United States Patent

Lewis

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[54] ROAD BASE BUILDING APPARATUS

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[52] **U.S. Cl.** **94/44**, 94/45, 172/59

[51] **Int. Cl.** **E01c 19/12**

[58] **Field of Search** 94/44, 45, 46; 172/51, 59, 172/110, 111, 49, 72; 37/108

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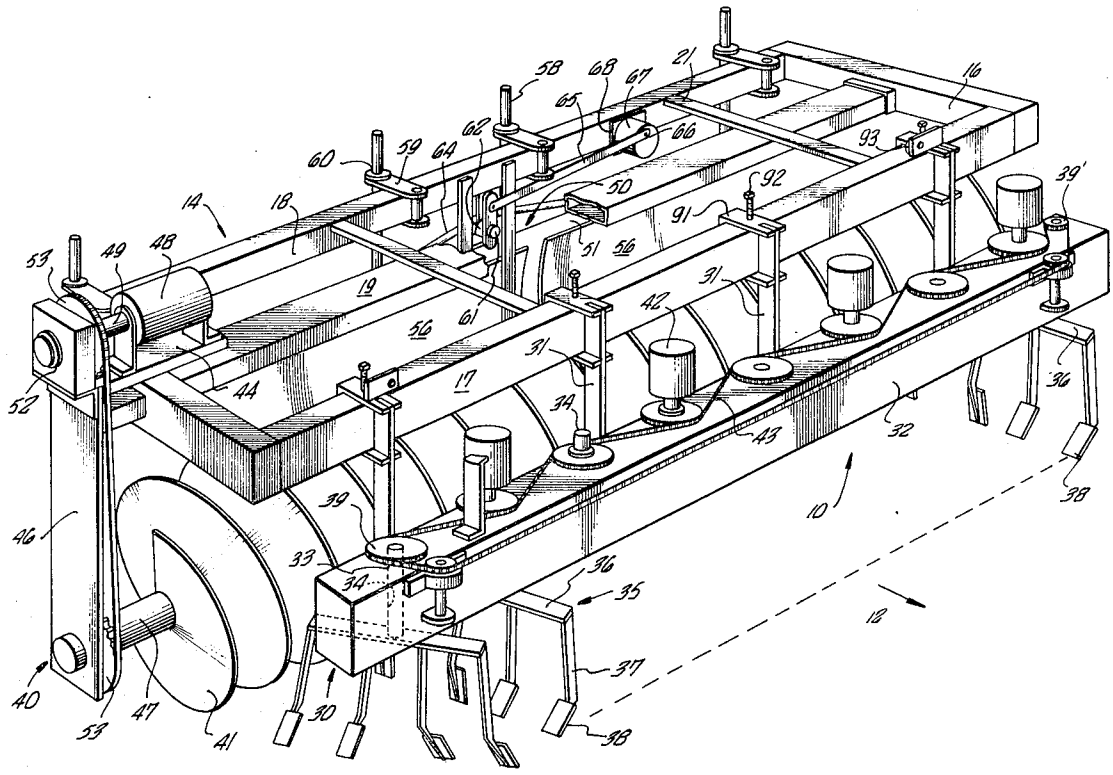
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[57] **ABSTRACT**

A road base building apparatus is described that is adapted to be attached to the support ring of a conventional road grader. The apparatus includes a mounting frame for supporting a plurality of rotating scarifiers, a shoveling assembly and a split moldboard strikeoff with the two portions thereof oscillating in opposite directions. The scarifiers are adapted to loosen and/or mix the rock base material to a uniform consistency. The shoveling assembly functions to laterally distribute the material while the pair of strikeoff portions operate to effect a leveling and smoothing of the material. A V-plow is also adapted to be attached to the conventional road grader forward of the rotating scarifiers for laterally distributing the earth or base material deposited ahead of the apparatus. The various components of the apparatus are driven by hydraulic motors operatively connected to a hydraulic pump which, in turn, is connected to the engine of the road grader through a power takeoff located at the rear of the grader.

