July 9, 1963 R. G. KERSHAW 3,096,724

APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

Filed Nov. 20, 1958 6 Sheets-Sheet 1

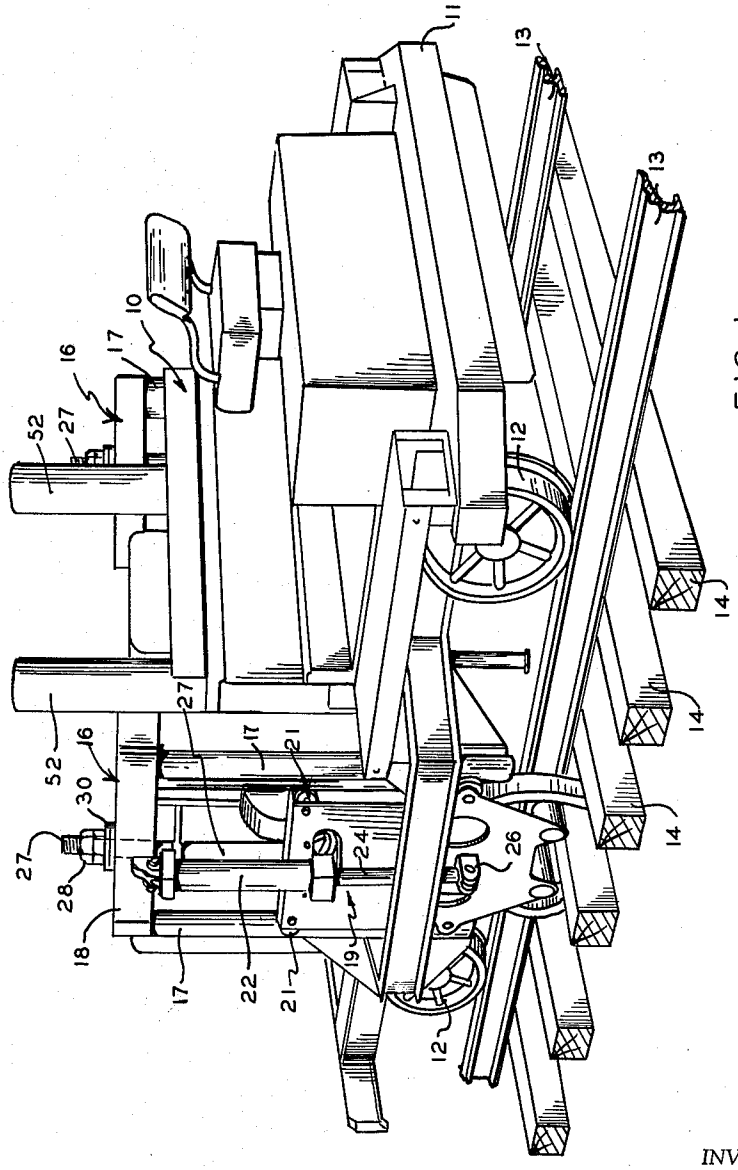

FIG. 1

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APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

Filed Nov. 20, 1958 6 Sheets-Sheet 2

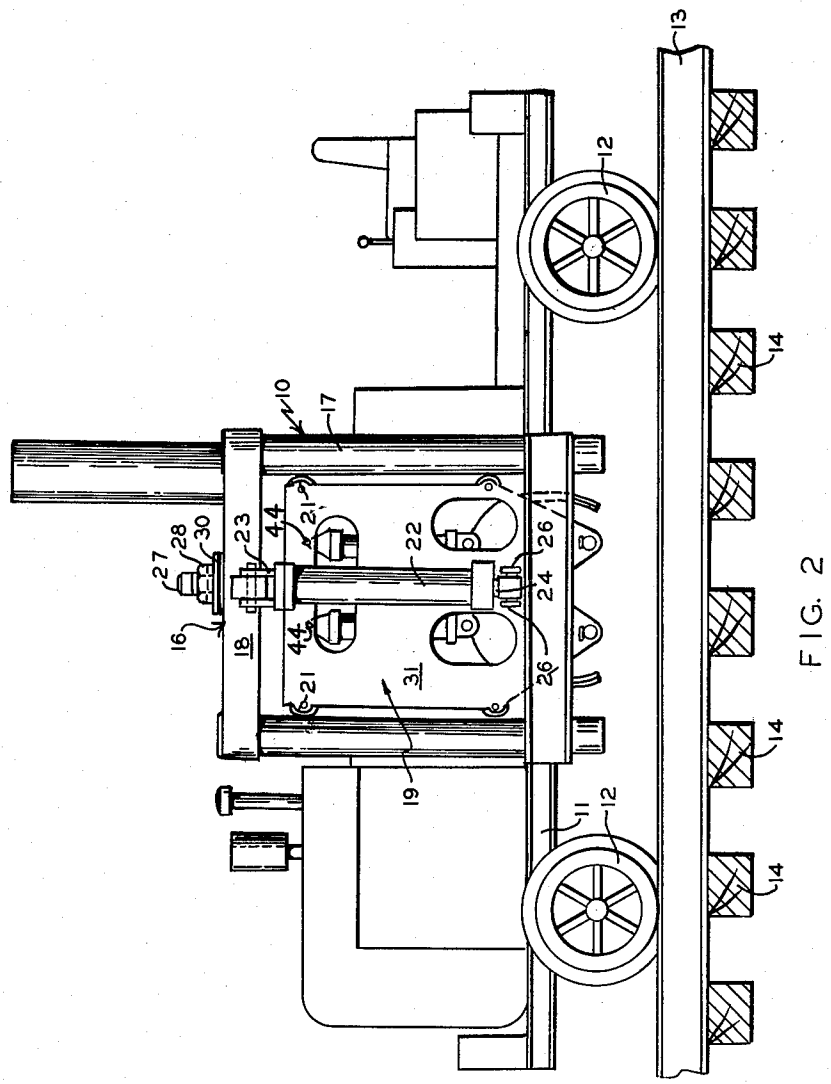

FIG. 2

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APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

