May 19, 1959 R. KERSHAW 2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Filed July 26, 1956 6 Sheets-Sheet 1

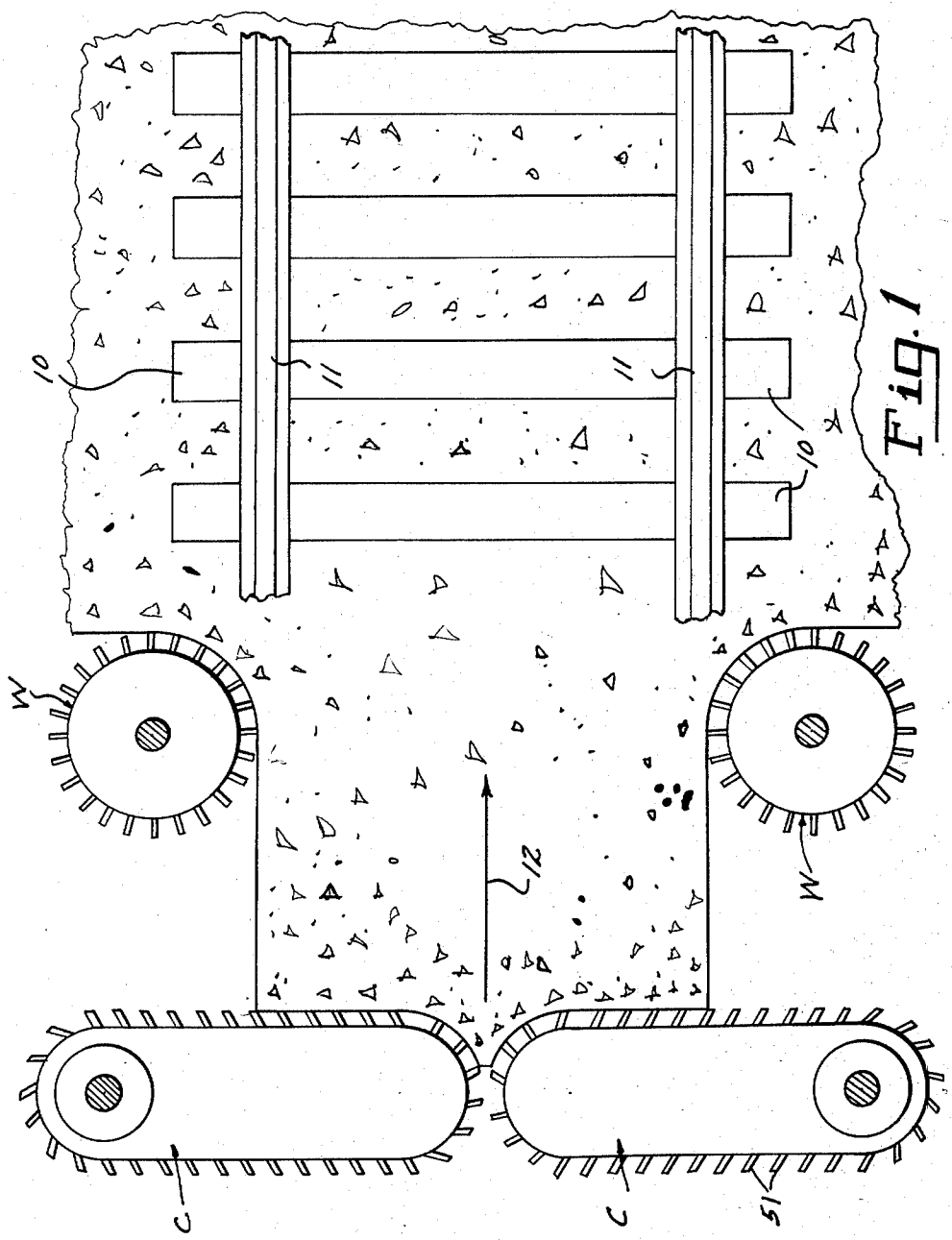


Fig. 1

INVENTOR.
ROYCE KERSHAW
BY Jennings & Carter
ATTORNEYS

May 19, 1959 R. KERSHAW 2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Filed July 26, 1956 6 Sheets-Sheet 2