30 Claims, 7 Drawing Figures



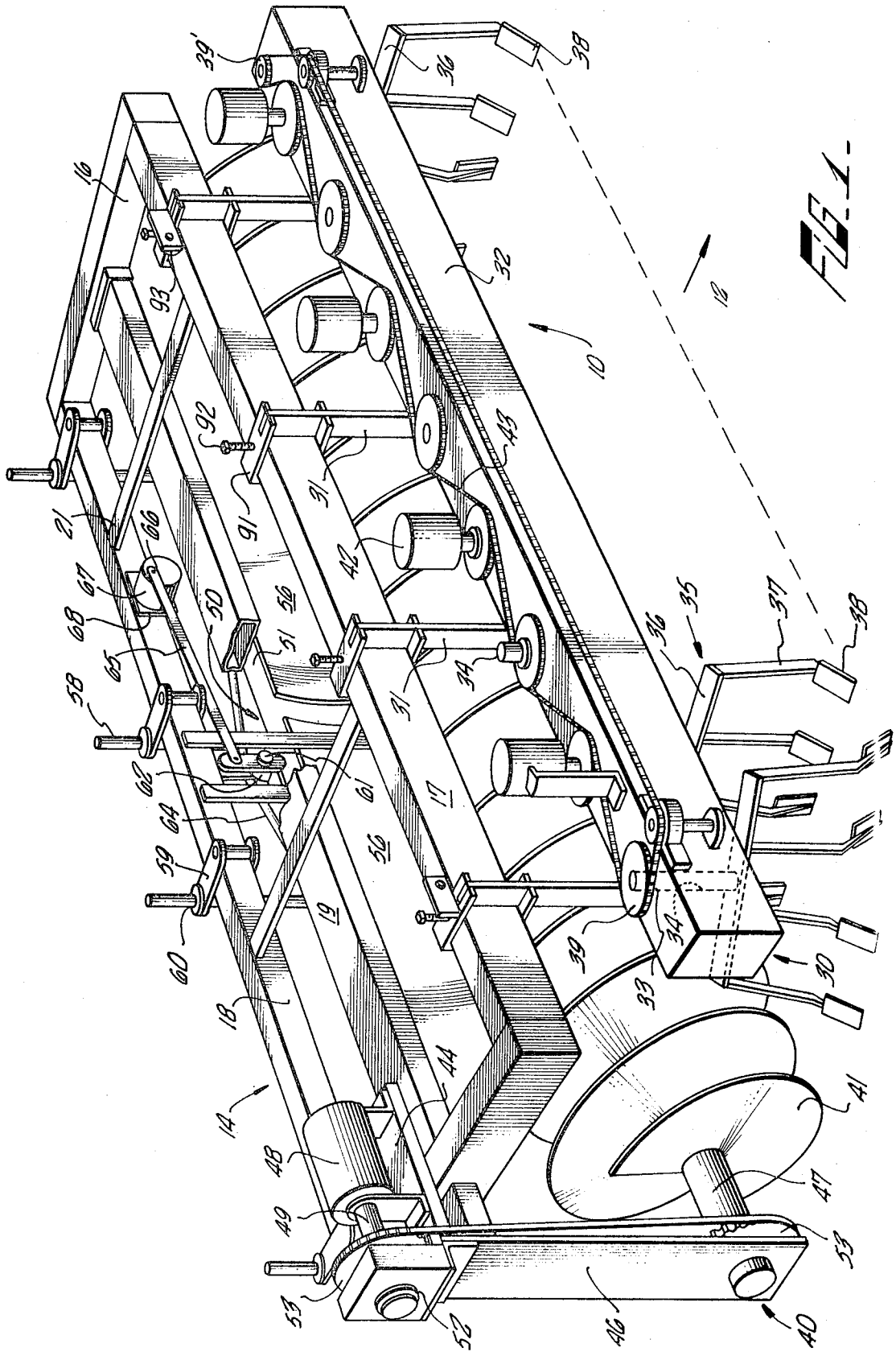


FIG. 1.