Filed Nov. 20, 1958 6 Sheets-Sheet 3

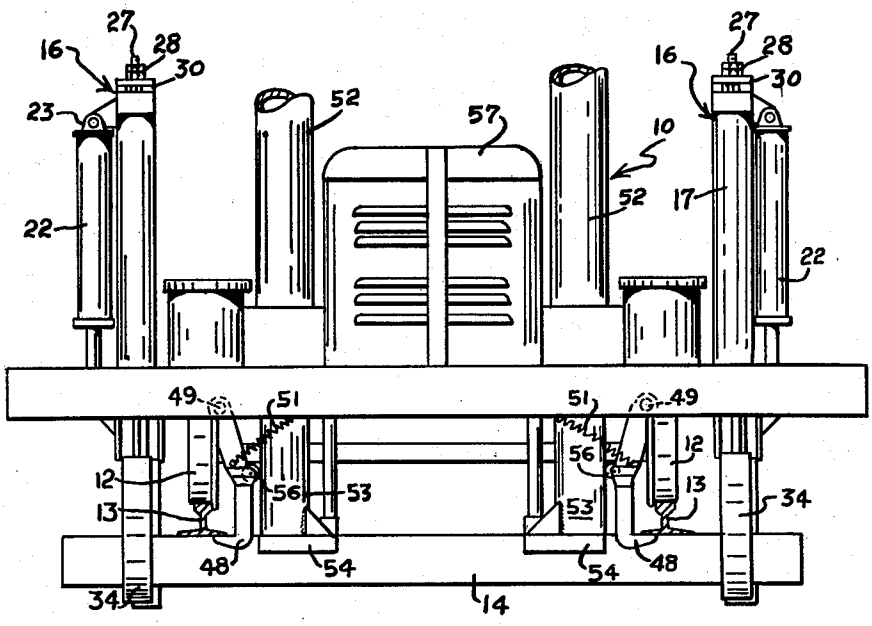

FIG. 3

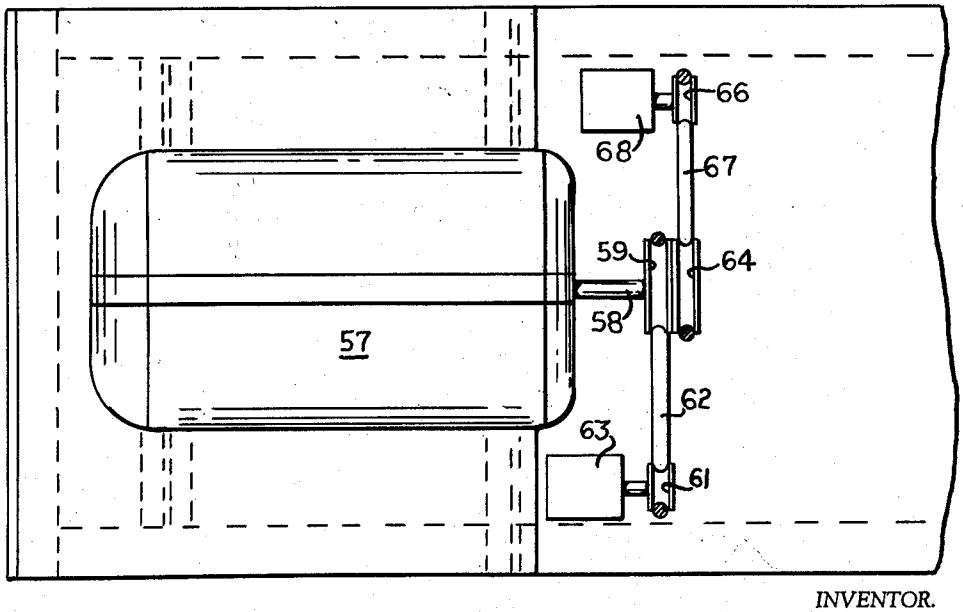

FIG. 8

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APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

Filed Nov. 20, 1958 6 Sheets-Sheet 4

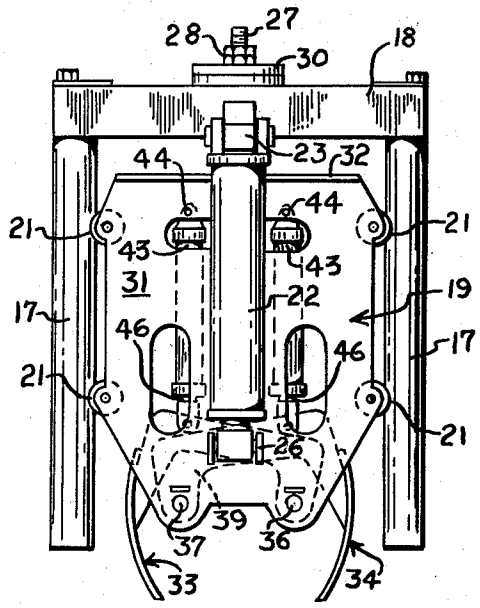

FIG. 4

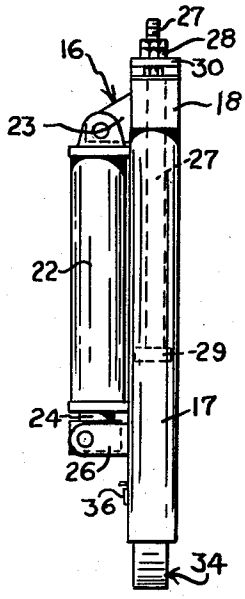

FIG. 5

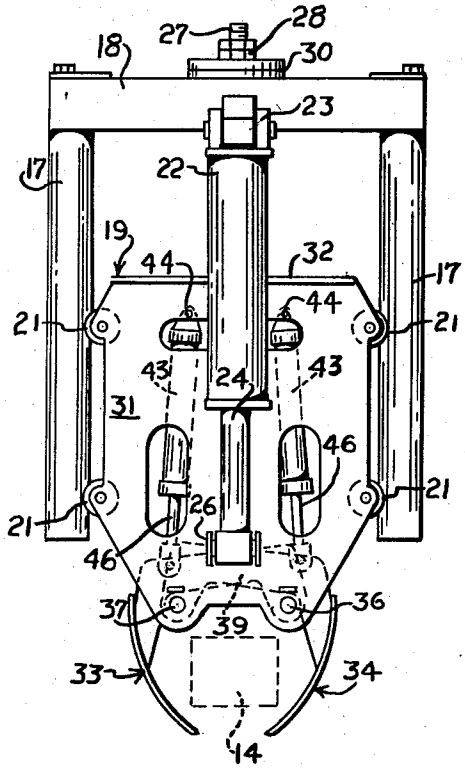

FIG. 6

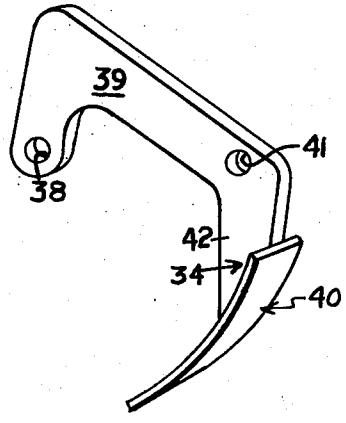

FIG. 7

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APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