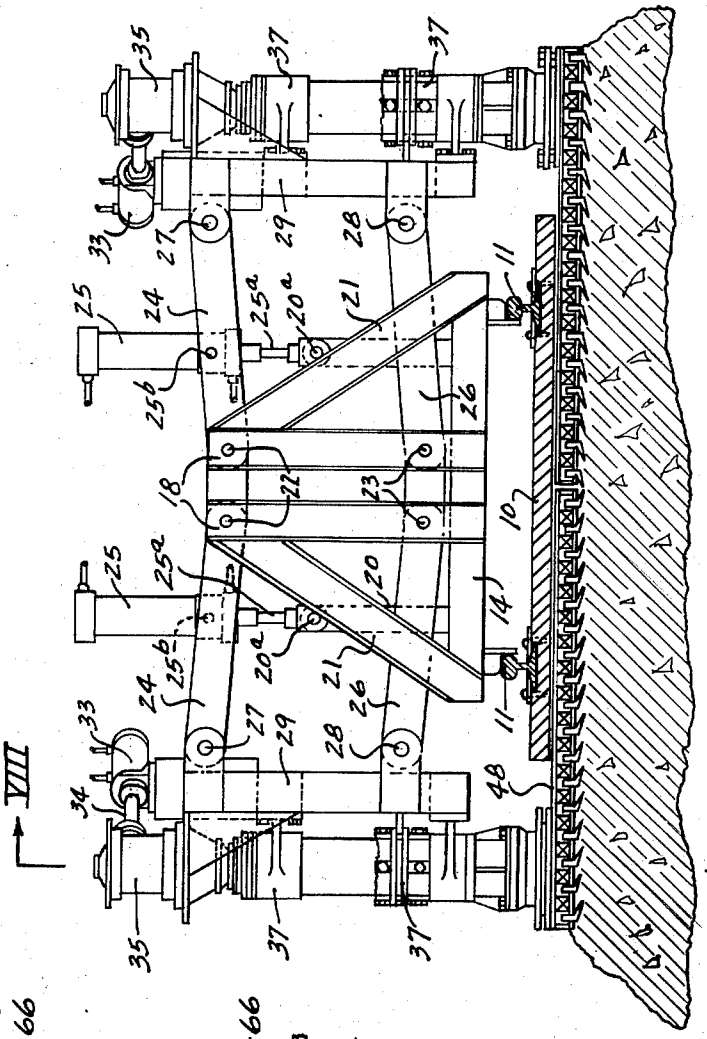


Fig. 2

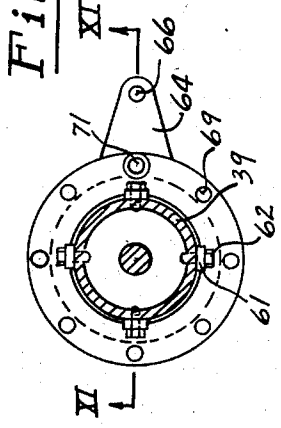


Fig. 10

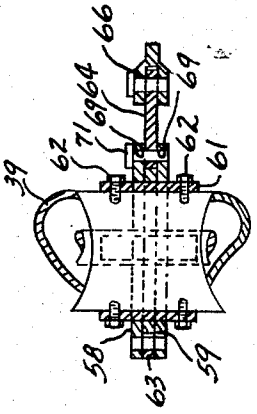


Fig. 11

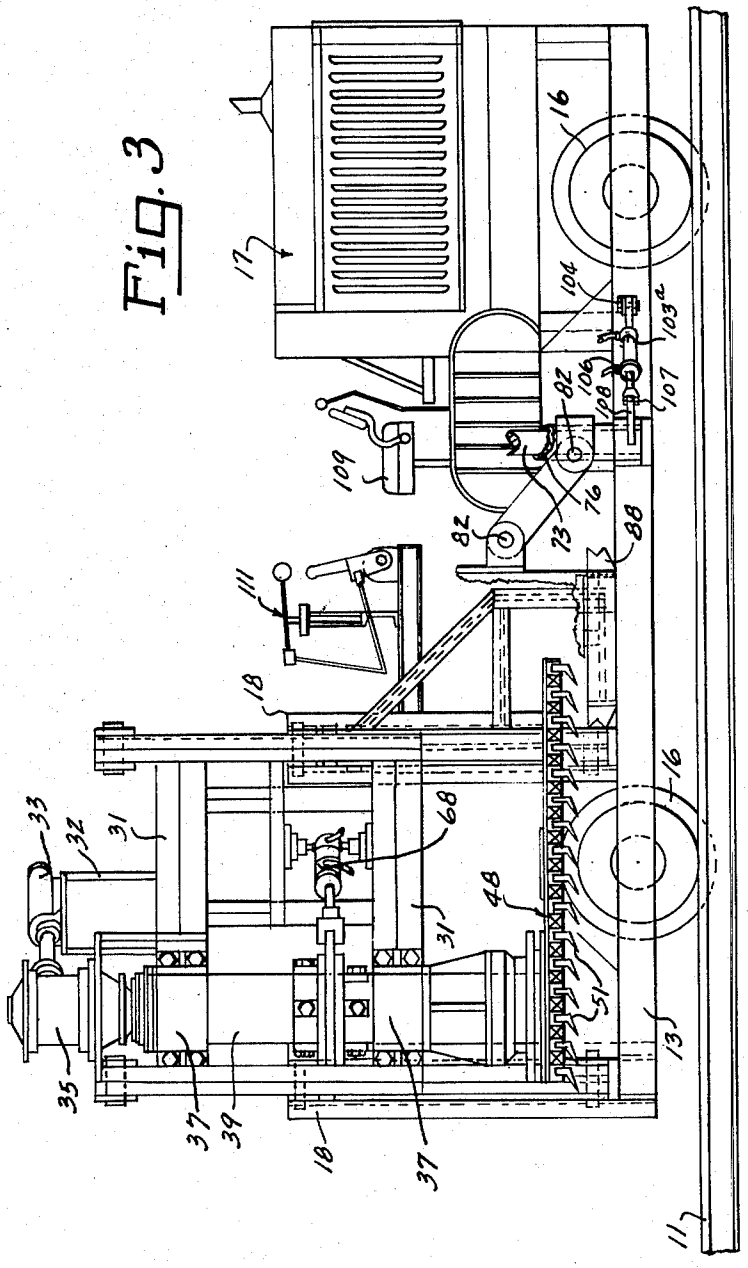
INVENTOR.
ROYCE KERSHAW
BY Jennings & Carter
ATTORNEYS

May 19, 1959 R. KERSHAW 2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Filed July 26, 1956 6 Sheets-Sheet 3

Fig. 3



INVENTOR.
ROYCE KERSHAW
BY
Jennings & Carter
ATTORNEYS

May 19, 1959 R. KERSHAW 2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Filed July 26, 1956 6 Sheets-Sheet 4