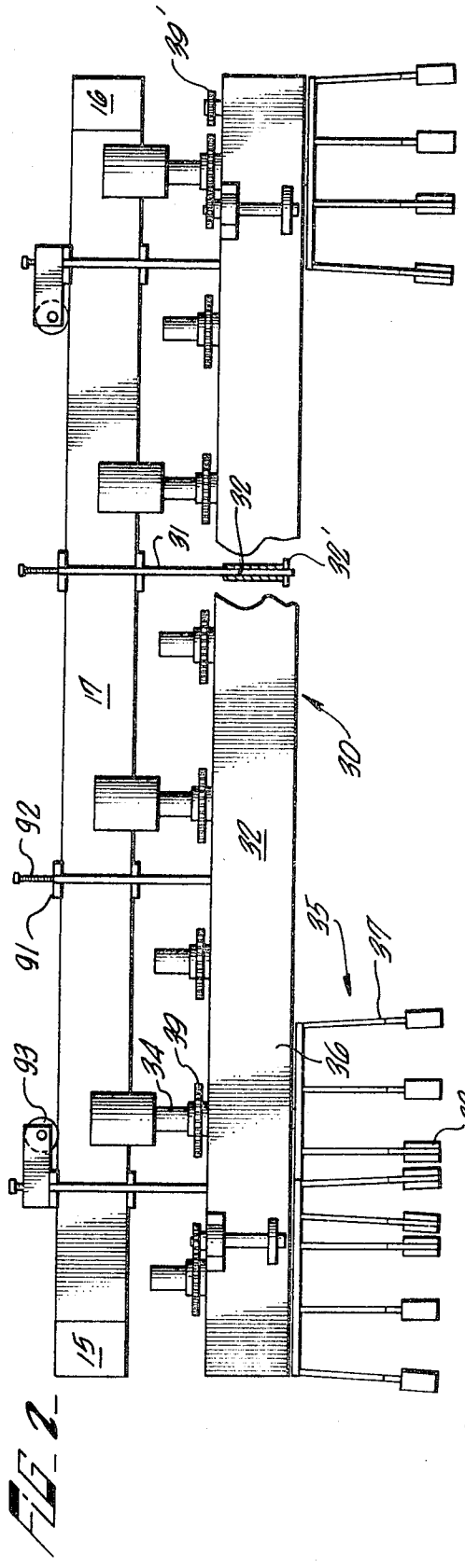

30'
16
31
32
36'
17
30
92
91
32
35
37
93
34
39
36
38
15

FIG. 2

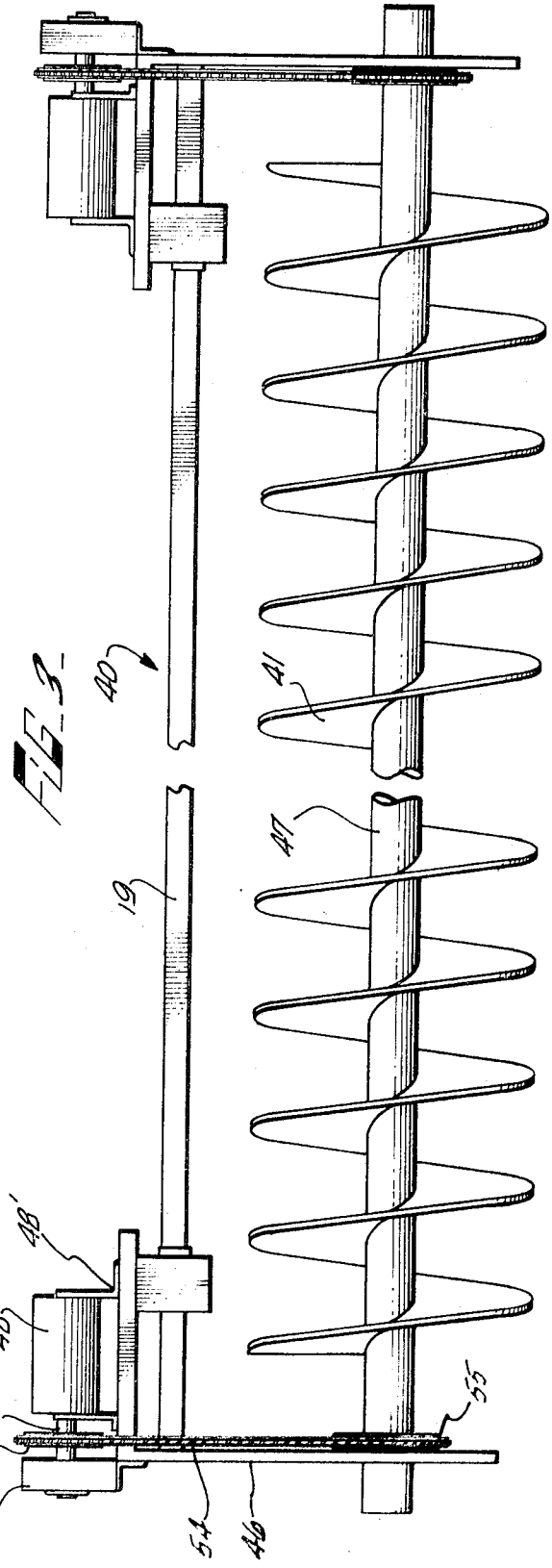

40
41
19
47
48'
48
49
53
55
52
54
46

FIG. 3

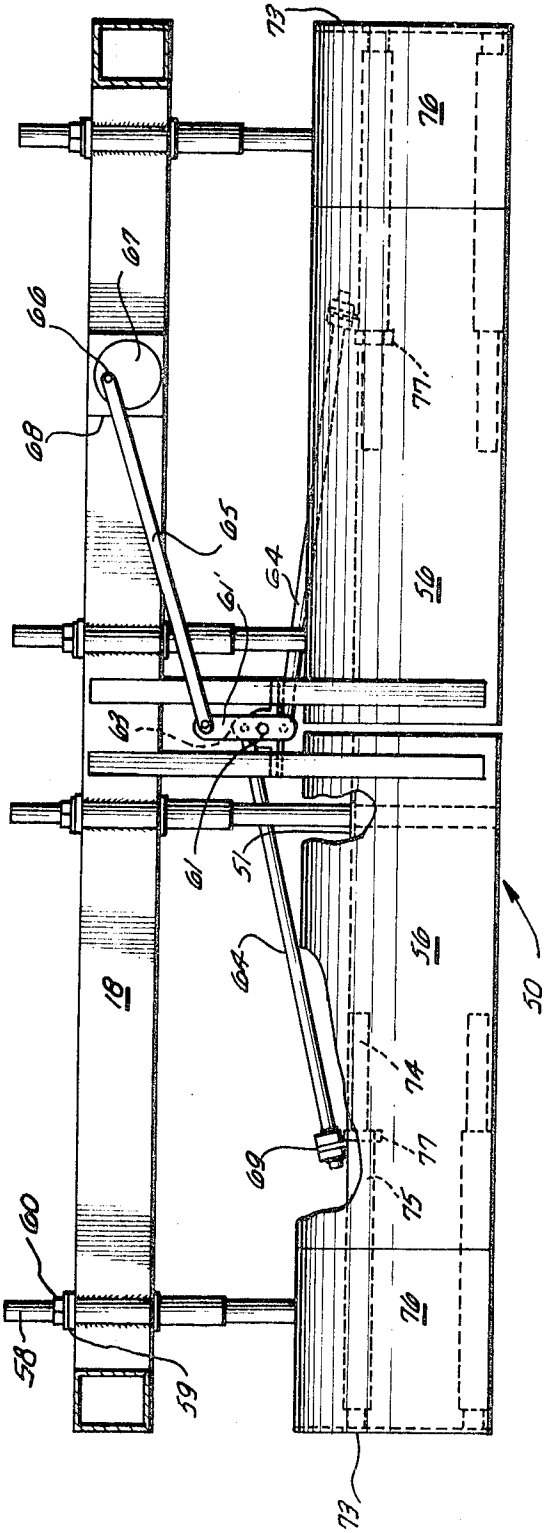

73
76
66
67
68
77
65
64
61'
50
62
61
51
64
16
18
50
74
69
77
75
60
58
59
70
73

FIG 4

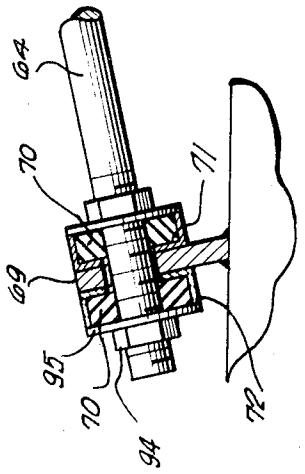

64
70
71
69
95
70
94
72

FIG 5

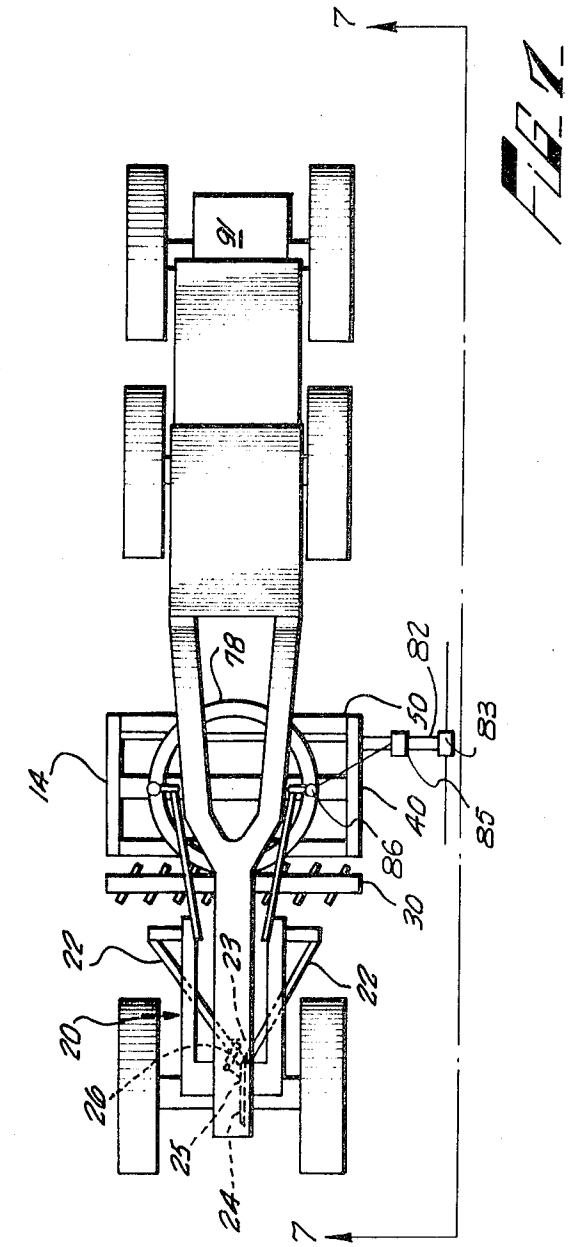

7
16
18
82
50
83
14
40
85
86
30
22
23
22
20
26
25
24
7

FIG. 6

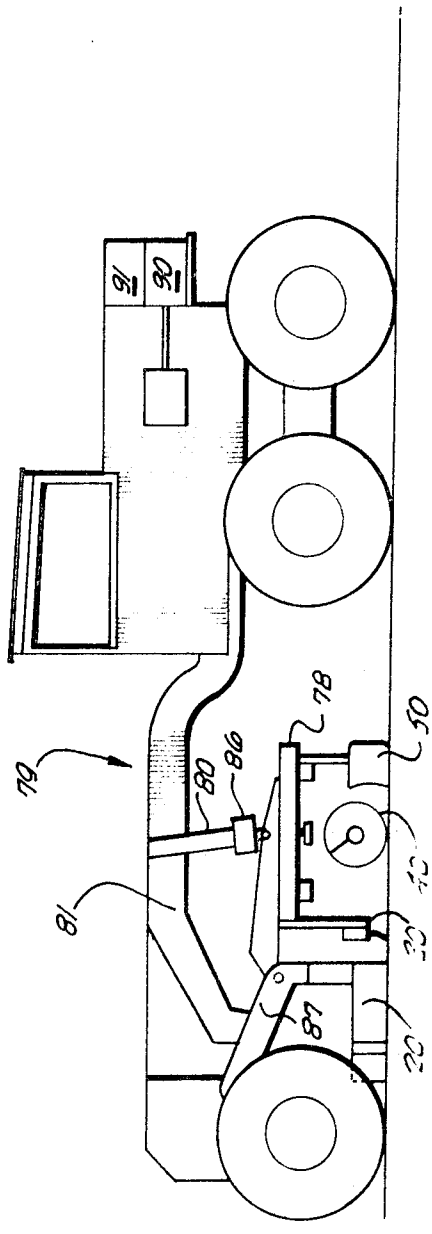

16
60
18
10
70
80
86
81
48
20

FIG. 7

ROAD BASE BUILDING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to road building apparatus and more particularly to an improved earth finish or base building apparatus.

2. Description of the Prior Art

Major economies have been effected in the construction of modern highways by reason of the utilization of large semiautomatic concrete finishing machines. As is well known, these machines are adapted to spread, compact and hand-finish in one operation a slab of concrete at any desired thickness. Furthermore, road base building apparatus have been constructed to provide a roadbed or road base according to the exacting specifications required by these finishing machines.

Although prior road base building and surface finishing apparatus have been manufactured in various constructions to function in various manners in preparing the road base, one type of apparatus which has met with a fair degree of success has included three main components; i.e., a scarifier, shoveling means, and moldboard strikeoff means. In such a device the scarifier functions to cut the roadbed to a subgrade and to reduce the material to sand and pebble size for easy removal or for mixing and leveling. The shoveling means functions to remove the excess material outside of the machine path, while the moldboard strikeoff functions to strike a true grade and to work the excess into material tumbled ahead of H into the low spots left by the scarifier. Although this type of device has met with a limited amount of success, various shortcomings are encountered which limit its widespread acceptance and use.

