Oct. 11, 1966 H. T. PETERSEN 3,277,802

TANDEM EARTHWORKING IMPLEMENT

Filed Oct. 18, 1963 4 Sheets-Sheet 1

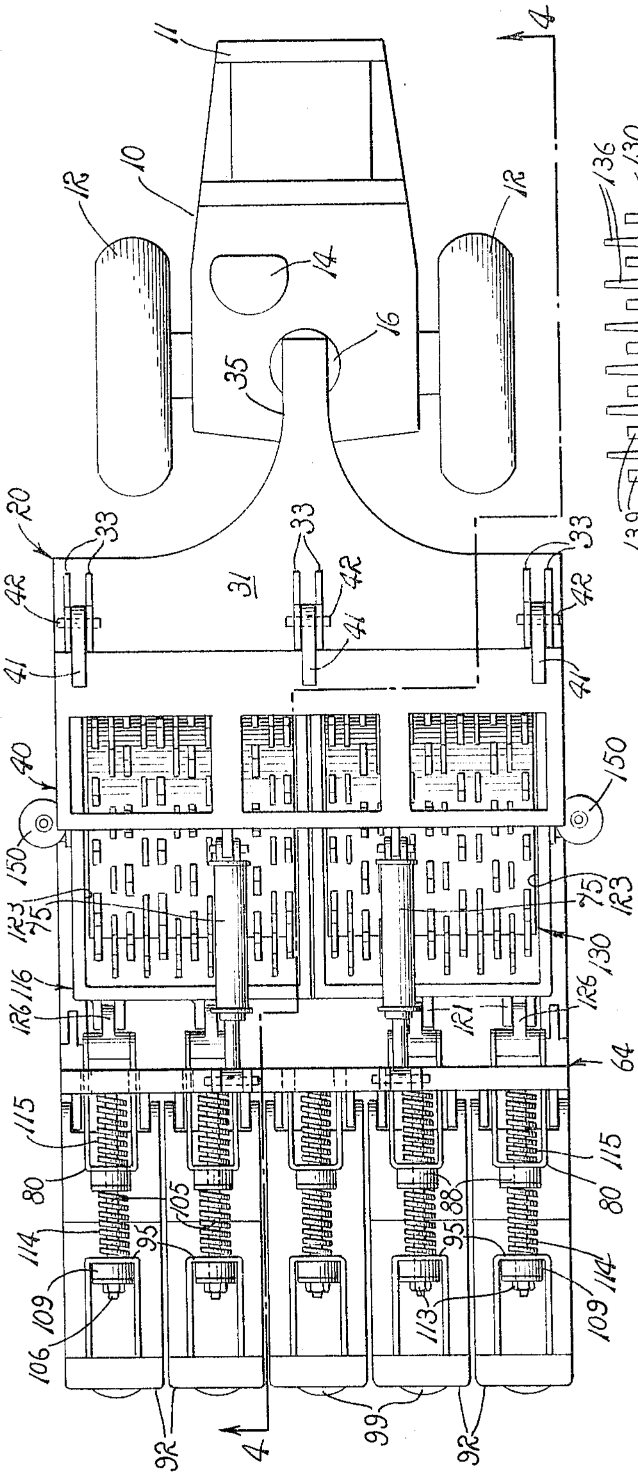

FIG. 1.

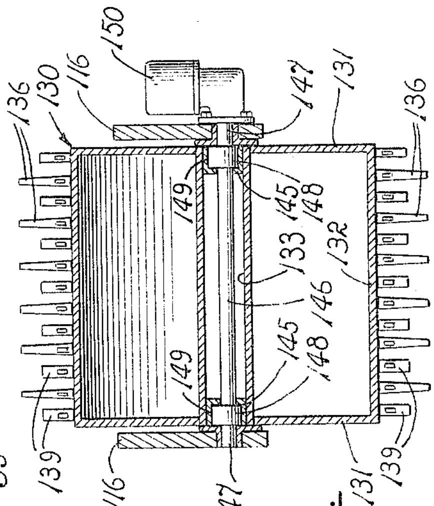

FIG. 9.

