TANDEM EARTHWORKING IMPLEMENT

Henry T. Petersen, 1711 Phantom Ave., San Jose, Calif.
Filed Oct. 18, 1963, Ser. No. 317,284
15 Claims. (Cl. 94—50)

The present invention relates to a tandem earthworking implement and, more particularly, to a multi-purpose implement for breaking up tough earth surfaces, for blending and pulverizing soil, and/or for compacting earth traversed by the implement as utilized in road resurfacing and the like.

In the construction of highways, dams, airport runways and similar projects, several earthworking operations are required, such as breaking up oil cakes, clods and hard crusts especially on old road beds being repaired, blending and pulverizing soil materials on grades and fills, and adequately compacting sub-grades, embankments and shoulders. Various types of equipment have been employed in an effort efficiently to accomplish these functions.

For example, it has long been known to use heavy steel rollers and weighted rubber-tired rollers to compact the soil. Tamping or sheefoot rollers have also been employed with varying degrees of success on soils of relatively greater cohesive properties. While a sheefoot roller is of little effect on loose, clean, and sandy soil, a rubber-tired roller is of greater effect on such soils of low cohesive property because of its greater contact area. With most types of rollers, it is usually necessary to adjust the contact pressure depending on the soil conditions encountered. It has also been known to use vibratory devices to achieve better compaction.

Still further, scarifying and digging equipment have been available for penetrating into and breaking up existing pavements, aggregates, or surfaces as a preliminary to increasing the compaction of the road bed and subsequent resurfacing. The structure of prior United States Patent No. 2,751,205 is excellently suited for this latter purpose.

While such various types of equipment have independent functions, they are frequently driven one behind the other so as to combine their actions in attempting to achieve a desired surface effect. Thus, rubber-tired rollers may follow a sheefoot roller to roll down the fluff usually existing on top of the ground compacted by the sheefoot roller. However, two separate implements having separate prime movers and operators have generally been required under such circumstances. In addition, it has been difficult to obtain an optimum relative adjustment, as to contact pressure and the like, between such companion implements which have been separate and uncoordinated.

Accordingly, it is an obvious object of the present invention to provide a multi-purpose earthworking implement particularly suited for use in the construction and/or repair of roads, dams, grades, runways, and the like.

Another object is to minimize the time, labor, and expense of performing such earthworking tasks.

Another object is to provide a multi-purpose implement from breaking up tough earth surfaces, for blending and pulverizing the soil, and/or for compacting earth traversed by the implement.

Another object is to couple a sheefoot and/or digging roller in fore and aft tandem relation with an inflated, resiliently flexible and compressible roller wherein such rollers are individually mounted for elevationally free floating movement but wherein the coupled interconnection of the rollers enables alternate and opposite elevational movement.

Another objective is to provide a tandem implement of the type described wherein there are a plurality of fore and aft rollers independently mounted in side-by-side relation for individual elevational movement over uneven terrain.

Another object is adjustably to distribute the load on such rollers between positions with one or the other of the rollers lifted out of ground engagement and including an intermediate position with the load or weight distributed between such rollers.

Another object is elevationally to vibrate such rollers during earth traversing movement thereof.

Other objects are to provide a multi-purpose, tandem earthworking implement which is of durable, heavy-duty construction and which is dependable in action.

These, together with other objects, will become more fully apparent upon reference to the following description.

In the drawings:

FIG. 1 is a top plan view of a tandem earthworking implement embodying the principles of the present invention and being connected to a draft appliance.

FIG. 2 is a side elevation of the implement and draft appliance of FIG. 1 showing the forward and rearward rollers of the implement engaging substantially level ground being traversed.

FIG. 3 is a view similar to FIG. 2 with the rearward roller elevated slightly above the forward roller incident to movement over uneven terrain.

FIG. 4 is a view similar to FIG. 3 but with the rearward roller slightly below the forward roller.

FIG. 5 is a transverse vertical section taken on line 5—5 in FIG. 2.

FIG. 6 is a horizontal section taken on line 6—6 in FIG. 2.

FIG. 7 is a transverse vertical section taken on line 7—7 in FIG. 2.