A serious problem of this type of device occurs in its scarifier construction. One such scarifier utilizes a horizontally revolving tube having a plurality of digger teeth projecting radially outward therefrom. Although such a scarifier operates effectively in small size material, in the rugged type of subgrading the digger teeth encounters rather large rocks and because of the pile driving movement of these teeth they are subject to rapid disintegration in the course of these encounters. Another type of scarifier includes a reciprocating rake having a plurality of teeth reciprocating through the material in a transverse direction. As in the revolving scarifier, the reciprocating rake operates adequately in small size material, but in the rugged type of subgrading the rake teeth are easily damaged by the large rocks located therein.

Serious problems are also encountered in the shoveling means used in these prior devices. A prior shoveling means includes a paddle train comprising a plurality of paddles mounted on a flexible drive which function to push the excess material into windrows outside the machine path. One shortcoming lies in the complexity of the paddle and drive structure. The multiplicity of parts in such means seriously effects its reliability while rendering its maintenance exceptionally arduous. Moreover, such devices require a large amount of space which is usually attained by compromising adjoining structure to accommodate it.

Prior moldboard strikeoffs usually include an oscillating moldboard pivotally mounted to the superstructure of the apparatus. A serious shortcoming with such a device is that, being of heavy construction, the transverse oscillating movement creates a rocking moment on the superstructure as it moves forward. Such moments create undue stresses and strains on the apparatus and cause frequent breakdowns thereof.

Another serious shortcoming is the expense involved. Although these apparatus save many man hours of labor, their initial cost is prohibitive to the average road construction firms.