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TANDEM EARTHWORKING IMPLEMENT

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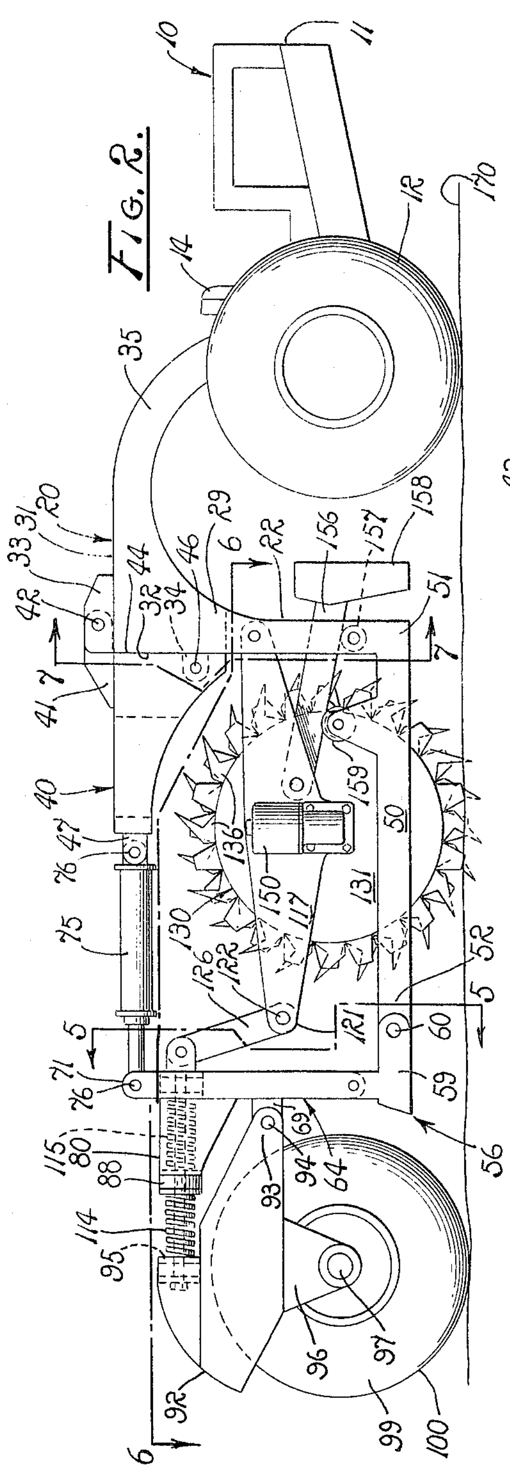

FIG. 2.

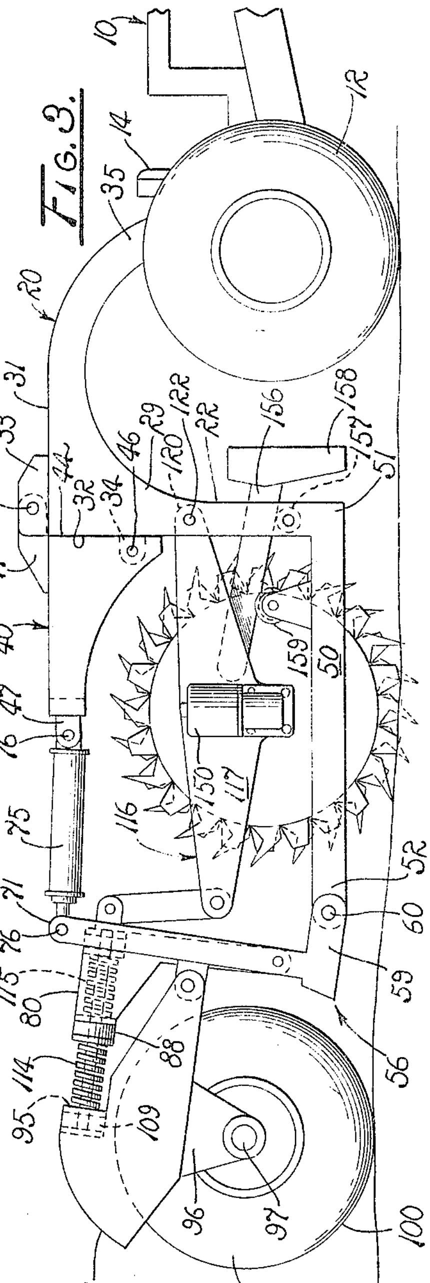

FIG. 3.