Filed Nov. 20, 1958 6 Sheets-Sheet 5

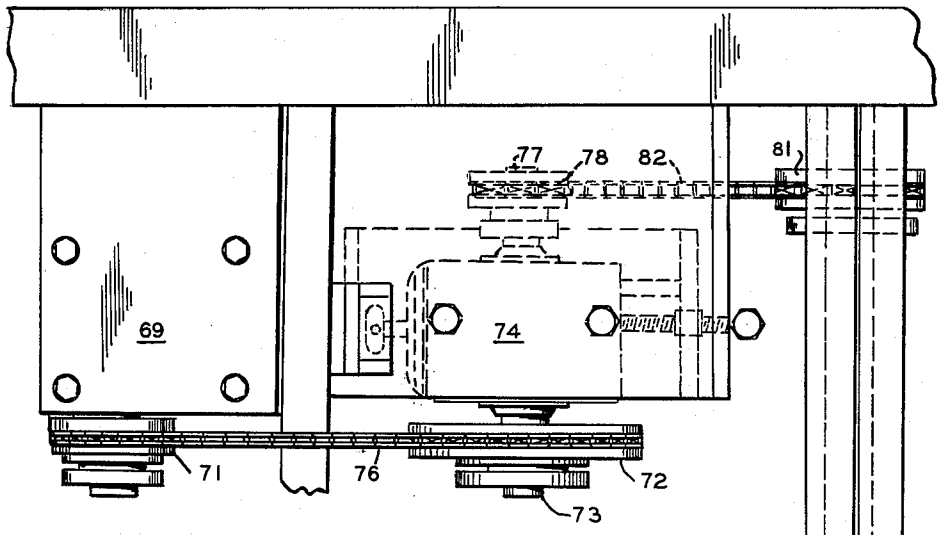

FIG. 9

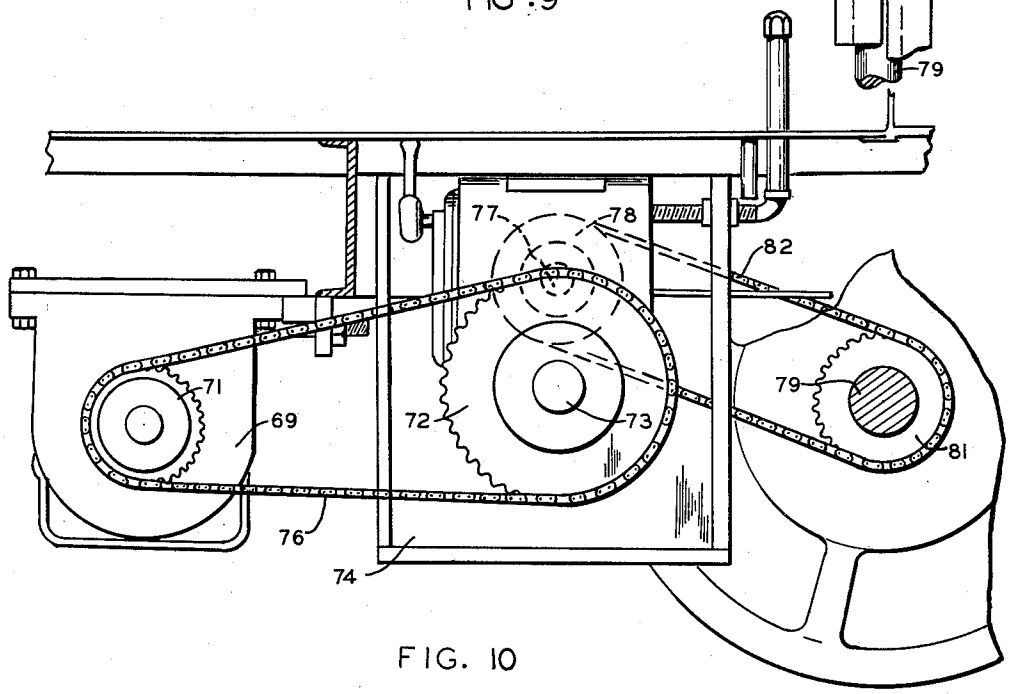

FIG. 10

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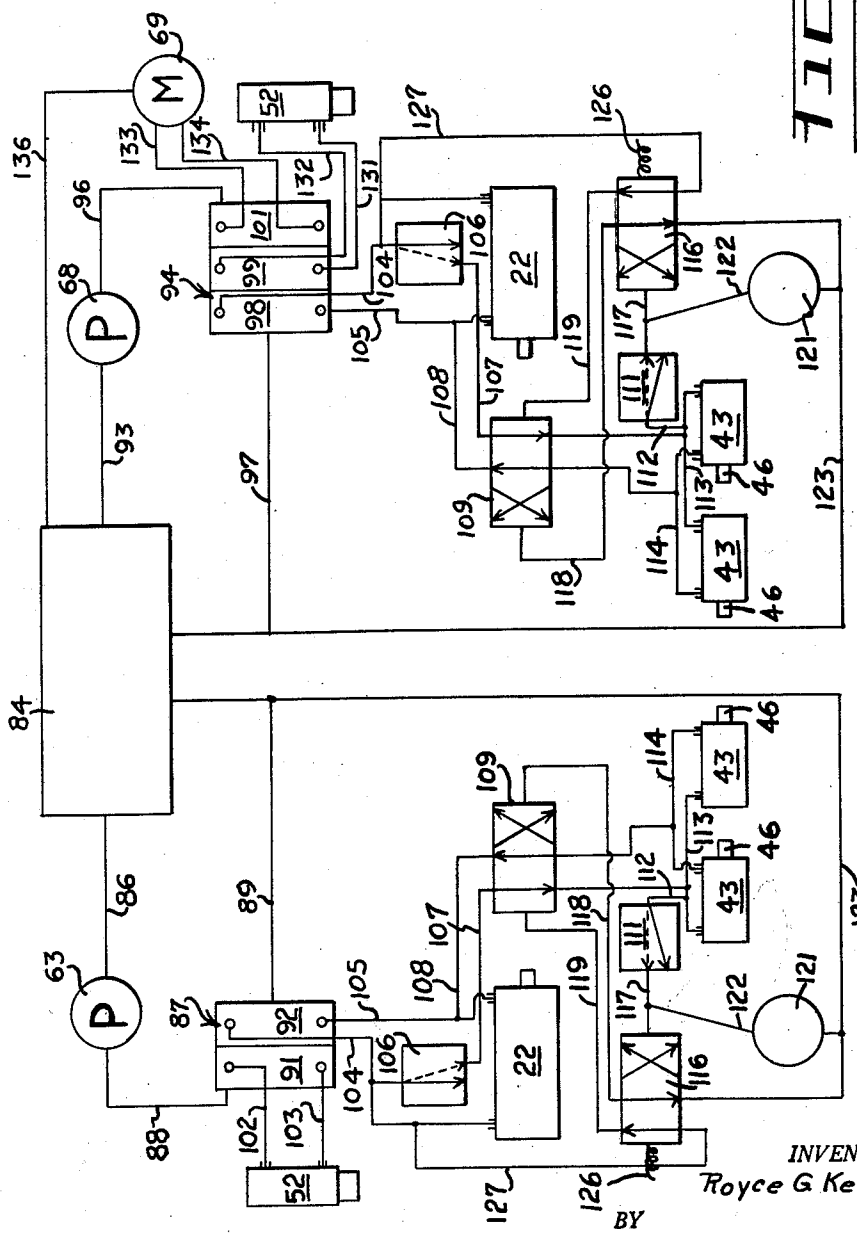
APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

