portion adapted for connection with a source of power for bodily swinging said arm so that another end thereof swings through an arcuate path, a shaft in said one end portion of said main arm and having a wheel fixed thereto, a second shaft fixed in said main arm in spaced relation to the first-named shaft, a second arm on said second shaft and bodily swingable on the axis of said second shaft and relative to the main arm, a second wheel about the second shaft and fixed to the second arm and in alignment with said first-named wheel, a third shaft rotatably mounted in the second arm in spaced relation to the second shaft, a member carried by said third shaft, a third wheel fixed to said second shaft, a fourth wheel fixed to the third shaft and in alignment with said third wheel, flexible means operatively connecting said third and fourth wheels, and a second flexible means operatively connecting said first-named and second wheels whereby when said main arm is operated by the source of power the main and second arms are swung simultaneously, said first and second wheels having the same ratio between their diameters as the ratio between the diameters of the fourth and third wheels with the first wheel being larger than the second wheel whereby the angle of swinging movement of the second arm is greater than the angle of rotation of the third shaft is the same as the angle of swinging movement of the main arm.

second wheel whereby the angle of swinging movement of the second arm is greater than the angle of swinging movement of the main arm and the angle of rotation of the third shaft is the same as the angle of swinging movement of the main arm.

3. A mechanical movement of the character described comprising, a main arm having one end portion adapted for connection with a source of power for bodily swinging said arm so that another end thereof swings through an arcuate path, a shaft rotatable in said one end portion of said main arm whereby said main arm swings about said shaft, a chain wheel fixed to said shaft, a second shaft fixed in said arm in spaced relation to the first-named shaft, a second arm on said second shaft and bodily swingable on the axis of said second shaft and relative to the main arm, a second chain wheel about the second shaft and fixed to the second arm and in alignment with said first-named chain wheel, a third shaft rotatably mounted in the second arm in spaced relation to the second shaft, a member carried by said third shaft, a third chain wheel fixed to said second shaft, a fourth chain wheel fixed to the third shaft and in alignment with said third chain wheel, a chain trained over and operatively engaging said third and fourth chain wheels, and a second chain trained over and operatively engaging said first-named and second chain wheels whereby when said main arm is operated by the source of power the main and second arms are swung simultaneously, said second and third chain wheels and the first and fourth chain wheels each being of diameters to provide a two-to-one effective ratio between the first and second chain wheels and the fourth and third chain wheels respectively whereby the angle of swinging movement of the second arm is twice the angle of swinging movement of the main arm and the angle of rotation of the third shaft is the same as the angle of swinging movement of the main arm.

4. A mechanical movement of the character described comprising, a main arm having one end portion adapted for connection with a source of power for bodily swinging said arm so that another end thereof swings through an arcuate path, a shaft in said one end portion of said main arm and having a wheel fixed thereto, a second shaft fixed in said main arm in spaced relation to the first-named shaft, a second arm on said second shaft and bodily swingable on the axis of said second shaft and relative to the main arm, a second wheel about the second shaft and fixed to the second arm and in alignment with the first-named wheel, a third shaft rotatably mounted in the second arm in spaced relation to the second shaft, a member carried by said third shaft, a third wheel fixed to said second shaft, a fourth wheel fixed to the third shaft and in alignment with said third wheel, flexible means operatively engaging said third wheel and having end portions, means adjustably connecting the end portions of said flexible means to the fourth wheel and operable to move said fourth wheel relative to said flexible means and adjust the angularity of the member carried by the third shaft relative to the second arm while said second arm is stationary, and a second flexible means operatively connecting said first-named and second wheels whereby when said main arm is operated by the source of power the main and second arms are swung simultaneously, said first and second wheels having the same ratio between their diameters as the ratio between the diameters of the fourth and third wheels with the first wheel being larger than the second wheel whereby the angle of swinging movement of the second arm is greater than the angle of rotation of the third shaft is the same as the angle of swinging movement of the main arm.

5. A mechanical movement of the character described comprising, a main arm having one end portion adapted for connection with a source of power for bodily swinging

said arm so that another end thereof swings through an arcuate path, a shaft rotatable in said one end portion of said main arm whereby said main arm swings about said shaft, a chain wheel fixed to said shaft, a second shaft fixed in said arm in spaced relation to the first-named shaft, a second arm on said second shaft and bodily swingable on the axis of said second shaft and relative to the main arm, a second chain wheel about the second shaft and fixed to the second arm and in alignment with said first-named chain wheel, a third shaft rotatably mounted in the second arm in spaced relation to the second shaft, a member carried by said third shaft, a third chain wheel fixed to said second shaft, a fourth chain wheel fixed to the third shaft and in alignment with said third chain wheel, a chain trained over and operatively engaging said third chain wheel and having ends, means adjustably connecting the ends of said chain to the fourth chain wheel for moving said fourth chain wheel relative to said chain to change the angularity of the member carried by said third shaft relative to the second arm while said second arm is stationary, a second chain trained over and operatively engaging said second chain wheel and having ends, and means adjustably connecting said ends of the second chain to the first-named chain wheel to adjust the angular relationship of the main arm relative to said first-named chain wheel, said main and second arms being swung simultaneously when the main arm is operated by the source of power, said second and third chain wheels and the first and fourth chain wheels each being of diameters to provide a two-to-one effective ratio between the first and second chain wheels and the fourth and third chain wheels respectively whereby the angle of swinging movement of the second arm is twice the angle of swinging movement of the main arm and the angle of rotation of the third shaft is the same as the angle of swinging movement of the main arm.