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FIG. 4.

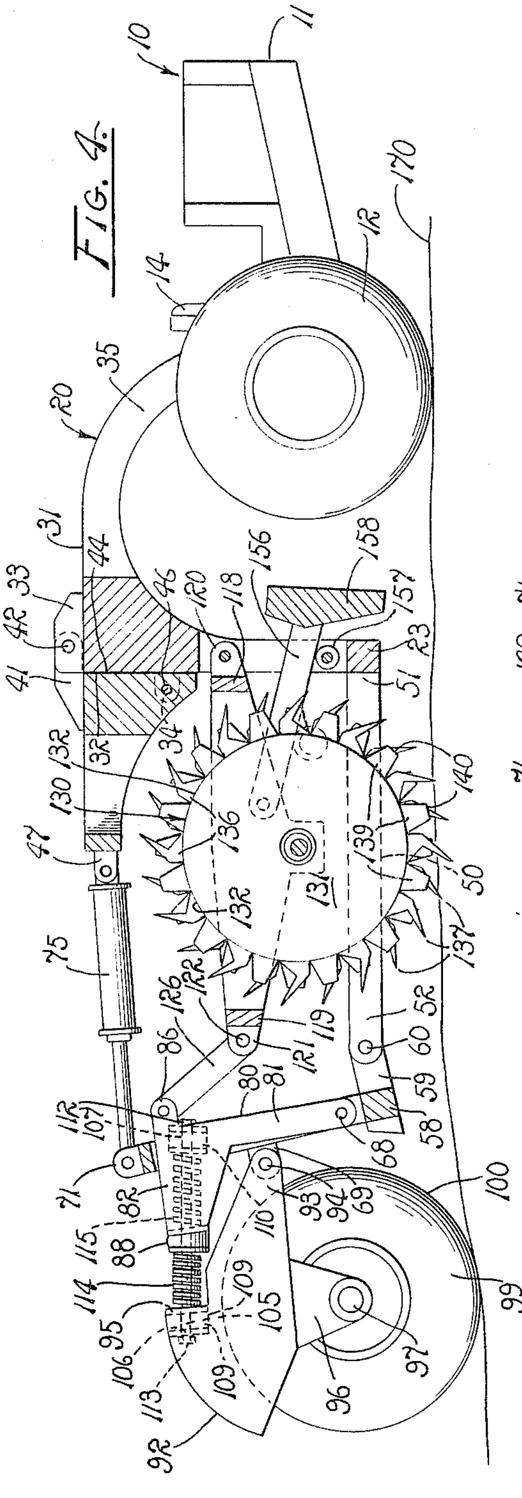
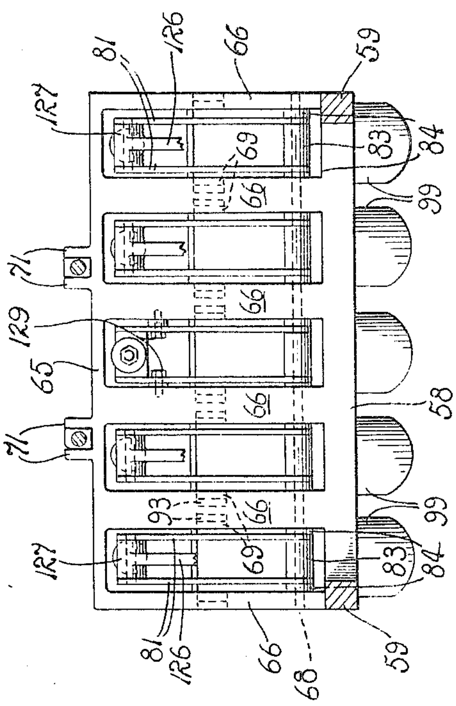


FIG. 5.