FIG. 8 is a somewhat enlarged fragmentary section through the forward roller showing angulated digging teeth and sheefoot pads mounted on the periphery thereof.

FIG. 9 is a transverse vertical section taken centrally through the forward roller.

Referring more particularly to the drawings, a tractor, constituting a draft appliance, is generally indicated by the numeral 10. The tractor has a forward portion 11, a pair of rear mounting wheels 12, a seat 14, and a fifth wheel type of coupling 16. It is to be understood that the invention is not limited to the particular type of draft appliance illustrated as there are many other types of draft appliances that are suitable for the purpose.

The subject earthworking implement includes an elongated main support frame 20 having a forward, substantially rectangular upright section 22, best illustrated in FIGS. 1, 2 and 7. This upright section includes a lower, transverse member 23, a pair of transversely spaced, upright side members 24 having elongated slots 25, an intermediate upright member 26 having a slot 27, and an upper transverse member 29 interconnecting the upright members and being substantially parallel to the lower transverse member. The upper transverse member has an upper, substantially flat surface 31, a rear substantially flat surface 32, lugs 33 extended upwardly from the upper surface, and lugs 34 extended rearwardly from the rear surface.

In addition, an elongated arcuate leg 35 is integrally forwardly and downwardly extended from the upper transverse member and is releasably connected to the fifth wheel coupling 16 of the tractor 10 for relative swiveling movement about an upright axis.

The main support frame 20 also includes an upper section 40, best seen in FIGS. 1 and 2. This section includes a plurality of transversely spaced hinge plates 41 individu-
ually coupled to the lugs 33 by pivot pins 42. The upper frame section is thereby mounted for pivotal movement about an axis extended transversely of the frame between a lower position, as illustrated in FIGS. 2 and 3, with a forward surface thereof in abutting engagement with the rear surface 32 of the upright section, and an upwardly retracted position, not shown, but with said upper frame section extended upwardly from the upper surface 31. In said lowered position, the upper section is rearwardly extended from the surface 32 of the forward section. As best illustrated in FIG. 7, an elongated rod 46 is releasably transversely extended through the upright section and the lugs 34 for releasably retaining the upper section in its lower position. The upper section also has a plurality of forward ears 47 extended rearwardly therefrom.

The main frame 20 also provides lower side members 50 individually integrally connected to the lower transverse member 23 and rearwardly extended therefrom in transversely spaced, substantially parallel relation to each other. The side members thus have forward ends 51 and rearward ends 52. A rear, substantially L-shaped, auxiliary frame 56 includes a transversely extended lower cross piece 58, and transversely spaced side pieces 59 extended from the cross piece in opposed relation to each other. The side pieces are individually pivotally connected by pins 60 to the rear ends 52 of the lower side members 50. The auxiliary frame also includes an upper cross piece 65 and a plurality of spaced partitions 66 integrally downwardly extended from the cross piece and rigidly connected to the lower cross piece. An elongated mounting shaft 68 is extended through the partitions in upwardly spaced, substantially parallel relation to the lower cross piece. It is to be noted that the auxiliary frame pivots relative to the lower side members about an axis which is normal to the path of travel of the frame and which is defined by the pins 60. Spaced pairs of flanges 67 are rigidly rearwardly extended from the partitions, and ears 71 are rigidly upwardly extended from the upper cross piece.

With particular reference to FIGS. 1, 2, 3 and 4, elongated hydraulic rams 75 pivotally interconnect the forward ears 47 on the upper section 40 of the main frame 20 and the rear ears 71 on the auxiliary section 56 by means of pivot pins 76. These rams are simultaneously expandable or contractible for tilting the auxiliary frame 56 rearwardly or forwardly about its described axis of pivotal movement.

With particular reference to FIGS. 4 and 5, a plurality of inverted L-shaped coupling brackets 80 are provided. Each bracket includes an upstanding leg 81 pivotally mounted on the shaft 68 between a pair of adjacent spaced partitions 66 of the auxiliary frame 56 for fore and aft tilting movement about the axis of this shaft. Each bracket also includes a rearwardly extended leg 82 in upwardly spaced relation to the shaft. The legs are preferably bifurcated with the bifurcations on the shaft being held in spaced relation from each other by spacers 83 and from the adjacent partitions by washers 84. Further, each bracket has a forwardly extended, bifurcated web 86. An intermediate collar 88 having a central resiliently compressible portion is rigidly borne by the rearwardly extended leg of each bracket.