SUMMARY OF THE INVENTION

The present invention obviates the above-mentioned shortcomings by providing a road base building apparatus that is adapted to perform a variety of different but related functions,

including the preparation of the subgrade for a road, the spreading and leveling of a select base for a road, and the spreading and leveling of treated earth for a road, as well as other uses in agriculture and large building sites, providing in all cases a roadbed or road base which is uniform, accurate and smooth. The road base building apparatus includes a frame adapted to be mounted on the support ring of a conventional road grader. The frame includes three transverse beams, one beam supporting a plurality of rotating scarifiers transversely spaced across the entire width of the apparatus. Each scarifier rotates about a vertical axis and includes a plurality of axially extending projections adapted to rotate within the subgrade or finish material. The projections are adapted to receive either a plurality of digger teeth for desegregating the earth and/or base material to a uniform consistency or a plurality of paddles for mixing a treated base to a smooth consistency. The second beam is adapted to support a shoveling assembly which includes a rotating auger rotatably mounted behind the scarifiers and extending transversely across the entire width of the apparatus. The auger is rotatable about a horizontal axis in either direction and functions to remove any excess material into windrows outside the machine path. The third beam is adapted to support a pair of moldboard strikeoffs hingeably mounted thereon and extending transversely across the entire width of the apparatus. The moldboard strikeoffs are counteroscillated to achieve a balanced movement and prevent undue stresses on the frame. Novel shock absorbing means are also provided to absorb the loads transferred from the moldboard strikeoffs to the drive linkages. A pair of moldboard strikeoff extensions are mounted on the exterior ends of the moldboard strikeoffs to strike off the grade on either side of the apparatus, the auger being axially movable to accommodate either of these extensions. A windrow splitter or V-plow is also adapted to be attached to the conventional road grader forward of the rotating scarifiers to split and laterally distribute the windrow of either finish or base material deposited ahead of the apparatus. The various components of the apparatus are driven by hydraulic motors operatively connected to a hydraulic pump which, in turn, is connected to the engine of the road grader through a power takeoff located at the rear of the grader. Although each of the above-mentioned components are individually adjustable, the elevation of the entire frame and the road grader support ring is controlled by a grade-wire control system to maintain exact elevation and frame cross-level.

An important advantage of the rotating scarifiers is that they are able to operate efficiently and durably in all types of material to mix the base or finish material to a uniform consistency. Moreover, the scarifiers of the present invention are positioned in an overlapping interrelationship and are counterrotatable to function effectively as mixers when the material is composed of a treated base. The rotatable auger provides a simple and efficient way of removing the excess material from the path of the apparatus while being axially adjustable to also remove the excess material from the path of the moldboard strikeoff extensions. Besides operating in a balanced manner, the moldboard strikeoffs are also vertically adjustable in various positions to form either a straight edge or various types of crowns in the finished grade of material.

Another very important advantage of the apparatus is that it is comparatively compact in size with respect to other road base building apparatus and since the apparatus functions as an attachment to a conventional road grader a substantial cost reduction is achieved.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the road base building apparatus in accordance with the present invention;

FIG. 2 is a front elevational view of the scarifier assembly;

FIG. 3 is a front elevational view of the shoveling assembly;

FIG. 4 is a front elevational view of the moldboard strikeoff;

FIG. 5 is an enlarged fragmentary view partly in section of the moldboard strikeoff shock absorbing means;

FIG. 6 is a top plan view of the road building apparatus being attached to a conventional road grader; and

FIG. 7 is a side plan view of the road grader taken along lines 7—7 of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIG. 1 shows a road base building apparatus 10, according to the present invention, as it would appear when traveling forwardly in the direction of the arrow 12. The apparatus 10 includes a rigid rectangular frame 14 which is adapted to be supported by a conventional road grader, hereinafter described.

Although the apparatus 10 is adapted to be utilized as a heavy duty accurate subgrader, the description hereinafter made will be directed to utilization of the apparatus 10 for spreading and leveling the base course material upon an already prepared subgrade. The base course for a concrete highway is usually a rock base or treated material over which the slab of concrete is laid. However, it should be noted that the present apparatus 10 is adapted to spread and level various types of base course materials as well as treated material which itself constitutes the road surface, and the description hereinafter made is therefore merely exemplary.

Since the accuracy of the grade of the base course to a great extent controls the accuracy of the finished road it is extremely important to mix, break up, spread and level the base course in relatively close tolerances. The base material is usually dumped into a conventional calibrated windrower (not shown) by a dump truck. The windrower lays down a windrow arranged coextensive with and upon the proposed road bed, and the apparatus 10 mixes, spreads and levels the windrow to provide a finished base course for supporting an overlying slab of concrete to form the road. A windrow splitter of V-plow 20 (see FIG. 6) is located ahead of the frame 14 and functions to split and laterally distribute the windrow of base or finish material across the width of the apparatus 10. In a typical instance, the material is spread to a loose depth of about 4½ inches across a lateral span of 14 feet. The forward extremity of the frame 14 rearwardly of the V-plow 20 carries a scarifier assembly 30 which desegregates or works the base material to a uniform consistency by mixing through the material in a rotating transverse direction. Mounted on the frame 14 rearwardly of the scarifier assembly 30 is a shoveling assembly 40 which includes a horizontally rotating auger 41 to provide lateral distribution of the material.

To the rear of the shoveling assembly 40 the frame 14 mounts a transversely reciprocating moldboard strikeoff assembly 50, which effects leveling and smoothing of the material which is laterally positioned by the shoveling assembly 40. The moldboard strikeoff assembly includes a pair of transverse moldboard strikeoffs 51 which further function to pick up the material from the high or heavy spots and deliver it to the low or lean spots while also imparting an accurate finished surface to the base or finish material as the apparatus 10 proceeds beyond it.

As will be seen, each of the above-mentioned components is individually adjustable to perform its function in a manner tailored to a particular job to be done.

The frame 14 includes a pair of longitudinally extending side members 15 and 16 integrally connected by front and rear crossbeam 17 and 18, respectively. An intermediate transverse beam 19 extends through and is supported by the side members 15 and 16. The frame 14 is also suitably reinforced by various bracing components, including a pair of side trusses 21, but such bracing components will not be described in detail inasmuch as their particular construction does not form a part of the present invention. The members 15 and 16 and the beams 17 and 18 may be secured together in any suitable fashion, as by welding or bolting together, although welding is preferred to provide a unitized body capable of being easily attached to a road grader.