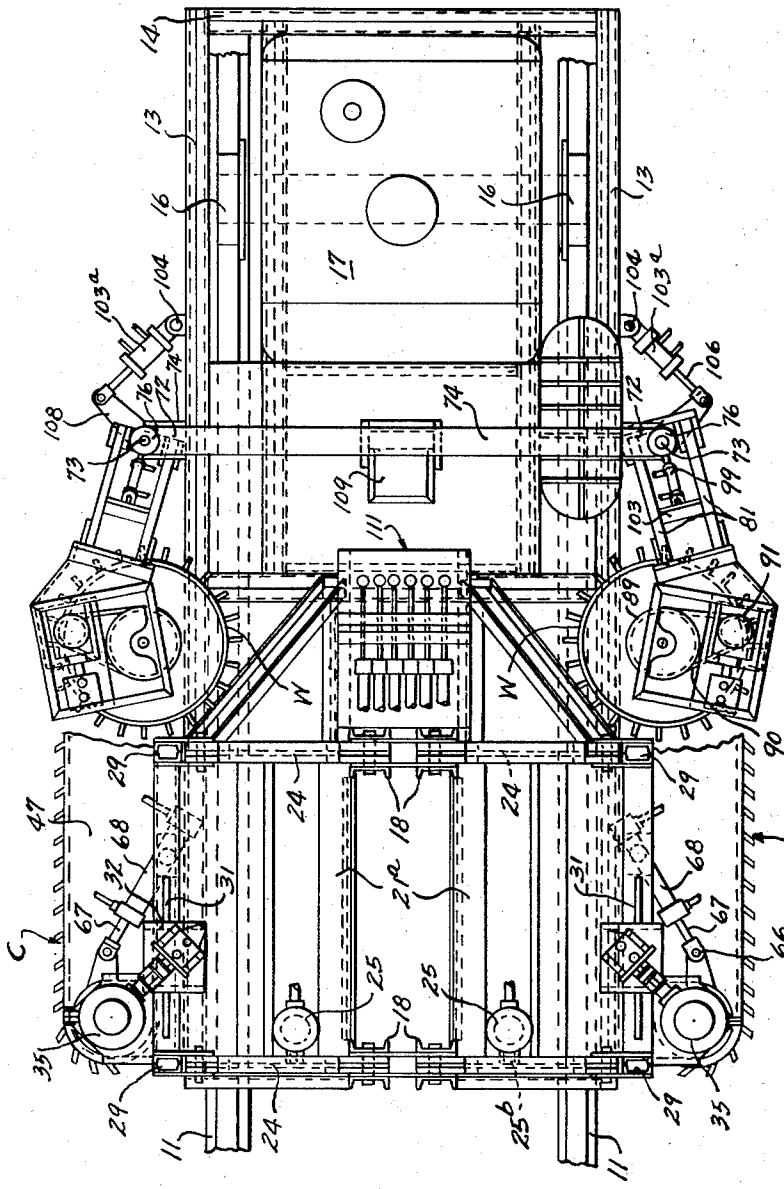


Fig. 4

INVENTOR.
ROYCE KERSHAW
BY Jennings & Carter
ATTORNEYS

May 19, 1959 R. KERSHAW 2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Filed July 26, 1956 6 Sheets-Sheet 5