Rear roller frames 92 provide bifurcated forward portions 94 pivotally connected to the flanges 69 of the auxiliary frame 56 by pins 94. When mounted in this manner, the roller frames are pivotally about a common axis extended transversely of the main frame 20 and substantially normal to the path of travel thereof. The rear roller frames also provide upper bearing flanges 95 in rearwardly and substantially parallel, support flanges 96. An axle 97 is mounted in each pair of flanges 96. Rear, resiliently compressible, pneumatically inflatable rollers 99 are individually journaled on the axles 97 and provide substantially cylindrical, smooth surfaces 100 concentric to the axles.

Elongated rods 105 are individually slidably extended through the intermediate collars 88 and have rear ends 106 slidably extended through their respective bearing flanges 95. The rods also have forward ends 107 extended forwardly of their respective intermediate collars between the bifurcations of the rearwardly extended legs 82, as best illustrated in FIGS. 1 and 6. Rear blocks 109 are connected on the rear ends of the bearing flanges, and forward blocks 110 are fitted on the forward ends of the rods forwardly of the intermediate collars. Forward and rearward nuts 112 and 113 are screw-threadably connected to the forward and rearward ends of the rods for limiting endwise movement of the blocks on the rods. Elongated forward and rearward compression springs 115 and 114 encircle the rods and are respectively interposed the forward blocks 110 and the intermediate collars and the bearing flanges 95 and the intermediate collars. The springs are substantially equal and thus tend to maintain the intermediate collars substantially equidistantly between the forward and rearward ends of the rods. However, the springs are resiliently compressible and thus yield for movement of the intermediate collars and thus the coupling bracket 80 relatively forwardly and rearwardly of the rods.

With particular reference to FIG. 6, the subject implement also includes a pair of substantially rectangular forward roller frames 116 each including a pair of side bars 117 and forward and rearward bars 118 and 119 rigidly interconnecting the side bars. Forward lugs 120 are rigidly forwardly extended from the forward bar individually into the slots 25 and 27. Also, pairs of rear lugs 121 are rearwardly extended from the rearward bar. Pins 122 pivotally connect the forward lugs to the upright section 22 of the main support frame 20 for elevational pivotal movement of the forward roller frames about a substantially common axis extended transversely of the main frame and also normal to the path of movement thereof. It is to be noted that each of the forward roller frames provides a substantially rectangular opening 123.

Elongated links 125 have forward ends individually pivotally connected to the rear lugs 121 and opposite rear ends. Cylindrical bosses 127 are provided on the rear ends of the links and are individually journaled between the bifurcated webs 86 of the outermost pair of coupling brackets 80. Therefore, the links and the coupling brackets interconnect each outermost pair of forward roller frames 92 and the correspondingly forwardly disposed forward roller frame 116. It is to be noted however, that the intermediate coupling bracket 80 is connected to the auxiliary frame by pins 129.

A pair of substantially cylindrical, forward rollers 130 are individually positioned in the openings 123 of the forward roller frames 116. Each forward roller has opposite end walls 131 and a circumcising, substantially cylindrical side wall 132 concentric to an elongated bore 133 opening outwardly through each end wall, as best illustrated in FIG. 9. With reference to FIG. 8, a plurality of rows of pegs 134 are provided on the side walls 132 of each forward roller with the rows being in substantially equidistantly, axially spaced relation to each other. Further, the pegs are radially outwardly extended from the side wall with the pegs in each row being in substantially uniformly circumferentially spaced relation to each other. In the form of forward roller shown in the diagram, relation to the internal penetrating points 137 are individually fitted over and releasably connected to alternate pegs in each row. Preferably, the teeth are in staggered relation to each other with respect to adjacent rows of pegs. Further, sheep-
foot pads 139 are individually, releasably connected to the remained of the pegs and provide blunt ends 140. As best illustrated in FIG. 8, keys 141 are employed for releasably securing the teeth and the pads to the pegs. Alternatively, the forward rollers may be provided entirely with teeth 136 or entirely with pads 139.