Filed Nov. 20, 1958 6 Sheets-Sheet 6

FIG. 11



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United States Patent Office 3,096,724
Patented July 9, 1963

3,096,724

APPARATUS FOR TAMPING BALLAST ON A RAILROAD TRACK

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Filed Nov. 20, 1958, Ser. No. 775,254
12 Claims. (Cl. 104—12)

This invention relates to apparatus for tamping ballast on a railroad track and more particularly to such apparatus for tamping on both sides of a crosstie in a continuous recycling tamping operation.

Heretofore, it has been common in tamping ballast on a railroad track to over tamp or under tamp the ballast in a ballast tamping operation. This has been due to the fact that no means have been devised previously to tamp the ballast automatically to a predetermined compaction pressure.

It is an important feature of my invention to provide means to tamp the ballast to a predetermined compaction pressure by controlling automatically the tamping cycle of the ballast tools through the pressure exerted by the ballast against the ballast tools. My controls reverse the downward movement of the tools when a predetermined compaction pressure is reached by resistance of the ballast to the ballast tools, and a new tamping cycle is begun automatically without the operation of any controls by the operator of the tamping apparatus. Thus, as the ballast becomes compacted under the crossties, the working stroke of the ballast tools will be decreased automatically with each succeeding stroke. A uniform compaction is thereby obtained and by visual inspection, it may be easily ascertained when the tamping is complete since the movement of the tools during the working stroke at this time will be decreased considerably from that of the initial working stroke. The control means may also be adjusted to predetermine the speed of movement of the ballast tools in a cycle. Thus, over or under tamping which has been prevalent in tamping operations heretofore is obviated and a uniform compaction of ballast is obtained automatically.

It has been very difficult previously to obtain a high tamping efficiency in tamping apparatus for tamping ballast around crossties in place on a railroad track because of the limited space between adjacent crossties in which space the ballast tools must work. To avoid contacting adjacent crossties the width of the tamping head on which the ballast tools have been mounted is necessarily limited which has made it very difficult for ballast tools to reach under the crosstie a sufficient distance to effect maximum tamping action. It is highly desirable for tamping tools to reach under a crosstie, as when tamping tools go under the crosstie a positive compactive force is exerted on the underside of the crosstie by the ballast between the crosstie and the tool. This compactive force tends to force the crosstie upwardly against the rail and allows ballast to be compacted adjacent the underside of the tie.

The present invention provides tamping apparatus in which a pair of ballast tools reach under opposite sides of the crosstie and thereby raise the tie firmly against the base of the rail. The ballast tools are mounted on a tamping head that extends across the top of the crosstie over which the apparatus is positioned in working relation and the tools are pivoted in a vertical plane generally parallel to the rails. Each of the ballast tools is pivotally mounted on the tamping head adjacent the side of the crosstie opposite the side thereof on which the tool engages the ballast in working position. Thus, the shanks of the tools cross each other and extend over the top of the crosstie in close proximity to the crosstie and reciprocating

fluid pressure means are connected to the extended portion of the tools thereby moving the tools in an arc of a relatively long radius and in a relatively small space which is highly desirable. The tamping apparatus fits easily between the ties with sufficient space between the working tools and the ties adjacent the tie about which ballast is being tamped. The ballast engaging blade on the ballast tools is arcuate and is struck on a radius from the pivotal connection of the ballast tools thereby providing easy penetration of the blades in the ballast and allowing the blades to reach under the crosstie. The relatively long radius from which the arcuate blades are struck provides a blade with a relatively small degree of curvature while allowing the blades to reach under the crossties.

It is an object of the present invention to provide ballast tools adapted to engage ballast on opposite sides of a crosstie, with each tool being pivotally mounted adjacent the side of the crosstie opposite the side thereof on which the tool engages the ballast. The ballast tools cross each other and extend across the top of the crosstie in close proximity thereto and fluid pressure means are connected to the extended portion of the tools thereby reciprocating the tools in a relatively small space.

It is a further object of the present invention to provide means for controlling automatically the tamping cycle of ballast tools through the pressure exerted by the compacted ballast against the ballast tools, thereby obtaining a uniform compaction in the ballast without any over or under tamping thereof.

Apparatus embodying features of my invention is shown in the accompanying drawings, forming a part of this application, in which:

FIG. 1 is a perspective view of the tamping apparatus forming the present invention and showing the tamping apparatus on the rails of a railroad track;

FIG. 2 is a side elevational view of the tamping apparatus shown in FIG. 1;

FIG. 3 is an end elevational view of the tamping apparatus shown in FIGS. 1 and 2 and showing means for raising the railroad track;

FIG. 4 is a fragmentary side elevational view of the tamping head removed from my apparatus shown in FIGS. 1–3 and mounted in a supporting frame with the tamping tools raised to an upward position;

FIG. 5 is a fragmentary end elevational view of the tamping head and supporting frame shown in FIG. 4;

FIG. 6 is a side elevational view of the tamping head shown in FIG. 4 but showing the tamping tools lowered in working position;

FIG. 7 is a perspective view of one of the tamping tools shown removed from the tamping head of FIGS. 4–6;

FIG. 8 is a partially diagrammatic, fragmentary plan view of the power means for operating my apparatus;

FIG. 9 is a fragmentary top plan view of the propelling means for propelling the railway vehicle on the rails;

FIG. 10 is a fragmentary, side elevational view of the propelling means shown in FIG. 9; and,

FIG. 11 is a diagrammatic view of the hydraulic system for operating the several working elements in my apparatus.

Referring now in detail to the drawings, I show in FIGS. 1 and 2 a railway vehicle indicated generally by the numeral **10** having a main frame **11** on which flanged wheels **12** are mounted for riding on the rails **13**. The rails **13** are secured to crossties **14** which rest on ballast forming the roadbed for the railroad track. A supporting frame indicated generally by the numeral **16** is mounted on each side of the main frame **11** and extends outwardly therefrom. Each supporting frame **16** comprises a pair of spaced vertical guide rails **17** which are connected at their upper ends by a horizontal cross member **18**.