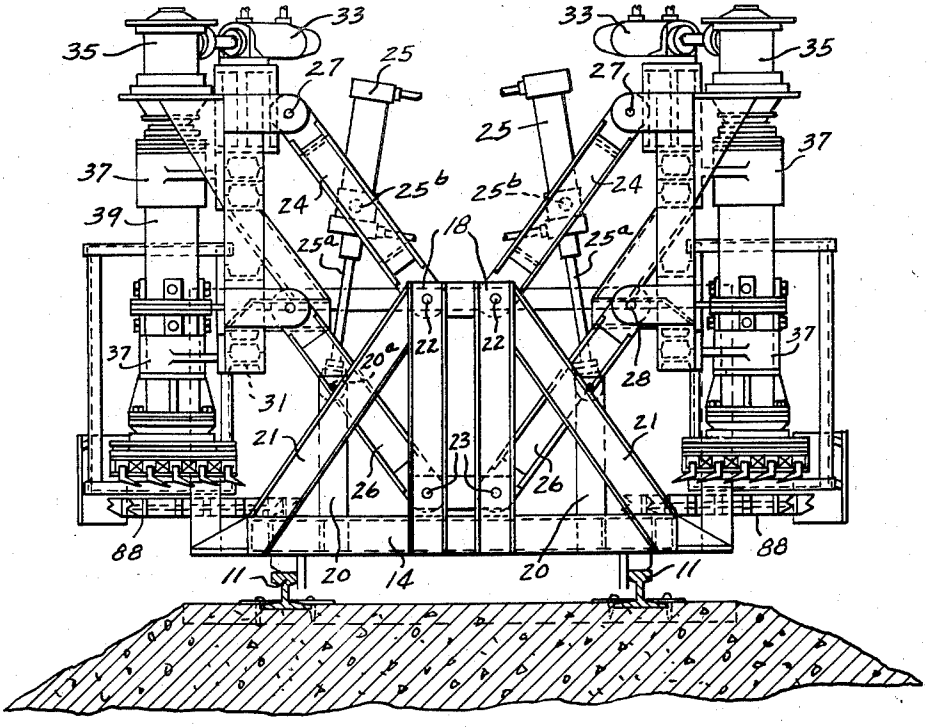


Fig. 5

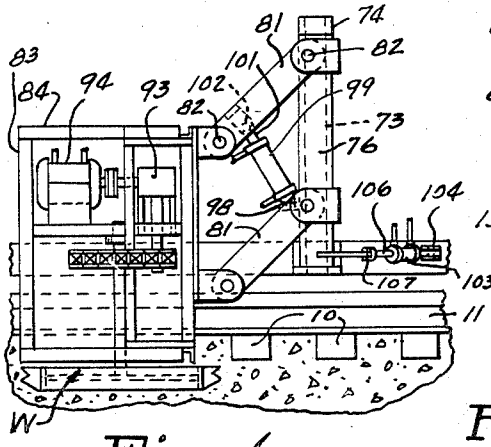


Fig. 6

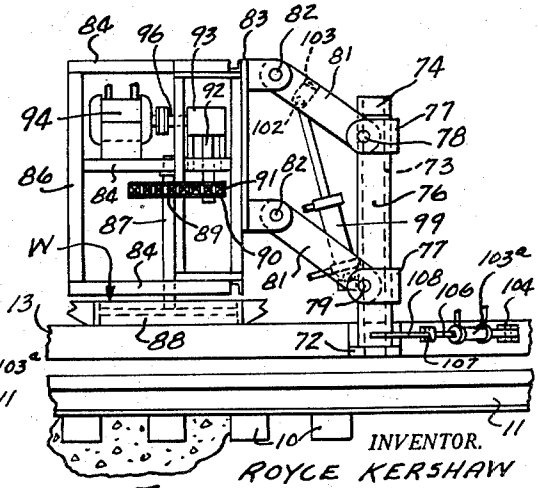


Fig. 7

INVENTOR.
ROYCE KERSHAW
BY Jennings & Carter
ATTORNEYS

May 19, 1959 R. KERSHAW 2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Filed July 26, 1956 6 Sheets-Sheet 6