With reference to FIG. 9, bearing sleeves 145 are individually securely fitted in the bore 133 adjacent to the end wall 131 and have inner cylindrical surfaces concentric to the bore. An elongated mounting shaft 146 is extended through the bore and the sleeves and provides opposite ends 147 journaled in the side bars 117 of the respective forward frames 116. Cams 148 are secured to the mounting shaft and are individually located within the bearing sleeves. The cams provide circumferencing surfaces 149 eccentric to the axis of the shaft and in slidable engagement with the internal surfaces of the sleeves. Electric motors 150 are mounted on the outer side bars of each forward frame and provide drive shafts, not shown, respectively connected to adjacent ends 147 of the mounting shafts for imparting rotation thereto incident to energization of the motors.

Auxiliary arms 156 are individually pivotally connected to the side bars 117 of the forward roller frames 116 for elevational movement about a substantially horizontal axis extended transversely of the main frame 20 and also substantially parallel to the length of the main frame 20. The auxiliary arms extend forwardly and downwardly from their pivotal connections through the slots 25 and 27 in the upright section 22 of the main frame. Roller bearings 157 are borne by the upright section of the main frame in said slots, and the arms are rested on the bearings. Elongated counterclockwise 158 rigidly interconnect the arms associated with each forward frame and serve to counterbalance the weights of the forward rollers 130. The counterweights aid the rams 75 during expansion thereof in transferring weight from the forward rollers to the rearward rollers 99.

Operation

The operation of the described embodiment of the subject invention is briefly summarized at this point. Assuming that it is desired to resurface a road having an existing hard and rough surface, as generally indicated in FIG. 10 in the drawings, and further assuming that the rollers 99 and 130 are initially located on a substantially horizontal portion of this road surface, as illustrated in FIG. 2, the rams 75 are adjusted to equalize the compression on the springs 115 and 114 whereby the weight of the implement is transmitted forwardly to the forward and rearward rollers. The tractor 10 is driven forwardly along a longitudinal path of travel relative to the main frame 20, pulling the subject implement therebehind, and imparting ground driven rotation to the rollers 99 and 130. The weight of the forward rollers drives the digging teeth 136 into the ground to break up the surface into large chunks or cakes of earth. The pads 139 bear downwardly on the surface and on the described chunks of earth further to crush and to disintegrate the same. Actually, the teeth and pads have an alternate and opposite, but cooperative effect on soil; that is, the teeth dig up clods of earth while the pads press downwardly on and slice through such clods thereby achieving more rapid breakup of the earth into desirably small particles of loose composition. This action should be contrasted with the prior art practice of working the surface of a road, or the like, with a digging roller followed by a sheepfoot roller. In the latter case of the sheepfoot roller it is required to do the job of two rollers of the prior art.

Still further, the rear rollers 99 pass over, press downwardly, and further pulverize the soil which is preliminarily broken up into relatively larger chunks by the forward rollers 130, as described above. By flattening out the clods of dirt, the rear rollers blend and compact the soil. Since respectively adjacent end walls 131 of the forward rollers, and adjacent sides of the rear rollers 99 are very close to each other, substantially all of the surface 170 of the road in the swath of the subject implement is broken up, blended, and compacted in the manner described. The implement is passed over the surface as often as is required to obtain the desired surface condition.

During such earth traversing movement of the implement, the motors 150 may be energized to rotate the mounting shafts 146 and the cams 148 within their bearing sleeves 145. As is believed evident, this imparts a vibratory movement to the forward roller frames 116 and thus to the forward rollers 130. Also, the vibration of the forward frames is transmitted to the rear roller frames 92 by the links 126, the coupling brackets 80 and the rear roller frames 92. Such vibration facilitates pulverization of the soil as the rollers move thereover.

Relative movement of the certain parts of the subject implement during earth traversing movement thereof, are believed worthy of note. Thus, each roller 99 and 130 is independently mounted on substantially free-floating movement. Accordingly, if one of the rear rollers rides over a chuck hole, for example but not shown, it drops into the hole without appreciably affecting the action of the other rear rollers. The action between the forward rollers is similar in this respect. However, when the relative to the rearward rollers, and adjacent sides of the rear rollers 99 are very close to each other, substantially all of the surface 170 of the road in the swath of the subject implement is broken up, blended, and compacted in the manner described. The implement is passed over the surface as often as is required to obtain the desired surface condition.