As shown in FIGS. 1 and 2, the crossbeam 17 forms the support for the scarifier assembly 30 by having a plurality of legs 31 mounted on a plurality of brackets 91 which extend about the crossbeam 17. Each bracket 91 includes three mounting screws 92 extending therethrough which engage the crossbeam 17 and are adjustable therewith to permit the legs to be axially adjustable. Each of the outer brackets 91 located on the beam 17 also includes a wheel 93 which, upon adjustment of the screws 92, is adapted to engage and roll on the beam 17 to permit ease of traversal. A transverse box beam 32 is supported on the lower extremities of the support legs 31 by a plurality of trunnions 32′ and is adjustably supported thereon by means of threaded nuts 31′ to adjust the height of the box beam 32 to any desired position. A plurality of cylindrical bores 33 are formed in the box beam 32 to receive a plurality of shafts 34 which are rotatably journaled therein. The lower extremity of each shaft 34 extends below the box beam 32 and is integrally connected to a fork 35. Each fork includes a crossbar 36 integrally connected to a plurality of vertically oriented elongated elements 37 having a plurality of digger teeth 38 attached thereto for mixing the base or finish material to a uniform consistency by revolving through the material in a transverse direction. Each pair of elements 37, located on one side of the rotating axis is oriented to permit the teeth 38 to form the leading edge with respect to the rotation thereof. It should be noted that the forks 35 are overlapping and are counterrotatably driven as will be described hereinafter. It should also be noted that a plurality of paddles could also be attached to the elements 37 in place of the teeth 38 to effect a mixing operation when the base material is treated.

The upper extremity of each shaft 34 extends above the box beam 32 and is integrally attached to a sprocket 39. A plurality of hydraulic motors 42 are integrally connected to the box beam 32 and is drivingly engaged to each alternate upper extremity of the shafts 34. A closed loop timing chain 43 extends about alternate peripheral sectors of the sprockets 39 with respect to a plane extending through the axis of these sprockets 39. The remaining portion of the chain 43 extends around a plurality of sprockets 39′ located at both ends of the beam 32 to form an endless loop thereon. Through the timing chain 43 the motors 42 function to drive the forks 35 in a counterrotating fashion.

As shown in FIGS. 1 and 3, the transverse beam 19 functions as the support for the shoveling assembly 40. As stated previously, the transverse beam 19 extends through each of the side members 15 and 16 and is also laterally moveable with respect thereto. In order to be axially slidable therewith each end of the transverse beam 19 includes a motor support plate 44 which is cantilevered over the upper surface of the side members 15 or 16. The outer extremities of the support plates 44 extend beyond the side members 15 and 16 and are integrally connected to a pair of journal plates 46. Each journal plate 46 is also connected to the outer extremities of the transverse beam 19 with the lower extremity of each journal plate 46 being apertured to receive one outer extremity of an auger shaft 47 which is rotatably journaled therein. The auger 41 is mounted on the auger shaft 47 in a helical configuration and is rotatably driven by a hydraulic motor 48 mounted on each support plate 44 by a pair of flanges 48′. Each motor 48 includes a motor shaft 49 extending out of the external side thereof with the outer extremity of the motor shaft 49 being supported by a journal bearing 52. The drive sprocket 53 is fixedly keyed to each shaft 49 and is drivingly connected by means of an endless chain 54 to a driven sprocket 55 located at one end of the auger shaft 47. Thus the auger 41 can be

rotatably driven in either direction by the hydraulic motor **48** with the entire shoveling assembly **40** being axially movable to accommodate the moldboard strikeoff assembly hereinafter described. Upon rotation the auger **41** functions to laterally distribute the base or finish material while depositing the excess material into windrows outside the path of the apparatus **10**.

Referring now to FIGS. **1** and **4** the crossbeam **18** is utilized to hingeably support the moldboard strikeoff assembly **50** which includes a pair of moldboard strikeoffs **51**. Each moldboard strikeoff **51** includes an elongated horizontal scraper element **56**, both of which extend across the width of the apparatus **10** and is characterized by a straight lower edge. The scraper element **46** is welded to the forward edge of an elongated I-beam (not shown). Each I-beam includes a pair of cylindrical sheaths (not shown) welded thereto for slidably receiving a pair of vertically extending shanks **58** which are rotatably journaled therein. The upper extremity of each shank **58** is journaled within one end of a hinge **59** located on the rear side of the crossbeam **18**, while the other end of each hinge **59** extends to the forward side of the crossbeam **18** and is pivotally connected thereto. More particularly, the upper extremities of each of the pair of shanks **58** is threaded to receive a pair of wrench nuts **60** which are operable to adjust the vertical position of the shanks **58** relative to the hinges **59** whereby rotation of the nuts **60** in opposite directions raises and lowers the shanks **58** relative to the hinges **59**. With this arrangement, a means is provided for relatively rapidly adjusting the height of the moldboard strikeoffs **51** as by merely rotating the nuts **60** in the proper direction. It should also be noted that these means permit the moldboard strikeoffs **51** to be adjusted to various horizontal positions, including a straight edge or various crown positions.

Each moldboard strike off **51** is transversely oscillated by movement of a shaft **61** which translates rotary movement of the shaft **61** into reciprocating movement of the moldboard strikeoffs **51**. The shaft **61** is located within a journal bearing **62** with its rear extremity fixedly attached to a link **63**. The link **63** is connected on both sides of the shaft **61** to a pair of drive rods **64** which, in turn, are connected at their other ends to the respective moldboard strikeoffs **51** by shock absorbing means hereinafter described.

The forward end of the shaft **61** is connected through a connecting bar **61'** to one end of a connecting link **65** with the other end of the link **65** being connected to an eccentric **66** rotatably mounted on a hydraulic motor **67**. The hydraulic motor **67** is mounted on the crossbeam **18** by means of a pair of flanges **68** whereby rotation of the motor **67** causes oscillating movement of the shaft **61** for transversely reciprocating the rods **64**.