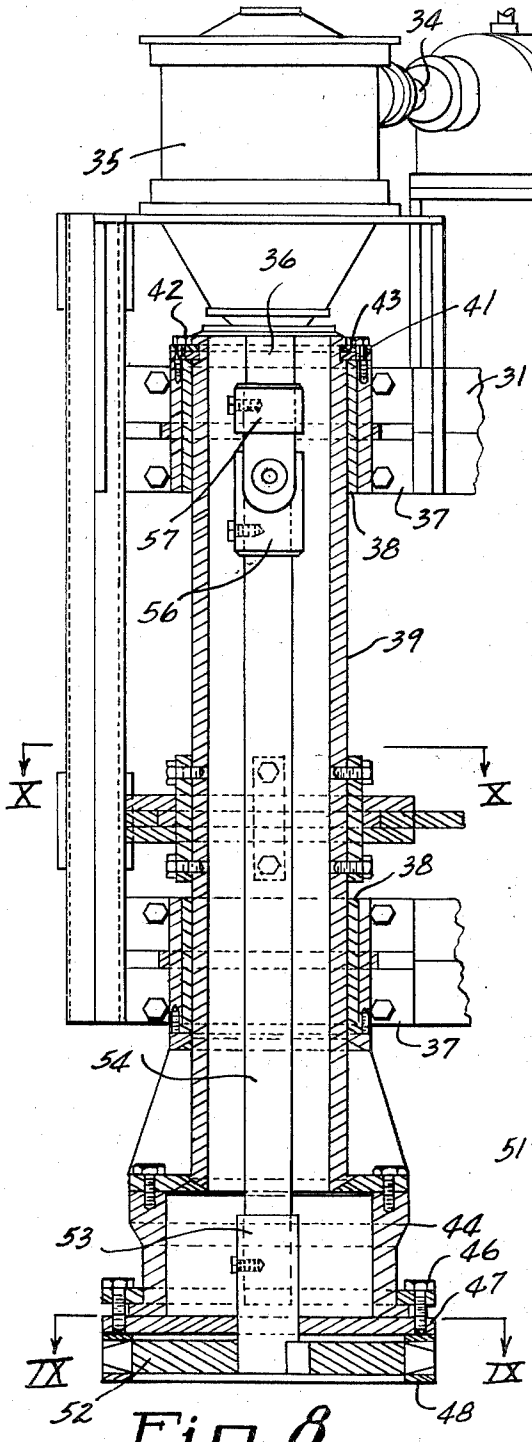


Fig. 8

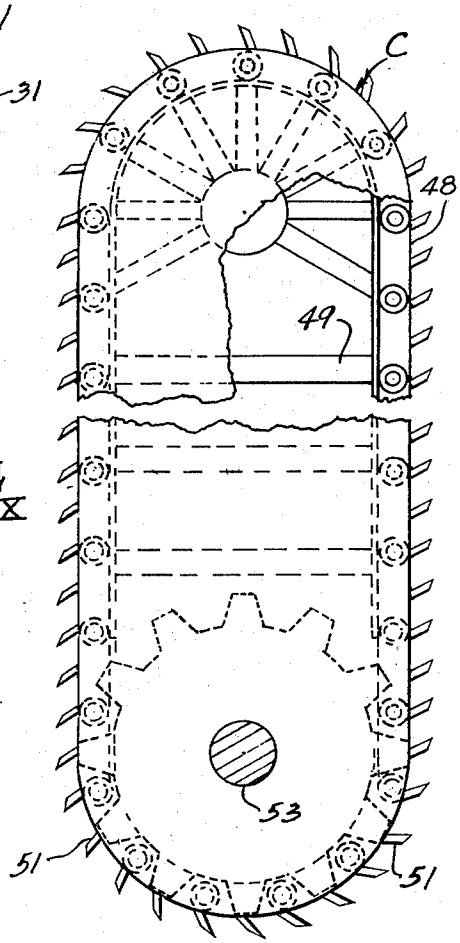


Fig. 9

INVENTOR.
ROYCE KERSHAW
BY Jennings & Carter
ATTORNEYS

United States Patent Office 2,886,904 Patented May 19, 1959

2,886,904

APPARATUS FOR REMOVING BALLAST FROM BENEATH RAILROAD TRACKS

Royce Kershaw, Montgomery, Ala., assignor to Kershaw Manufacturing Company, Incorporated, a corporation of Alabama

Application July 26, 1956, Serial No. 600,300

9 Claims. (Cl. 37—104)

This invention relates to apparatus for removing ballast from beneath the crossties of a railroad track, and especially to such apparatus which shall remove the ballast in a continuous operation with the rails in place on the crossties.

An object of my invention is to provide apparatus embodying horizontally supported driven digging units mounted on a vehicle adapted to run upon the rails, the units being disposed to swing inwardly of the roadbed from each side, thereby to dig the ballast from beneath the crossties as the vehicle moves along the rails.

Another object is to provide support means for the digging units by which they may be moved from raised inoperative or travel position to lowered or working position while at the same time the digging units proper remain substantially horizontal.

Another object is to provide ballast removing apparatus in which the digging units are in the form of chains mounted for movement about the periphery of a plate-like chain guide and holder member, the plates being mounted on the lower ends of vertically disposed rotatable columns inside of which are driven shafts operatively connected to the chains, the vertical columns being carried on the outer ends of the links defining a parallelogram supporting frame whereby the digging units may be moved from raised inward positions to downward horizontal positions under the crossties.

Another object is to provide a rail supported under-track ballast remover which shall be capable of removing the ballast from beneath the entire width of the track at one pass, or, selectively, may remove the ballast from beneath a portion of the track width, from one or both sides of the track, as desired.