During such earth traversing movement of the implement, the motors 150 may be energized to rotate the mounting shafts 146 and the cams 148 within their bearing sleeves 145. As is believed evident, this imparts a vibratory movement to the forward roller frames 116 and thus to the forward rollers 130. Also, the vibration of the forward frames is transmitted to the rear roller frames 92 by the links 126, the coupling brackets 80 and the rear roller frames 92. Such vibration facilitates pulverization of the soil as the rollers move thereover.

Relative movement of the certain parts of the subject implement during earth traversing movement thereof, are believed worthy of note. Thus, each roller 99 and 130 is independently mounted on substantially free-floating movement. Accordingly, if one of the rear rollers rides over a chuck hole, for example but not shown, it drops into the hole without appreciably affecting the action of the other rear rollers. The action between the forward rollers is similar in this respect. However, when the relative to the rearward rollers, and adjacent sides of the rear rollers 99 are very close to each other, substantially all of the surface 170 of the road in the swath of the subject implement is broken up, blended, and compacted in the manner described. The implement is passed over the surface as often as is required to obtain the desired surface condition.

During such earth traversing movement of the implement, the motors 150 may be energized to rotate the mounting shafts 146 and the cams 148 within their bearing sleeves 145. As is believed evident, this imparts a vibratory movement to the forward roller frames 116 and thus to the forward rollers 130. Also, the vibration of the forward frames is transmitted to the rear roller frames 92 by the links 126, the coupling brackets 80 and the rear roller frames 92. Such vibration facilitates pulverization of the soil as the rollers move thereover.

Relative movement of the certain parts of the subject implement during earth traversing movement thereof, are believed worthy of note. Thus, each roller 99 and 130 is independently mounted on substantially free-floating movement. Accordingly, if one of the rear rollers rides over a chuck hole, for example but not shown, it drops into the hole without appreciably affecting the action of the other rear rollers. The action between the forward rollers is similar in this respect. However, when the relative to the rearward rollers, and adjacent sides of the rear rollers 99 are very close to each other, substantially all of the surface 170 of the road in the swath of the subject implement is broken up, blended, and compacted in the manner described. The implement is passed over the surface as often as is required to obtain the desired surface condition.

During such earth traversing movement of the implement, the motors 150 may be energized to rotate the mounting shafts 146 and the cams 148 within their bearing sleeves 145. As is believed evident, this imparts a vibratory movement to the forward roller frames 116 and thus to the forward rollers 130. Also, the vibration of the forward frames is transmitted to the rear roller frames 92 by the links 126, the coupling brackets 80 and the rear roller frames 92. Such vibration facilitates pulverization of the soil as the rollers move thereover.

Relative movement of the certain parts of the subject implement during earth traversing movement thereof, are believed worthy of note. Thus, each roller 99 and 130 is independently mounted on substantially free-floating movement. Accordingly, if one of the rear rollers rides over a chuck hole, for example but not shown, it drops into the hole without appreciably affecting the action of the other rear rollers. The action between the forward rollers is similar in this respect. However, when the relative to the rearward rollers, and adjacent sides of the rear rollers 99 are very close to each other, substantially all of the surface 170 of the road in the swath of the subject implement is broken up, blended, and compacted in the manner described. The implement is passed over the surface as often as is required to obtain the desired surface condition.
pector with cooperative action occurring between the sheepfoot rollers and the gang of inflated, resiliently compressible rear rollers 99. In using such a converted implement, passage of the sheepfoot rollers over the ground leaves a fluff on top of the compacted surface. Then, the rollers pass over this surface and settle the fluff so that with each subsequent pass of the implement over the surface, it is compacted that much faster. In such an instance, the sheeprollers serve to obtain a course compaction of the soil while the inflated rollers effect a finer compaction of the soil. Alternatively, the forward rollers can be provided with drive means and driving means for digging teeth and sheepfoot pads achieves a conjugate digging and crushing action while subsequent passage of the inflatable rollers further pulverizes and compacts the soil initially worked upon by the forward rollers. It is significant that the rollers are individually mounted on substantially fixed floating frame, elevational movement and both the forward and rearward rollers are interconnected for alternate and opposite elevational movement during earth traversal of the implement over uneven terrain. Still further, rams are provided for adjusting the proportion of the total weight imposed upon the rollers so that more or less pressure can be imposed on the rollers, or so that one or the other of the forward or rearward rollers can be lifted out of ground engagement.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices and apparatus.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An earthworking implement comprising an elongated frame having predetermined forward and rearward portions and being adapted for connection to a draft appliance for earth traversing movement in a predetermined path of travel longitudinally of the frame, forward and rearward earth engaging members, separate mounting means individually pivotally supporting said forward and rearward members in the frame in longitudinally spaced relation to each other and in respectively trailing relation to the forward and rearward portions of the frame for independent elevational floating movement with their respective mounting means during earth traversing movement by the frame, and coupling means pivotally interconnecting the mounting means for said members whereby the members move elevationally of the frame alternately and oppositely relative to each other.