6. An apparatus mounting a portable tool unit on a vehicle having a wheel-supported frame and a source of fluid pressure thereon, said tool unit having a carrying structure and mechanism for effecting movement of the tool in a fixed path relative to said carrying structure, a vertical post unit, means supporting the carrying structure on said post unit, a main arm, means on the vehicle rotatably mounting one end of said arm for bodily horizontal swinging movement thereof relative to said vehicle, a second arm, means rotatably supporting said post unit at one end of said second arm, means pivotally connecting the other ends of said main and second arms for relative bodily horizontal swinging movement of said arms in parallel planes, means operatively connected to said main arm for swinging same about its rotative mounting on the vehicle, a wheel fixed relative to the means rotatably mounting the main arm on said vehicle, a second wheel fixed to said other end of the second arm and in alignment with the first-named wheel, means operatively connecting said first- and second-named wheels, a third wheel fixed relative to the means pivotally connecting said other ends of said main and second arms and movable therewith, a fourth wheel fixed to said post and in alignment with said third wheel, and means operatively connecting said third and fourth wheels, said first and fourth wheels being of larger diameter than said second and third wheels respectively whereby the second arm swings through an angle of swinging movement that is larger than the angle of swinging movement of the main arm and the post is turned through the same angle as swinging movement of the main arm.

7. An apparatus mounting a portable tool unit on a vehicle having a wheel-supported frame, said tool unit having a carrying structure and mechanism for effecting movement of the tool, a vertical post unit, means supporting the carrying structure on said post unit, a main arm, an upright shaft fixed on said vehicle in axial alignment with the vertical axis of the post in one position of said post, one end of said main arm being rotatably mounted

on said upright shaft for bodily swinging movement of said main arm, a second arm, means rotatably supporting said post unit in upright position at one end of said second arm for rotation about the vertical axis of said post unit, a second shaft fixed to the other end portion of the main arm and extending therefrom in upright relation, the other end of said second arm being pivotally mounted on said second shaft for relative bodily swinging movement of said main and second arms in parallel horizontal planes, a motor carried by the vehicle in spaced relation to the first-named shaft, a driving chain wheel connected to said motor and operated thereby, a second chain wheel fixed to the main arm and in alignment with the driving sprocket, a chain trained over and operatively connecting said driving and second chain wheels whereby operation of the motor swings said main arm, a third chain wheel fixed to said first-named upright shaft between said main and second arms, a fourth chain wheel about the second shaft and fixed to the other end of the second arm and in alignment with the third chain wheel, a chain trained over said third and fourth chain wheels and connected thereto whereby swinging movement of the main arm effects swinging movement of the second arm, a fifth chain wheel fixed to the second shaft, a sixth chain wheel fixed to said post and in alignment with said fifth chain wheel, and a third chain trained over said fifth and sixth chain wheels and connected thereto whereby swinging movement of the second arm effects rotation of the post unit relative to said second arm.

8. An apparatus mounting a portable tool unit on a vehicle having a wheel-supported frame and a source of fluid pressure thereon, said tool unit having a carrying structure and mechanism for effecting movement of the tool in a fixed path relative to said carrying structure, a vertical post unit, means tiltably supporting the carrying structure on said post unit, a main arm, a bracket fixed on said vehicle, an upright shaft fixed on said bracket in axial alignment with the vertical axis of the post in one position of said post, one end of said main arm being rotatably mounted on said upright shaft for bodily swinging movement of said main arm, a second arm, means rotatably supporting said post unit in upright position at one end of said second arm for rotation about the vertical axis of said post unit, a second shaft fixed to the other end portion of the main arm and extending therefrom in upright relation, the other end of said second arm being pivotally mounted on said second shaft for relative bodily swinging movement of said main and second arms in parallel horizontal planes, an hydraulic motor carried by the vehicle in spaced relation to the first-named shaft, a driving sprocket connected to said hydraulic motor and operated thereby, a second sprocket fixed to the main arm and in alignment with the driving sprocket, a chain trained over said driving sprocket and second sprocket whereby operation of the hydraulic motor swings said main arm, a chain wheel fixed to said first-named upright shaft between said main and second arms, a third sprocket about the second shaft and fixed to the other end of the second arm and in alignment with said chain wheel, a chain trained over and operatively connecting said third sprocket and chain wheel whereby swinging movement of the main arm effects swinging movement of the second arm, a fourth sprocket fixed to the second shaft, a second chain wheel fixed to said post and in alignment with said fourth sprocket, and a third chain trained over and operatively connecting said fourth sprocket and second chain wheel whereby swinging movement of the second arm effects rotation of the post unit relative to said second arm, said third and fourth sprockets each having an effective pitch diameter that is one-half the effective pitch diameter of the first-named and second chain wheels respectively whereby in swinging movement of said arms the swinging movement of the second arm relative to the main arm is

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through an angle that is twice the angle of the swinging movement of the main arm relative to said bracket and the post is turned through an angle relative to the second arm corresponding to said angle of swinging movement of the main arm to maintain the carrying structure in the same angular relationship to the linear path of movement of said post. 5

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