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TANDEM EARTHWORKING IMPLEMENT

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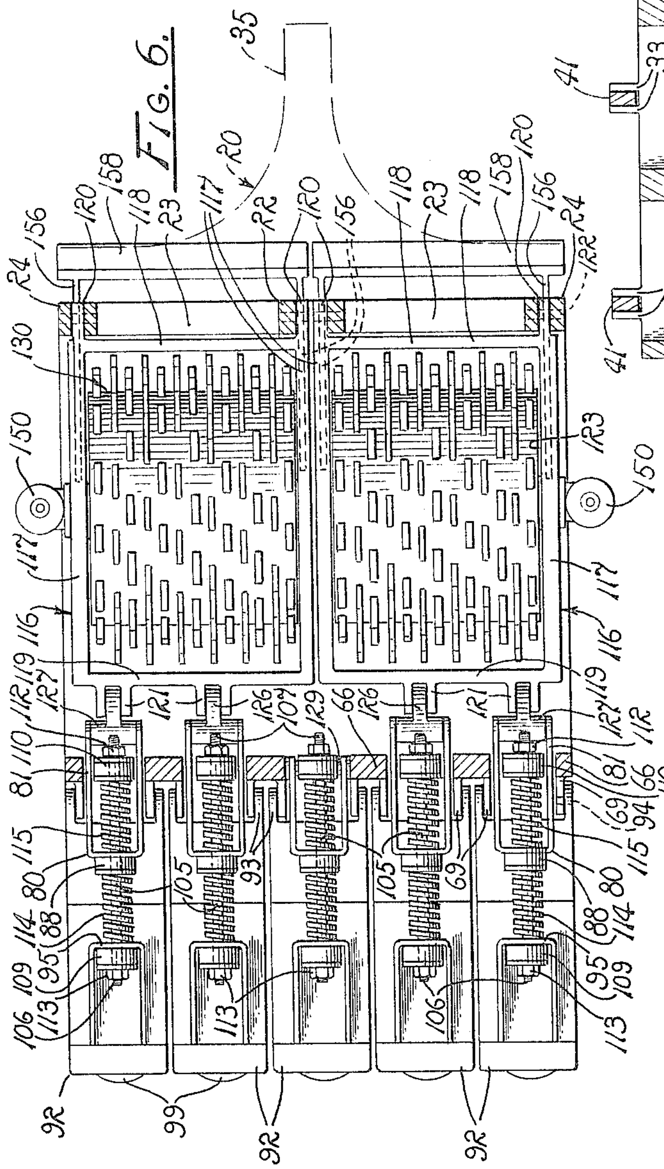

FIG. 6.

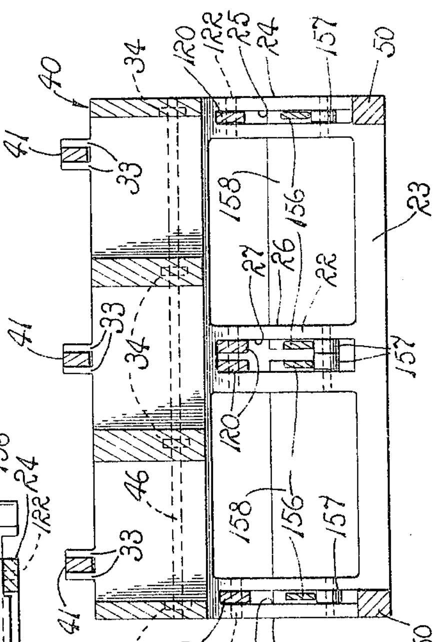

FIG. 7.

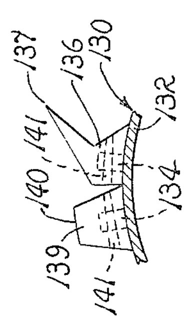

FIG. 8.