2. An earthworking implement comprising a support having forward and rearward portions and being adapted for earth traversing movement along a predetermined forward path of travel, a forward frame mounted on the support for elevational free floating movement about a predetermined substantially horizontal axis of reference disposed transversely of said path of travel, rear frame means mounted on the support rearwardly of the forward frame for elevationally free floating movement about an axis substantially parallel to said axis of reference, forward and rear ground engaging roller members individually journaled in the forward frame and the rear frame means, respectively, for rotatable movement about individual axes substantially parallel to said axis of reference, linkage means borne by the support and interconnecting the frame means and the forward frame for enabling a alternate opposite elevational movement of the frame and frame means and their respective roller member relative to the support during earth traversing movement of the support, and powered means mounted on the support and connected to the frame means for elevationally adjusting the frame means relative to the support whereby the frame is elevationally adjusted alternately and oppositely of the frame means through said linkage means.

3. The implement of claim 1 wherein one of said mounting means includes means for elevationally vibrating the earth engaging members supported by said one of said mounting means during earth traversing movement thereof, and said coupling means includes means to transmit such vibration to the other of said members through its respective mounting means.

4. The implement of claim 1 wherein said coupling means includes resiliently compressible members yieldingly resisting said alternate and opposite movement of the members.

5. The implement of claim 1 wherein the forward member is a roller having a plurality of radially outwardly extended sheepfoot pads; and wherein the rearward member is a resiliently compressible, pneumatically inflated roller.

6. The implement of claim 1 wherein the forward member is a roller including a plurality of rows of earthworking teeth with each row being in circumscribing relation to the axis of rotation of the roller, with said rows being in spaced relation longitudinally of the roller, and with each row including alternate digging and sheepfoot teeth; and wherein the rearward member is a pneumatically inflated, resiliently compressible roller.

7. The implement of claim 2 wherein the rear roller member is an inflated, resiliently compressible roller; and wherein the forward roller member is a digging roller including a plurality of pointed, radially outwardly extended earth-digging teeth.

8. The implement of claim 2 wherein bearing members are mounted on the support forwardly and downwardly of the forward frame, wherein arms are pivotally connected to the forward frame and extended forwardly therefrom over and rested on the bearing members, and wherein a weight is coupled to the arms and extended transversely of the support forwardly of the bearings for countering the weight of the front roller member.