A shock absorbing means is located at the one end of each drive rod **64** and, as more clearly shown in FIG. **5**, includes a plate **69** which is integrally connected to an I-beam, the plate **69** being apertured to receive the drive rod **64**. The shock absorbing assembly also includes a pair of elastomeric toroids **70** mounted over the drive rod **64** on both sides of the plate **69**. A pair of cups **71** extend over the toroids **70** to prevent the toroids from expanding. A nut **94** and washer **95** are threadedly secured to the drive rods **64** on the outer sides of the toroids **70** for securing purposes. These means also are adjustable to adjust the stroke of the moldboard strikeoffs **51**. A pair of cylindrical covers are integrally connected to the collars **71** and are positioned about the periphery of the toroids **70**. When each drive rod **64** moves in one direction, one of the toroids **70** is compressed, followed by movement of the moldboard strikeoffs **51** in that direction. Conversely, when the drive arm **64** is moved in the opposite direction, the other toroid **70** is compressed, followed by movement of the moldboard strikeoffs **51** in such opposite direction. Thus the movement of the moldboard strikeoffs **51** in either direction is first cushioned by initial compression of the toroids **70**, thereby reducing shock and smoothing the reversal of direction of the moldboard strikeoffs **51** during reciprocation of the drive rod **64**.

It should also be noted that since the drive rods **64** are connected on opposite sides of the shaft **61**, they are driven 180° out of phase. As a result, the moldboard strikeoffs **51** are driven in a counteroscillating movement to cancel the effect of sidethrust on the apparatus **10**.

Each end of the moldboard strikeoffs include an extension **73** which is slidably supported thereon by means of a pair of rods **74** extending into a pair of cylindrical sheaths **75**. Each extension **73** includes a horizontal scraper element **76** welded to the forward edge of the extension **73** and extends over the scraper element **56** in an overlapping manner. The extensions **73** are maintained in any adjusted position by means of lock nuts **77** located on each rod **74**. The extensions **73** function to enable the moldboard strikeoffs to level the material on either side of the apparatus **10** with the auger **41** being axially adjustable in either direction to accommodate these extensions.

Referring now to FIGS. **6** and **7**, the frame **14** includes four bores, two of which are formed in each of the crossbeams **17** and **18** and are utilized as attachment means for connecting the frame **14** to the rotating support ring **78** of a conventional road scraper **79**. The support ring **78** is usually utilized to support the transverse plow. However, such a plow can easily be dismantled from the support ring and the frame **14** can be easily attached thereto.

Although the height of each component of the apparatus **10** can be individually adjusted, the entire frame **14** and the support ring **78** can also be adjusted by a pair of hydraulic cylinders **80** which is connected to the support ring **78** and to the main frame **81** of the road scraper **79** by means of arms **90**. Furthermore, although the cylinders **80** can be manually controlled, a preferred grade-wire control system **82** is provided to control the elevation of the frame. The control system **82**, shown schematically, includes a sensitive feeler **83** mounted on each side of the road grader **79** and is adapted to follow piano wire grade lines located at the side of the proposed road lane. Each feeler **83** is linked with a control valve or switch **85** which, in turn, is operatively connected to a servocontrol **86** located adjacent each hydraulic cylinder **80**. Each servocontrol **86** functions to control the movement of the respective hydraulic cylinder **80** and is controlled by the movement of the feeler **83** acting through the valve or switch **85**.

A second support beam **87** is pivotally attached to the front portion of the main frame **81** directly behind the front wheels **88** of the road grader **79**. The support beam **87** normally functions to support a plurality of digger teeth (not shown). However, when the apparatus **10** is being utilized these teeth are removed from the support beam **87** and a V-plow or windrow splitter **20** is mounted thereon. The V-plow **20**, located ahead of the apparatus **10**, comprises a pair of elongated rearwardly diverging plow plates **22** whose forward extremities are secured to a short longitudinally extending plate **23**. The initial windrow splitting angle of the plow **20** is hydraulically adjustable so that the base course material is mixed and spread or laterally distributed in the most advantageous manner. More particularly, the plow **20** includes a splitter plate **24** pivotally connected to the forward end of the plate **23** and including an integral operating arm **25**, which is pivotally connected to the piston of a double-acting hydraulic cylinder **26**. The cylinder **26** of the plow **20** is suitably connected to the hydraulic controls of the apparatus **10** so that the operator is able to precisely split the windrows as required by the particular application at hand, whereby complete flexibility is provided for splitting and lateral distribution of the windrows of the base course material.

The hydraulic motors of all of the above-mentioned components are driven by a pump **90** located at the rear of the grader **79** which is driven by a power takeoff located thereon. A reservoir **91** is mounted adjacent the pump **90** to supply sufficient motive fluid for driving the hydraulic motors. Most of the details of the structure of the pump and the hydraulic motors and the means interconnecting these units are not described herein for reasons of brevity, because such details form no part of the present invention, and because such details will immediately suggest themselves to those skilled in the art.

From the above description, it will be apparent that the apparatus **10** is effective to accurately spread and level base course material for a road, to also mix, spread and level treated material, and to also actually prepare the subgrade itself. The apparatus **10**, being attached to conventional road graders is adapted to follow conventional windrowers and split, spread, mix and level the windrows to provide a roadbed of accurate grade.

I claim:

1. A road building apparatus for mixing, spreading and leveling treated base and/or finish materials comprising:

a frame;

scarifier means including a plurality of forks laterally spaced across the width of said frame, each of said forks is rotatable about a vertical axis and includes a plurality of vertically oriented elongated elements adapted to extend into the base material;

shovel means supported on said frame rearwardly of said scarifier means to laterally distribute the road base or finish material leaving said scarifier means;

strikeoff means pivotally mounted on said frame rearwardly of said shovel means, said strikeoff means comprising a split moldboard with each section being pivotally mounted on hinge means which in turn is pivotally mounted on said frame, said moldboard being mounted to said hinges by leg means which are axially adjustable therewith to enable said moldboard strikeoff to be mounted in a plurality of elevational and angular positions with respect to the horizontal plane;

means for transversely reciprocating said strikeoff means to level the base or finish material; and

drive means for simultaneously rotating said scarifier means and said shovel means, and actuating said means for reciprocating said strikeoff means whereby a strip of earth and/or road base material of uniform height and consistency may be continuously provided.