A tamping head **19** is mounted on each side of the

frame 11 and has rollers 21 thereon which engage the guide rails 17 in rolling relation. The tamping head 19 and supporting frame 16 are identical for each side of the vehicle 10 and for the purposes of illustration, only one tamping head 19 is described in detail. A hydraulic cylinder 22 is pivotally mounted to the horizontal cross member 18 on bracket 23 that is fixed to cross member 18. A piston rod 24 extends downwardly from cylinder 22 and is pivotally connected to the tamping head 19 by a bracket 26 extending outwardly from the head 19. A stop member 27 is connected to the horizontal cross member 18 and is adjusted vertically relative to the cross member 18 by means of a pair of threaded nuts 28 which are screwed onto the threaded upper end of stop member 27. A stop 29 (see FIG. 5) is secured to the lower end of the stop member 27 and upon downward movement of the tamping head 19, the tamping head will contact stop 29 and thereby be limited in its downward movement. To adjust the tamping head 19 for working on rails of a different height, the stop member 27 may be adjusted vertically by movement of the threaded nuts 28. A cushion member 30 is disposed between the top of cross member 18 and the nuts 28 to absorb shock from the bottoming of the tamping head 19.

Referring now to FIGS. 4–7, my tamping head 19 is shown in further detail and comprises a pair of side plates 31 connected at their upper end by end plate 32. The under side of plate 32 contacts the stop 29 when the tamping head 19 moves downwardly and thus limits the downward movement of head 19. The rollers 21 are mounted for rotation between the side plates 31 on shafts extending between the side plates 31. A pair of tamping tools 33 and 34 are pivotally mounted between the side plates 31. Tamping tool 33 is pivotally mounted at 36 and tamping tool 34 is pivotally mounted at 37 on axes extending between the side plates 31. The tamping tools are identical and as shown in FIG. 7, tamping tool 34 has an opening 38 extending therethrough which receives the pivot 37. An arm extending from pivot 37 in a direction generally parallel to the rails 13 is indicated by the numeral 39 and has an aperture 41 at its extremity opposite the extremity thereof on which the opening 38 is positioned. A leg 42 extends downwardly from arm 39 and has a blade 40 secured to an edge thereof and adapted to engage ballast in ballast tamping relation. The blade 40 is arcuate in shape and is preferably struck on a radius from the pivot 37.

The arcuate shape of blade 40 allows the blade to penetrate the ballast easily and allows the lower end of the blade to reach under the crosstie when it reaches its downward position in working relation. It is highly desirable that blade 40 reach under the crosstie as the crosstie is pressed upwardly by the blade into contact with the underside of the rails when the blade goes under the crosstie. This "nipping" action is obtained only when the blade reaches under the crosstie.

The ballast tools 33 and 34 are pivotally mounted on the tamping head 19 adjacent the side of the crosstie opposite the side thereof on which the tools engage ballast. Thus, the arms 39 of the ballast tools 33 and 34 cross each other over the crosstie. Hydraulic cylinder 43 is pivotally mounted at 44 between the side plates 31 and has a piston rod 46 extending downwardly therefrom pivotally connected at its lower end through the aperture 41 of the tamping tools. By this arrangement, a relatively long radius is provided for the arc of travel of tools 33 and 34 since arm 39 is pivotally mounted on the tamping head 19 at one extremity while being pivotally connected at the other extremity thereof to piston rod 46. The working space between adjacent crossties is necessarily limited and thus, it is highly desirable to obtain as long a radius as possible for the tamping tools 33 and 34 and to strike arcuate blades 40 substantially from the pivotal mounting of tools 33 and 34 as less force is required for the penetration of such blades. Further, it results in an increased life of the tamping apparatus.

Shown in FIG. 3 but not forming a part of this invention, are rail dogs 48 pivotally mounted at 49 to the main frame 11. The rail dogs 48 are biased or urged upwardly to raised position by springs 51. Hydraulic lifting cylinders 52 having a downwardly moving piston 53 are mounted on the main frame 11. A bottom plate 54 secured to each of the pistons 53 is adapted to engage the roadbed upon the lowering of the piston 53 and thereby allows the raising the track. A roller 56 is mounted on each of the rail dogs 48 and when the piston rods 53 start their downward movement, the plates 54 engage the rollers 56 and pivot the rail dogs 48 downwardly and outwardly into engagement with the underside of the rails 13. When the pistons 53 are raised, the springs 51 return the rail dogs 48 to raised position out of contact with the rails 13. Fluid pressure means (not shown) may be provided for raising the rail dogs 48 after they are pivoted under the rails 13 by the downward movement of pistons 53 so that the underside of the rails 13 will be tightly gripped.

Referring now to FIG. 8, the power means for operating my railway vehicle 10 is shown diagrammatically and comprises an engine 57 having a drive shaft 58 extending from one end thereof. A pulley 59 is secured to drive shaft 58 and drives pulley 61 through a pulley belt 62. Pulley 61 is connected to and drives hydraulic pump 63. A pulley 64 is also secured to shaft 58 and drives pulley 66 through a belt 67. Pulley 66 is secured to and drives pump 68. The pump 63 and 68 supply fluid to all of the working elements of my tamping apparatus.

Referring now to FIGS. 9 and 10, the propelling means for propelling the railway vehicle 10 on the rails 13 is shown and comprises a hydraulic motor 69 which is driven by suitable connections from the pump 68 and has a drive sprocket 71 extending therefrom. Sprocket 71 drives a sprocket 72 on the input shaft 73 of a gear reducer 74. Sprocket 71 drives sprocket 72 through a sprocket chain 76. A sprocket 78 is secured to the output shaft 77 of the gear reducer 74 and is connected to sprocket 81 on the rear axle 79 of the railway vehicle 10. Sprocket 81 is driven from sprocket 78 through sprocket chain 82 extending between sprockets 78 and 81. The gear reducer 74 is a two speed gear reducer and the motor 69 is reversible. Thus, the railway vehicle 10 can be driven at two speeds in both a forward and a rearward direction.

If desired, means may be provided on a railway vehicle 10 to position the railway vehicle 10 so that the tamping tools 33 and 34 are centered over a crosstie. Such means does not form a part of my invention and is not shown in the drawings.