9. A multi-purpose, tandem earthworking implement comprising a support having forward and rearward portions and being adapted for earth traversing movement along a predetermined forward path of travel, a pair of forward frames mounted on the support in side-by-side relation for elevationally free floating movement independently of each other about a predetermined, substantially horizontal axis of reference during earth traversing movement of the support, a plurality of rear frames independently mounted in side-by-side relation on the support rearwardly of the forward frames for elevationally free floating movement about an axis substantially parallel to said axis of reference, forward ground engaging roller members individually journaled in the forward frames for rotatable ground driven movement about axes substantially parallel to said axis of reference, forward ground engaging roller members individually journaled in the forward frames and the rear frames for rotatable ground driven movement about axes substantially parallel to said axis of reference, rear ground engaging roller members individually journaled in the rear frames for rotatable ground driven movement about axes substantially parallel to said axis of reference during earth traversing movement of the support, and a pair of elongated, longitudinally resiliently compressible linkage means borne by the support and individually interconnecting the forward frames and at least one of the
rear frames for yieldable movement of said frames to-ward and away from each other whereby the intercon- 
ected forward and rearward frames and their respective 
roller members are alternately and oppositely elevation-
ally adjustable and whereby transversely related roller
members are independently elevationally movable during 
earth traversing movement of the main frame; and a 
rearward frame; an elongated rod longitudinally slidably received in the collar having a rearward end connected to the rear por-
tion of the rear frame above the axis of rotation of the rear
roller; and a forward end spaced forwardly of the collar; a 
forward block connected to the forward end of the rod;
forward and rearward compression springs encircling the 
rod and individually interposed the collar and the block 
and the collar and the rear portion of the rear frame; and 
a rigid link pivotally interconnecting the bracket adjacent 
the upper end of the upstanding leg and the rear end 
portion of the forward frame whereby the forward and 
rear rollers move alternately and oppositely upwardly 
and downwardly during earth traversing movement of the 
implement.

The embodiment of claim 11 wherein the main frame 
also has an upper portion pivotally connected to said for-
ward portion for movement about an axis substantially 
parallel to said predetermined axis between a position 
rearwardly extended from the forward portion over the 
forward rollers and a retracted position upwardly ex-
tended from said forward portion; and wherein the rear 
is pivotally connected to the upper portion of the main 
frame.

The embodiment of claim 11 wherein bearings are 
mounted on the upwardly extended portion of the main 
frame forwardly of the forward roller and downwardly 
of the forward roller frame and extended through the 
the forward roller frame laterally adjacent to the forward 
roller and extended over and rested on the bearings forwardly of the forward roller, and wherein an elongated weight rigidly interconnects the arms forwardly of the bearings for counter-balancing the weight of the forward roller.

The embodiment of claim 11 wherein the forward 
roller has an elongated bore concentric to its axis of rota-
tion, wherein bearings are fitted in the bore of the 
roller in axially spaced relation to each other, wherein an 
elongated shaft is journaled in the forward roller frame 
and extends through the bore of the forward roller and 
bearing sleeves therein, wherein cams are secured to the 
shafts within the bearing sleeves and provide peripheral 
surfaces eccentrically circumscribing the shaft and 
slidably engaging the sleeves, wherein a motor is mounted on the 
forward roller of the frame and includes a drive shaft hav-
ing driving connection to the vibrating shaft for imparting 
rotation to the latter thereby to vibrate the forward roller 
frame up and down whereby an elevational vibratory 
movement is imparted to the forward roller and, through 
the bracket, collar, roll, and springs, to the rear roller.

The embodiment of claim 11 wherein the main frame 
includes an upper section pivotally connected to the for-
ward portion of the main frame for movement about an 
axis substantially parallel to said axis of reference between 
a position rearwardly extended from said forward por-
tion over the forward rollers and a retracted position ex-
tended upwardly from said forward portion, and an elon-
gated rod having a forward end pivotally connected to 
the main frame above the axis of rotation of the rear 
roller frame; an elongated rod longitudinally slidably received in the collar having a rearward end connected to the rear por-
tion of the rear frame above the axis of rotation of the rear 
roller and a forward end spaced forwardly of the collar; a 
forward block connected to the forward end of the rod; 
forward and rearward compression springs encircling the 
rod and individually interposed the collar and the block 
and the collar and the rear portion of the rear frame; and 
a rigid link pivotally interconnecting the bracket adjacent 
to the upper end of the upstanding leg and the rear end 
portion of the forward frame whereby the forward and 
rear rollers move alternately and oppositely upwardly 
and downwardly during earth traversing movement of the 
implement.

References Cited by the Examiner

UNITED STATES PATENTS

1,927,088 9/1933 Gerlinger [49-50 X
2,132,059 10/1938 Trembley [49-50
2,585,177 2/1952 Garries [49-50 X
2,874,948 2/1959 Bjorkman 94-50 X

CHARLES E. O’CONNELL, Primary Examiner.

JACOB L. NACKENOFF, Examiner.

N. C. BYERS, Assistant Examiner.