Another object is to provide, in combination with the chain diggers already mentioned, horizontally disposed rotary digging units which operate upon the ballast immediately ahead of the chain units, removing the ballast from beneath the ends of the crossties to provide cleared spaces so that as the long inwardly extending chain units pull the ballast outwardly there is room for such ballast without danger of choking or clogging the chain units.

A more general object is to provide apparatus of the character designated in which the ballast removing units are all independently movable into and out of their working positions, thus permitting in selective manner the use of one, some, or all of them as desired.

Briefly, my invention comprises a vehicle having a main frame with wheels adapted to support the vehicle on the rails. Pivotally connected to upstanding members on the main frame in position to overhang the sides thereof and the ends of the crossties, are parallelogram frames. At the outer ends of the parallelogram frames are mounted vertically disposed columns. Mounted for rotation in the columns are shafts which are connected adjacent their upper ends to suitable power sources, preferably fluid motors. On the lower ends of the shafts are chain type digging units of the undercutter type. Power means is provided for rotating the columns, thus to move the undercutters beneath the crossties and hold them there as the apparatus moves along the rails. Preferably, I mount ahead of each undercutter a horizontally disposed wheel-type digging unit which removes the ballast from beneath the ends of the crossties. Thus, the relatively long chain undercutters, each of which extends substantially one-half way across the track, have cleared areas near the outer ends thereof into which they may drag ballast from further inwardly of the track. This loosened ballast, without stopping its outward movement, is completely removed by the undercutters and deposited along the sides of the roadbed outwardly of the ends of the crossties. By removing some of the ballast near the outer ends of the undercutters, I eliminate the danger of choking or overloading the undercutters and greatly increase the capacity of the apparatus.