Referring now to FIG. 11 in which a schematic diagram shows the hydraulic system for my apparatus, I show a fluid reservoir 84 which supplies fluid for the entire operation of my tamping apparatus. The pumps 63 and 68 are driven by the engine 57 (see FIG. 8). Pump 63 receives fluid from reservoir 84 through flow line 86 and supplies fluid to the valve bank 87 through a fluid pressure line 88. Flow line 89 returns the fluid to reservoir 84 from valve bank 87. Valve bank 87 comprises valves 91 and 92 which are operated by suitable hand levers on the control panel (not shown) of my apparatus. Pump 68 receives fluid from reservoir 84 through the supply line 93 and supplies valve bank 94 through supply line 96. A return line 97 returns the fluid to reservoir 84. Valve bank 94 comprises valves 98, 99 and 101 which are also actuated by suitable hand levers on the control panel (not shown). Valve 91 of valve bank 87 supplies fluid to the lifting cylinder 52 through lines 102 and 103. The valves 92 and 98 actuate the tamping operation through the movement of the tamping heads 19. The operation of each of the tamping heads 19 is identical

and for the purposes of illustration, only the operation of valve 92 will be explained in detail, it being understood that valve 98 operates similarly and like reference numerals appear for the elements actuated by valve 98.

Fluid is supplied to cylinder 22 through lines 104 and 105. An adjustable sequence valve 106 is connected to line 104 between the valve 92 and cylinder 22 and controls the flow of fluid to cylinders 43. Sequence valve 106 may be set for actuation at a predetermined fluid pressure and upon the tamping head 19 contacting stop 29 (see FIG. 5) at the end of its downward movement, the pressure in sequence valve 106 builds up and valve 106 is actuated to move it to the dotted line position. Fluid is then supplied to the cylinders 43 through line 107. Thus, it is clear that upon the tamping head 19 reaching a predetermined downward position, the cylinders 43 which actuate the tamping tools 33 and 34 are actuated automatically by the actuation of sequence valve 106. Line 108 returns fluid to the reservoir 84 through line 89 from the cylinders 43 in both the upward and downward movements of the tamping tools 33 and 34. A pilot operated four-way valve 109 is interposed in the lines 107 and 108 to the cylinders 43 and the functioning thereof will be explained in further detail below.

A sequence valve 111 is connected through branch line 112 to line 113 which supplies fluid to the cylinders 43 in the downward movement of the tamping tools 33 and 34 while line 114 supplies fluid to the cylinders 43 in the upward movement of the tools 33 and 34. Upon a predetermined pressure being reached in line 113, the sequence valve 111 is actuated to move it to the dotted line position shown in valve 111 and fluid is supplied to a pilot operated spring offset valve 116 through line 117 to move valve 116 against the urging of spring 126. The sequence valve 111 returns to its normal (solid line) position upon a decrease in fluid pressure in lines 112 and 113 and fluid in line 117 holds the valve 116 in the alternate position against spring 126 until the fluid is bled from line 117.

A flow control device 121 is connected to line 117 through line 122 and the fluid in line 117 may be bled through the flow control 121 at a predetermined rate to a return line 123 to reservoir 84 thereby allowing valve 116 to return to its normal position shown in FIG. 11 after sequence valve 111 returns to its normal position. Thus, the length of time that valve 116 is held in its alternate position after return of sequence valve 111 to its normal solid line position may be varied by the manual adjustment of flow control device 121 which increases or decreases the rate of bleeding line 117. Upon the fluid in line 117 being decreased by bleeding through control device 121 after sequence valve 111 returns to the solid line position shown in FIG. 11, the valve 116 shifts to its normal position (shown in FIG. 11) under urging of spring 126.

The spring operated valve 116 is supplied with fluid from line 127 connected to line 104 and thus fluid is supplied to valve 116 independently of the sequence valves 106 and 111. Return line 123 returns the fluid to the reservoir 84 from valves 109 and 116. Lines 119 and 118 connect valve 116 with the four way valve 109 and upon actuation of valve 116 from its normal position (shown in FIG. 11) to its alternate position, valve 109 is also actuated since the flow of fluid in lines 118 and 119 is reversed. Thus, the flow of fluid in lines 113 and 114 to cylinders 43 is reversed and the movement of the tamping tools 33 and 34 is reversed. It is obvious that the length of the stroke of tools 33 and 34 may be varied by the adjustment of control device 121 as the length of time that valve 116 remains in its alternate position is determined by the control device 121. If a short stroke is desired, the rate of flow through the control device 121 is increased and thus, the time that valve 126 remains in its alternate position is decreased thereby decreasing the height of the upward stroke of the tools 33 and 34. Likewise, if desired to increase the length of the stroke of tools 33 and 34, the rate of flow through the control device 121 should be decreased to increase the time that valve 116 remains in its alternate position against the urging of spring 126. The sequence valve 111 remains in its solid line position throughout the cycle of the tamping operation except upon the build-up of fluid pressure when the ballast tools 33 and 34 reach the end of their downward stroke and upon a predetermined pressure being exerted against the ballast tools.

The speed of movement of the ballast tools 33 and 34 through a tamping cycle is determined by the rate of flow from pump 63 to cylinders 43 and if desired to increase the speed of the tamping cycle, the rate of flow to cylinders 43 is increased.

Valve 99 supplies fluid to the lifting cylinder 52 through lines 131 and 132. Valve 101 supplies fluid to the reversible motor 69 through lines 133 and 134, the return line to the reservoir 84 from motor 69 is indicated by the numeral 136. Motor 69 is the propelling motor for driving the railway vehicle 10 on the railroad track.

In operation, the railway vehicle 10 is first positioned over a crosstie with the tamping head 19 arrange centrally over a crosstie so that the tamping tools 33 and 34 will engage ballast on opposite sides of the crosstie. When the railway vehicle 10 has been positioned over the crosstie, the valves 91 and 99 are actuated to lower the piston rods 53 of lifting cylinders 52. During the downward movement of the piston rods 53, the rail dogs 48 are pivoted under the rails 13 and the rails with the crossties secured thereto are lifted upwardly. After the rails and the crossties have been lifted upwardly, the tamping operation is ready to commence. Valves 92 and 98 are actuated by suitable hand levers and cylinders 22 are thereby actuated to lower the tamping heads 19. Upon the tamping heads 19 contacting stop 29, pressure builds up in line 104 and actuates sequence valve 106 to move it to the dotted line position and fluid is then supplied through line 107 to actuate the cylinders 43. Upon the tamping tools 33 and 34 reaching the end of their downward stroke or upon a predetermined resistance exerted against tools 33 and 34, pressure builds up in lines 112 and 113 to actuate valve 111 and move it to the dotted line position. Valve 116 is thus actuated, which, in turn, actuates valve 109 thereby reversing the flow of fluid in lines 113 and 114 to raise the piston rods 46 and the tamping members 33 and 34 thereon. The sequence valve 111 returns to its normal (full line) position when the tamping members 33 and 34 are reversed and the fluid pressure drops in line 112. Valve 116 remains in its alternate position (to the left viewing FIG. 11) until sufficient fluid has been removed from line 117 through control device 121 to permit valve 116 to return to its normal position. Upon the return of valve 116 to its normal position, the upward movement of the tamping tools 33 and 34 is reversed and the tools automatically begin their downward stroke.