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United States Patent Office 3,277,802
Patented Oct. 11, 1966

3,277,802

TANDEM EARTHWORKING IMPLEMENT

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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 sheepfoot rollers have also been employed with varying degrees of success on soils of relatively greater cohesive properties. While a sheepfoot roller is of little effect on loose, clean, and sandy soil, a rubber-tired roller is of greater effect on such soils of little 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 penertating 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 my 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 sheepfoot roller to roll down the fluff usually existing on top of the ground compacted by the sheepfoot 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 objective 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 brekaing 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 sheepfoot 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 roller 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 sheepfoot 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** individually 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 **44** thereof in abutment 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 lower 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 upper 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 to the frame and which is defined by the pins **60**. Spaced pairs of flanges **69** 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 respectively 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 **93** individually pivotally connected to the flanges **69** of the auxiliary frame **56** by pins **94**. When mounted in this manner, the roller frames are pivotal 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 individually rearwardly spaced relation to the intermediate collars **88** on the coupling brackets **80**. In addition, the roller frames have downwardly extended pairs of spaced, 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 fitted on the rear ends of the rods rearwardly 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 endward axial 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 strength 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 **126** 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 pairs of coupling brackets **80**. Therefore, the links and the coupling brackets interconnect each outermost pair of rear 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 circumscribing, 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 wall **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 drawings, angulated digging teeth **136** having sharp 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, sheepfoot 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 walls 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 circumscribing 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 normal to the path of travel thereof. The 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 counterweights 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 tough surface, as generally indicated at 170 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 substantially equally distributed between 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 coopertaive 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 subject invention, only one roller 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 transmited 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 for 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 forward rollers rise relative to the rear rollers, as illustrated in FIG. 4, the forward roller frames 116 rise and press upwardly and rearwardly on the links 126. This causes force to be applied rearwardly on the coupling brackets 80 whereby the intermediate collars 88 are forced rearwardly on their respective rods 105 to compress the rear springs 114 whereby the rear roller frames 92 are urged downwardly about their pivot pins 94. Conversely, when the rear rollers rise relative to the forward rollers, the forward roller frames are urged downwardly to urge the forward rollers against the ground with greater force. This latter situation is illustrated in FIG. 3. Therefore, there is a continual transferring or shifting of forces between the forward and rearward rollers as the implement traverses uneven terrain of the type usually encountered where such an implement is employed. In this manner, each roller is urged against the ground not only by its own weight but by the forces transmitted thereto by the other roller and the coupling linkages. This enables more effective digging, crushing, pulverizing, and like functions, as discussed above.

If it is desired to adjust the amount of weight imposed upon either the forward or rearward rollers 99 or 130 relative to the other, the rams 75 are either expanded or contracted. If the rams are expanded, the rear rollers are urged downwardly relative to the forward rollers. Parenthetically, if the rams are sufficiently extended, the forward rollers are lifted out of ground engagement for facilitating transport of the implements over surfaces which it is not desired to break up or on which it is not desired to impose the pressures and actions of the forward rollers. Also with the forward rollers out of ground engagement, it is possible to obtain the action of the rear rollers alone. By contracting the rams, the opposite effect is obtained. That is, the rear rollers may be elevated and even lifted out of ground engagement for obtaining the action of the forward rollers alone. It is to be understood that by contracting and expanding the rams, the proportion of the total weight of the implement borne by the forward and rearward rollers can be adjusted. For example, the rollers can carry an equal amount of the weight, as noted above, the forward rollers can bear seventy percent of the weight while the rearward rollers bear the remaining thirty percent, or vice-vesa, or any other desirable ratio can be effected by proper adjustment of the rams.

By replacing all of the teeth 136 with pads 139 so that the forward rollers 130 are essentially sheepfoot rollers, the implement is converted into a combined surface compactor 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. 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 entirely with digging teeth **136** for achieving more initial digging action. In any event, with the implement employed as a multi-purpose rig, the rearward rollers leave a more desirable working surface behind the implement at all times essentially by controlling the fluff and making the surface more amenable to the addition of moisture.

From the foregoing, it will be evident that a tandem earthworking implement which has multiple functions has been provided. The implement is particularly suited for breaking up tough earth surfaces, for blending and pulverizing soil, and for compacting earth traversed by the implement. Use of the forward rollers having both digging teeth and sheepfoot pads achieves a conjoint 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 for substantially free floating, elevational movement and that 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 elevationally 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 alternate and opposite elevational movement of the frame and frame means and their respective roller members 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 means yieldably 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 connected to the arms and extended transversely of the support forwardly of the bearings for counterbalancing 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, rear ground engaging roller members individually journaled in the rear frames for ground driven rotation about individual 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 toward and away from each other whereby the interconnected forward and rearward frames and their respective roller members are alternately and oppositely elevationally adjustable and whereby transversely related roller members are independently elevationally movable during earth traversing movement of the support.