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

Fig. 1 is a wholly diagrammatic plan view partly broken away and in section and showing the work performed by my improved apparatus in removing ballast from beneath a railroad track;

Fig. 2 is an end elevational view of the apparatus with certain parts omitted for the sake of clarity and certain other parts being broken away, the chain type digging units being in place beneath the railroad track;

Fig. 3 is a side elevational view of my improved apparatus with certain parts of the horizontal wheel type digging unit and supporting structure broken away and showing both the chain type and the wheel type digging units in elevated position;

Fig. 4 is a plan view partly broken away and showing the digging units in raised position;

Fig. 5 is an end elevational view with the digging units in raised position;

Fig. 6 is a fragmental side elevational view showing the support and drive for one of the wheel type digging units in working position;

Fig. 7 is a view corresponding to Fig. 6 and showing one of the wheel type digging units in raised or inoperative position;

Fig. 8 is an enlarged detail sectional view taken generally along line VIII—VIII of Fig. 2;

Fig. 9 is a detail sectional view taken generally along line IX—IX of Fig. 8 and partly broken away;

Fig. 10 is a detail sectional view taken generally along line X—X of Fig. 8 and drawn to a reduced scale; and,

Fig. 11 is a detail sectional view taken generally along line XI—XI of Fig. 10.

Referring now to the drawings for a better understanding of my invention and particularly to Fig. 1 it will be seen that the purpose of my improved apparatus is to remove ballast from beneath the crossties **10** with the rails **11** in place. It is desired at one pass completely to remove all of the ballast from the entire width of the roadbed. It will be understood as the description proceeds that the main weight of the apparatus is supported by wheels which rest on rails **11** supported by crossties in turn still supported by the ballast beneath the tracks before the last of the ballast is removed. As shown in Fig. 1, I provide a pair of wheel type, rotary digging units indicated generally by the letter W which remove ballast as indicated from near the ends of the crossties **10**. Secured to the same vehicle as the wheels W are a pair of chain type digging units indicated generally by the letter C. It will be understood that the entire apparatus moves along in the direction of the arrow **12** when operating whereby the horizontally disposed rotary digging units W remove the ballast from beneath the ends of the crossties **10** and immediately are followed up by

the chain cutters C, to complete the removal of the ballast all the way across the width of the roadbed.

My improved apparatus comprises a vehicle frame having longitudinally extending frame members 13 and a number of transverse frame members 14. The vehicle frame is mounted upon wheels 16 which are adapted to run upon the rails 11 in the manner understood for railway equipment. It will be understood that my improved apparatus preferably is self-propelled although it could be propelled by an independent vehicle.

Mounted on the vehicle frame near the front of the apparatus is a prime mover and hydraulic pump unit indicated generally by the numeral 17. It will be understood by those skilled in the art that this unit consists of a gasoline engine which is operatively connected to a hydraulic pump, not shown, whereby there is readily available on the vehicle a source of hydraulic fluid under high pressure for driving the several hydraulic motors, cylinders and the like as will appear.

Upstanding from the vehicle frame and also from the cross members 14, near the rear of the apparatus, are vertical supporting posts or columns 18. The posts may be braced by members 21 and further braced by longitudinally extending frame members 21*a* whereby they are rigidly supported on the vehicle frame.

Pivotally mounted as at 22 and 23 to the posts are outstanding links 24 and 26. The links 24 and 26 are pivotally connected at 27 and 28 to brackets which outstand from vertically disposed posts 29. In view of the fact that the links 24 and 26 as well as the remainder of the mechanism now to be described is duplicated on each side of the apparatus, a description of one will suffice for both. It is to the posts 29, and on the longitudinally extending bracing 31 connecting these posts that I mount my improved type of chain digging units and the supporting and drive mechanism therefor. It will be noted that the links 24 and 26 together with the vertical posts 29 constitute a parallelogram linkage arrangement in which the post 29 remains vertical even though the links 24 and 26 are pivoted upwardly as will appear.

Carried on one of the cross members 14 of the main frame is an upstanding support 20 to which is pivotally connected at 20*a* the piston rod 25*a* of a hydraulic cylinder 25. The cylinder itself is pivotally connected at 25*b* to one of the upper links 24 so that when the cylinder is energized the links and hence the entire chain type digging unit and its associated mechanism move up and down.

Mounted on the upper member 31 is a support 32 for a fluid pressure motor 33. The output shaft 34 of the motor 33 drives into a gear reduction box 35. It is from this gear reduction box output shaft 36 that the chain cutters C are driven as will presently appear.

Mounted on the upper and lower members 31 are bearing housings 37. Each of the housings 37 is lined with a bushing of soft metal 38 such as bronze or the like. Mounted for limited rotation in bushings 38 is a hollow column 39. The column may be held rotatably in place by means of split ring retainers 41 which are secured to the upper bearing housing 37 by means of bolts 42. It will be noted that the rings fit in a groove 43 in the upper end of the column 39 and rest on the top of the upper bearing housing 37 and bushing 38.