2. The invention in accordance with claim **1** wherein said adjacent forks are alternately rotatable in the opposite direction.

3. The invention in accordance with claim **2** wherein said plurality of forks are laterally spaced in such a manner that the end elements of each fork overlap the end elements of each adjacent fork.

4. The invention in accordance with claim **1** wherein a plurality of digger teeth are adapted to be inserted on said elongated elements for digging, loosening, mixing and spreading the base or finish material to a uniform consistency.

5. The invention in accordance with claim **3** wherein a plurality of paddles are adapted to be inserted on said elongated elements for mixing road grade materials.

6. The invention in accordance with claim **1** wherein said shovel means includes an auger selectively rotatable in either direction mounted on said frame.

7. The invention in accordance with claim **1** wherein said moldboard strikeoffs are counteroscillated by said reciprocating means to dynamically balance the movement thereof and to prevent sidethrust of said frame.

8. The invention in accordance with claim **7** wherein said reciprocating means includes:

journal means rotatably supporting a shaft;

drive means for oscillating said shaft;

eccentric means mounted on said shaft with the eccentrics being located on opposite sides of said shaft; and

a rod connected to each moldboard strikeoff with each rod being connected to one of said eccentrics on opposite sides of said shaft in a 180° phase relationship.

9. The invention in accordance with claim **8** further including shock absorbing means interconnecting each of said rods to said respective moldboard strikeoffs.

10. The invention in accordance with claim **9** wherein each of said shock absorbing means includes:

a apertured plate integrally connected to said moldboard strikeoff with said rod extending through said plate aperture;

a pair of cylindrical casings located on both sides of said plate and about said bar, each of said casings includes a closed end integrally connected to said rod and an open end facing said plate; and

a pair of elastomeric toroids located within said pair of cylindrical casings, one side face of each toroid engaging the closed end of each casing with the other side face thereof engaging said plate.

11. The invention in accordance with claim **1** wherein each of said moldboard strikeoffs includes an extension that is transversely adjustably mounted on the outer end thereof.

12. The invention in accordance with claim **11** wherein said shovel means includes an auger rotatably mounted on said frame, said auger being axially adjustable with respect to said frame.

13. The invention in accordance with claim **1** wherein said frame includes attaching means for connecting said frame to a support ring of a conventional road grader.

14. The invention in accordance with claim **13** further including V-plow means adapted to be mounted on the conventional road grader ahead of said rotating scarifier means for laterally distributing the earth or rock base materials.

15. The invention in accordance with claim **2** wherein each of said forks includes a shaft rotatably mounted within a frame member and said scarifier drive means includes a plurality of hydraulic motors drivingly connected to said fork or paddle shafts.

16. The invention in accordance with claim **2** wherein each of said forks or paddles includes a shaft rotatably mounted within a frame member and a sprocket fixedly attached to each of said shafts, and said scarifier drive means includes a timing chain drivingly engaging said sprockets and motor means driving said chain.

17. The invention in accordance with claim **16** wherein said endless timing chain is looped about said sprockets in such a manner that at any one time one portion of the chain extends transversely across the width of said frame and partially around the outer two sprockets, with the remaining portion extending about alternate peripheral sectors of said sprockets with respect to a plane extending through the axes of said sprockets.

18. The invention in accordance with claim **13** further including grade control means for controlling the elevation of said support ring and attachment.

19. The invention in accordance with claim **18** wherein said grade control means includes:

feeler means responsive to separate wire grade lines located at each side of said apparatus;

switch or valve means operatively attached to said feeler means; and

servo means responsive to said switch or valve means for operating the hydraulic cylinders of the conventional road grader for raising or lowering the apparatus in response to the change grade level lines.

20. The invention in accordance with claim **13** wherein said drive means includes a plurality of hydraulic motors operatively connected to a hydraulic pump which is adapted for connection to a power takeoff located at the rear of the conventional road grader.

21. The invention in accordance with claim **1** including means to oscillate the sections in opposite directions.

22. The invention in accordance with claim **13** further including means for adjusting the height of the support ring.

23. A road base building apparatus for preparing earth or base material into a roadbed comprising:

a frame;

scarifier means connected to said frame and including a plurality of forks laterally spaced across the entire width of the frame, each of said forks is rotatable about a vertical axis and includes a plurality of vertically oriented elongated elements adapted to extend into the earth of base material for mixing, spreading and leveling the base material to a uniform mixture and grade level; and

strikeoff means pivotally mounted on said frame rearwardly of said shovel means, said strikeoff means comprising a split moldboard with each section being pivotally mounted on hinge means which in turn is pivotally mounted on said frame, said moldboard being mounted to said hinges by leg means which are axially adjustable therewith to enable said moldboard strikeoff to be mounted in a plurality of elevational and angular positions with respect to the horizontal plane; and

means for reciprocating said moldboard sections in opposite directions.

24. The invention in accordance with claim **23** wherein said plurality of forks is alternately rotatable in the opposite direction.

25. The invention in accordance with claim **24** wherein said plurality of forks are laterally spaced in such a manner that the end elements of each fork or paddle overlap the end elements of each adjacent fork or paddle.

26. The invention in accordance with claim **23** further including a plurality of digger teeth mounted on said elongated elements.

27. The invention in accordance with claim **25** further including a plurality of paddles mounted on said elongated elements for mixing all earth treated finish and/or base material.

28. The invention in accordance with claim **24** wherein each of said forks includes a shaft rotatably mounted within a frame member and said scarifier drive means includes a plurality of hydraulic motors drivingly connected to said fork shafts.

29. The invention in accordance with claim **24** wherein each of said forks includes a shaft rotatably mounted within a frame member and a sprocket fixedly attached to each of said shafts, and said scarifier drive means includes an endless timing chain drivingly engaging said sprockets and motor means driving said endless chain.

30. The invention in accordance with claim **29** wherein said timing chain is looped about said sprockets in such a manner that at any one time one portion of the chain extends transversely across the width of said frame and partially around the outer two sprockets, with the remaining portion extending about alternate peripheral sectors of said sprockets with respect to a plane extending through the axes of said sprockets.

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