It is evident that tamping tools 33 and 34 continue to tamp automatically without any further controls necessary. The timing of the tamping cycle may be determined by adjusting the height of the stroke through flow control device 121, and by controlling the rate of fluid flow to cylinders 43 by the speed of the fluid pumps 63 and 68 and engine 57.

Sequence valve 106 remains in its dotted line position as long as the tamping operation continues as the tamping head 19 remains in contact with the stop 29. The downward movement of the tamping tools 33 and 34 is determined by the resistance of the ballast to the tamping blades 40. The sequence valve 111 may be set to be actuated at any predetermined fluid pressure and upon the ballast exerting resistance against the tools 33 and 34, the movement of the tamping tools is reversed through actuation of valve 111. Thus, as the ballast becomes

compacted, the downward stroke will be successively decreased until the ballast is fully tamped. The fully tamped position can be easily ascertained by visual inspection since the movement of the tools **33** and **34** in the ballast will be slight. Any over or under tamping is thereby eliminated.

When it is desired to stop the tamping operation, the valve **92** is reversed to raise pistons **46** through lines **105** and **114** and simultaneously, to raise the cylinder **22** by supplying fluid to line **105**. The tamping tools **33** and **34** are thus returned to non-working position. Then, the lifting cylinders **52** may be raised through actuation of valves **91** and **99**. The rail dogs **48** are released from contact with the rails **13** by suitable means, not shown, and upon raising the piston rods **53**, the rail dogs **48** return to raised position.

From the foregoing, it will be seen that I have devised apparatus for tamping ballast on a railroad track which means tamps the ballast automatically to a predetermined compactive pressure and thereby eliminates any over or under tamping of the ballast. By merely the movement of a single lever to lower the tamping head **19**, the entire tamping operation is carried out automatically as described heretofore. It is not necessary to actuate any other levers to move the tamping tools and a recycling of the tamping tool is obtained automatically without the operation of any controls. As the ballast becomes compacted under the crossties, the working stroke of the ballast tools is decreased automatically with each succeeding stroke thereby obtaining a uniform compaction of the ballast. Further, my ballast engaging tools are pivotally connected to the tamping head in working relation on the side of the crosstie opposite the side thereof on which the tools engage ballast. The tools cross each other over the crosstie and a relatively long radius for the arc of travel of the tools is obtained since the actuating means for moving the tamping tools is connected to the laterally extending arm of the tamping tool at the extremity thereof opposite the pivotal connection of the tamping tools. The blades are arcuate and are struck preferably from the pivotal mounting of the tools. This arrangement is important in that a limited space is provided between adjacent crossties in which the tamping tools have to work and it is highly desirable to obtain an arc of travel for the tool with as large a radius as possible so that the degree of curvature of the blades may be relatively small and the tools may be forced downwardly in the ballast with as little force as possible. Also, my tools reach under the crosstie and thereby press the crosstie upwardly into contact with the underside of the rails.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible to various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In apparatus for tamping ballast on both sides of a crosstie of a railroad track, a vehicle having wheels for riding along the rails, a tool supporting frame mounted on said vehicle and being movable in a generally vertical direction, said supporting frame having a lower head portion extending across substantially the entire width of the crosstie over which the apparatus is positioned, a pair of ballast engaging tools pivotally mounted on the head portion for pivoting in a vertical plane substantially parallel to the rails and engaging ballast on opposite sides of the crosstie, each of the ballast tools being pivotally mounted to the head portion adjacent the side of the crosstie opposite the side thereof on which the tool engages ballast in working position whereby the tools cross each other over the crosstie and travel through an arc having a relatively long radius, and means connected to the ballast tools to pivot said ballast tools about said pivotal connections on the supporting frame thereby tamping ballast on both sides of the crosstie.

2. In apparatus for tamping ballast on both sides of a crosstie of a railroad track, a pair of ballast tools adapted to engage ballast on opposite sides of the crosstie, each of said ballast tools having an upper arm extending in a direction generally parallel to the rails and a lower leg extending downwardly from the arm, a tool support frame having a lower head on which the upper arms are mounted for pivoting in a vertical plane substantially parallel to the rails, each of the upper arms being pivotally mounted to the head adjacent the side of the crosstie opposite the side thereof on which the tool engages the ballast and extending over the entire width of the crosstie when the tools are in working position about a crosstie, an arcuate blade on each leg and being struck on a radius in the vicinity of the pivotal connection of the tool to which the respective blade is attached, and means connected to the ballast tools generally at the juncture of the legs and arms to pivot said tools about the pivotal connections on the supporting frame thereby tamping ballast on both sides of the crosstie.

3. In apparatus for tamping ballast on both sides of a crosstie of a railroad track, a vehicle having wheels for riding along the rails, a tool supporting frame mounted on said vehicle and being movable in a generally vertical direction, said supporting frame having a lower head extending across substantially the entire width of the crosstie when the apparatus is positioned in ballast tamping position over the crosstie, a pair of ballast tools mounted on the head for pivoting in a vertical plane substantially parallel to the rails and engaging ballast on opposite sides of the crosstie, each of the ballast tools being pivotally mounted on said head adjacent the side of the crosstie opposite the side thereof on which the tool engages ballast and extending across the width of the crosstie in ballast tamping position, and reciprocating fluid pressure means connected to each of said ballast tools to pivot said ballast tools about the pivotal connections on the supporting frame thereby tamping ballast on both sides of the crosstie.

4. In apparatus for tamping ballast on both sides of a crosstie of a railroad track, a pair of ballast tools adapted to engage ballast on opposite sides of the crosstie, each of said ballast tools having an upper arm extending in a direction generally parallel to the rails and a lower leg extending downwardly from the arm, a tool support member having a lower head on which the upper arms are mounted for pivoting in a vertical plane substantially parallel to the rails, each of the ballast tools being pivotally mounted to the head adjacent the side of the crosstie opposite the side thereof on which the tool engages the ballast in ballast tamping position, said arms extending over substantially the entire width of the crosstie and crossing each other over the crosstie in ballast tamping position, and reciprocating fluid pressure means connected to each of said ballast tools and pivoting said ballast tools about the pivotal connections on the supporting frame thereby tamping ballast on both sides of the crosstie.