10. An earthworking implement comprising an elongated main support frame mounted for earth traversing movement longitudinally of the frame and in a predetermined forward path of travel and having a rearwardly extended end portion; an upstanding auxiliary support frame pivotally connected to said end portion of the main frame for fore and aft tilting movement about a predetermined axis of reference substantially normal to said path of travel; a fluid control ram pivotally interconnecting the main and auxiliary frames for fore and aft adjustment of the auxiliary frame incident to contraction and expansion of the ram, respectively; a forward roller frame pivotally connected to the main frame for free floating, elevationally adjustable movement; a forward, substantially cylindrical earth engaging roller journaled in the forward frame; a rear roller frame having a forward portion pivotally connected to the auxiliary frame for free floating, elevational adjustable movement, and a rear portion; a rear earth engaging roller journaled in the rear frame; a coupling bracket pivotally connected to the auiliary support frame for fore and aft tilting movement about an axis substantially parallel to said axis of reference; resiliently compressible means interconnecting the rear end of the rear roller frame and the coupling bracket for resisting relative movement of the bracket and rear roller frame toward and away from each other; and a link pivotally interconnecting the bracket and the forward frame whereby the forward and rear rollers move alternately and oppositely upwardly and downwardly during earth traversing movement of the implement.

11. An earthworking implement comprising an elongated main support frame having an upwardly extended forward portion and a lower rearwardly extended portion; ground engaging wheels mounting the frame for earth traversing movement longitudinally of the frame and in a predetermnied path of travel; a substantially rectangular auxiliary support frame having a lower portion pivotally connected to the lower portion of the main frame for fore and aft tilting movement about a predetermined axis of reference substantially normal to said path of travel, and an upwardly extended end portion; a fluid control ram pivotally interconnecting the main and auxiliary frames for fore and aft adjustment of the auxiliary frame incident to contraction and expansion of the ram, respectively; a substantially rectangular forward roller frame having a forward end portion pivotally connected to the upwardly extended portion of the main frame for free floating elevational adjustable movement, and a rear end portion; a forward, substantially cylindrical earth engaging roller journaled in the forward frame; a rear roller frame having a forward portion pivotally connected to the auxiliary frame for free floating elevational adjustable movement, and a rear portion; a rear earth engaging roller journaled in the rear frame; a substantially L-shaped coupling bracket having an upstanding leg providing a lower end pivotally connected to the lower end portion of the auxiliary support frame for fore and aft tilting movement and an upper end, and an upper leg rearwardly extended from the upper end of the upstanding leg, the forward and rear frames and rollers and the bracket being pivotal about individual axes substantially parallel to said axis of reference; a collar secured to the upper leg of the bracket in forwardly spaced relation to the rear portion of the rear frame; an elongated rod longitudinally slidably received in the collar having a rear end connected to the rear portion 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.

12. The implement of claim **11** wherein the main frame also has an upper portion pivotally connected to said forward 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 extended from said forward portion; and wherein the ram is pivotally connected to the upper portion of the main frame.

13. The implement 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, wherein elongated arms are individually connected to the forward roller frame laterally adjacent to the forward roller and extended over and rested on the bearings forwardly of the forward roller, and wheren an elongated weight rigidly interconnects the arms forwardly of the bearings for counter-balancing the weight of the forward roller.

14. The implement of claim **11** wherein the forward roller has an elongated bore concentric to its axis of rotation, wherein bearing sleeves 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 extended 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 having 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, rod, block, and springs, to the rear roller.

15. The implement of claim **11** wherein the main frame includes an upper section pivotally connected to the forward 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 portion over the forward rollers and a retracted position extended upwardly from said forward portion, and an elongated ram having a forward end pivotally connected to said upper section of the main frame and a rear end pivotally connected to the upwardly extended end portion of the auxiliary support frame for fore and aft tilting movement of the auxiliary frame.

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