5. In apparatus for tamping ballast on both sides of a crosstie of a railroad track, a vehicle having wheels for riding along the rails, a tool supporting frame mounted on said vehicle for movement in a vertical plane generally parallel to the rails, said supporting frame having a lower head extending across the crosstie over which the apparatus is positioned in working relation, a pair of ballast tools mounted on said head and adapted to engage ballast on opposite sides of the crosstie, each of said ballast tools having an upper arm pivotally mounted on the head adjacent a side of the crosstie opposite the side thereof on which the tool engages the ballast in working position, said arms extending over substantially the entire width of the crosstie in a direction generally parallel to the rails

and crossing each other over the crosstie in working position, a downwardly extending leg on the outer end of each arm, an arcuate blade on each leg being struck from a radius substantially at the pivotal mounting of the arm on which the blade is mounted, and reciprocating fluid pressure means arranged over each of said ballast tools and having relatively movable parts, one of said movable parts being connected to the extremity of the arms opposite the pivotal connections thereof and the other of said movable parts being connected to said supporting frame whereby reciprocation of said pressure means pivots said ballast tools about the pivotal connections on the supporting frame.

6. In apparatus for tamping ballast on a railroad track having ballast tools for engaging ballast on the roadbed of the track and fluid pressure means operatively connected to the ballast tools for alternately forcing said ballast tools downwardly in said ballast on a working stroke and raising said ballast tools upwardly therefrom in continuous successive cycles, the improvement of control means operatively connected to said fluid pressure means responsive to an increase in fluid pressure in said fluid pressure means caused by resistance exerted by the ballast against the ballast tools, said control means reversing the downward movement of said tools when a predetermined fluid pressure is reached in said pressure means through contact of said tools with the ballast whereby the working stroke of said tools is decreased upon successive cycles and a uniform compaction of the ballast is obtained.

7. In apparatus for tamping ballast simultaneously about both sides of a crosstie on a railroad track, a vehicle having wheels for riding along the rails, a tool frame mounted on said vehicle and adapted to move in a generally vertical direction over the crosstie, a pair of ballast tamping tools mounted on said tool frame and adapted to engage ballast on opposite sides of the crosstie, means on said vehicle to lower said tool frame to place the tamping tools in ballast tamping position, fluid pressure means operatively connected to said tools to force said ballast tools downwardly in said ballast about both sides of the crosstie when the tool frame has been lowered and to raise said ballast tools upwardly from said downward position, and control means operatively connected to said fluid pressure means and operable responsive to a predetermined fluid pressure in said fluid pressure means caused by resistance exerted by the ballast against the ballast tools, said control means reversing the downward movement of said tools when a predetermined fluid pressure is reached as determined by the compaction of the ballast.

8. In apparatus for tamping ballast simultaneously on opposite sides of a crosstie on a railroad track, a vehicle having wheels for riding along the rails, a tool frame mounted on said vehicle and adapted to move vertically in a generally vertical direction over the crosstie, a pair of ballast tamping tools mounted on said tool frame and adapted to engage ballast on opposite sides of the crosstie, means on the vehicle to lower said tool frame over the crosstie to place the tamping tools in ballast tamping position, fluid pressure means operatively connected to said tools to force said ballast tools downwardly in said ballast and to raise said ballast tools upwardly from said downward position when a predetermined fluid pressure is reached by said pressure means, controls operatively connected to said fluid pressure means responsive to an increase in fluid pressure therein caused by resistance exerted against the ballast tools in their downward movement, said controls reversing the downward movement of said tools in the ballast when a predetermined fluid pressure is reached by a compaction obtained in said ballast and reversing the upward movement of said tools when the tools reach a predetermined fluid pressure at a predetermined height whereby a continuous tamping cycle is maintained, and manual control means to predetermine selectively the length of the stroke of the tamping tools through a tamping cycle.

9. In apparatus for tamping ballast simultaneously on opposite sides of a crosstie on a railroad track, a vehicle having wheels for riding along the rails, a tool frame mounted on said vehicle and adapted to move in a generally vertical direction over the crosstie, a pair of ballast tamping tools mounted on the lower end of said tool frame and adapted to engage ballast on opposite sides of the crosstie, fluid pressure means on the vehicle to lower said tool frame over the crosstie to place the tamping tools in ballast tamping position, additional fluid pressure means operatively connected to the tools to force said ballast tools downwardly in said ballast and to raise said ballast tools upwardly from said downward position when a predetermined fluid pressure is reached in said additional fluid pressure means, said additional fluid pressure means operable responsive to a predetermined fluid pressure reached in said first mentioned fluid pressure means by resistance exerted against the downward movement of said tool frame thereby automatically beginning the operation of said tamping tools upon the tool frame reaching its downward tamping position, controls operatively connected to said additional fluid pressure means responsive to an increase in fluid pressure carried by resistance exerted against the ballast tools by the ballast in the downward movement of said tools, said controls reversing the downward movement of said tools in the ballast when a predetermined fluid pressure is reached through resistance of said ballast to raise the tools out of the ballast, and manual control means to predetermine selectively the length of the stroke of the tamping tools.

10. In apparatus for tamping ballast on a railroad track, the combination of ballast tools mounted on the apparatus adapted to engage and compact ballast on the roadbed of the railroad track, fluid pressure means operatively connected to said tools to force said ballast tools to a downward position in said ballast and to raise said ballast tools upwardly from said downward position, and control means operatively connected to said fluid pressure means responsive to an increase in fluid pressure in said fluid pressure means caused by the resistance exerted by the ballast against the ballast tools, said control means reversing the downward movement of said tools when a predetermined fluid pressure is reached whereby the ballast tools being an upward movement without any manual operation.

11. In apparatus for tamping ballast on both sides of a railroad crosstie, a vehicle having wheels for riding along the rails, a supporting member mounted on said vehicle, a pair of ballast tools pivotally mounted on said supporting member for engaging ballast on opposite sides of the crosstie, reciprocating fluid pressure means operatively connected to the ballast tools for alternately forcing said ballast tools downwardly in said ballast and raising said ballast tools upwardly from the downward position in a continuous tamping cycle, and control means operatively connected to said fluid pressure means responsive to an increase in fluid pressure in said fluid pressure means caused by resistance exerted by the ballast against the ballast tools, said control means reversing the downward movement of said tools when a predetermined fluid pressure is reached in said fluid pressure means whereby the ballast tools begin their upward movement automatically.

12. In apparatus for tamping ballast on a railroad track, the combination of ballast tools adapted to engage and compact ballast on the roadbed of the railroad track by moving in a continuous cycle comprising an upward stroke and a downward stroke, reciprocating fluid pressure means operatively connected to the ballast tools for alternately forcing said ballast tools downwardly in said ballast to compact same and raising said ballast tools upwardly from said downward position in the continuous tamping cycle, control means operatively connected to said fluid pressure means responsive to an increase in fluid pressure in said fluid pressure means caused by resistance exerted against the ballast tools in their downward

movement, said control means automatically reversing the movement of said tools when a predetermined fluid pressure is reached in said fluid pressure means, and manual control means to predetermined selectively the length of a stroke of the tamping tools in a tamping cycle.

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