Near its lower end the column 39 carries an adaptor member 44 to which is secured by bolts 46 an elongated plate 47. The plate 47 is the chain supporting and guard member for the chains 48 of the cutter unit C. As will be understood the chain 48 passes around guides 49 which are secured underneath the plate 47. See Fig. 9. The chain 48 carries cutting or digging teeth 51, the exact shape and construction of which will be apparent to those skilled in the art and which as such form no part of my invention.

The chain 48 passes over a drive sprocket 52 which is keyed to a connector 53. The connector 53 is in turn fast on a shaft 54 which connects through a universal joint 56 and a coupling 57 with the power output shaft 36. It will be apparent that when the motor 33 is rotated the chain 48 is driven through the shafts 36 and 54 and sprocket 52.

As has been stated, the entire column 39 is mounted for rotation in the upper and lower bearings 37. As best shown in the detail views, Figs. 10 and 11, there are mounted about the column 39 a pair of spaced rings 58 and 59. The rings 58 and 59 are welded to vertically disposed blocks 61 which in turn are secured to the column 39 by bolts 62. Mounted for rotation between the rings 58 and 59 is an intermediate ring 63 which has an extension 64 thereon. The extension 64 is pivotally connected as at 66 to the piston rod 67 of a double acting hydraulic cylinder 68 pivotally mounted on the bracing 31. The cylinder 68 is supplied with hydraulic fluid under pressure and under control of a valve, from the unit 17. The rings 58 and 59 are provided with a plurality of aligned holes 69 spaced 45° apart about the circumference of the rings. A pin 71 is adapted to be placed through a selected pair of the holes thereby to lock the three rings together. Therefore, when the piston rod 67 moves outwardly or inwardly the entire column 39 including the lower plate 47 and hence the chain 48 is rotated approximately 45° at which position pin 71 may be removed to allow intermediate ring 63 and piston rod 67 to move relative to rings 58 and 59. After removal of pin 71 ring 63 and piston rod 67 may be positioned for the next succeeding working stroke of the hydraulic cylinder 68 at which position pin 71 is inserted through the next succeeding pair of aligned holes 69 for rotating column 39 additionally. Thus, by successive rotations of column 39 outwardly of the track from the non-working position shown in Fig. 4 of the drawings, the ballast removing tool may be arranged in working position beneath the crossties. To remove the ballast removing tool from working position, cylinder 68 and piston rod 67 rotate column 39 in the opposite direction from the above in a similar manner.

Mounted forwardly of the units C, at the sides of the apparatus, are the horizontal wheel type digging units W. As shown in the drawings these units are identical and a description of one will suffice for both.

Outstanding from the frame members 13 are brackets 72. Mounted vertically in the brackets 72 are posts 73. The posts 73 are cross braced by a lateral brace 74 so that they are held in rigid, upright position.

Mounted for limited rotation about the posts 73 are columns 76. Mounted on the columns 76 are upper and lower clevis-like members 77. Pivotally mounted to the clevises 77 as at 78 and 79 are upper and lower sets of links 81. Pivotally mounted as at 82 to the outer ends of links 81 is a vertical frame member 83. It is from the member 83 that the entire digging units W together with their drives are supported.

Mounted on the member 83 is a framework consisting of horizontal members 84 and vertical members 86. Journalled on suitable bearings in the horizontal members 84 is the shaft 87 of the digging wheel 88 proper. The shaft 87 carries a sprocket 89 on its upper end. A chain 90 passes around the sprocket and over a sprocket 91 fast on a shaft 92 which is the power output shaft from a gear box 93. A fluid pressure motor 94 drives the input shaft 96 of the gear box 93 whereby the wheel 88 is rotated.

Pivotally mounted on a bracket 98 carried on the column 76 is a hydraulic cylinder 99. The piston rod 101 of the cylinder 99 is pivotally connected at 102 to a cross member 103 which connects the uppermost set of links 81. Fluid may be supplied to this cylinder from the source 17 under control of suitable valves. It will be apparent that when the cylinder 99 is energized the links 81 move upwardly, raising the entire digging unit W and its drive mechanism.

The column 76 may be rotated about the post 73 by means of a small hydraulic cylinder 103*a* which is pivotal-

ly connected to the frame member **13** as at **104**. The piston rod **106** of the cylinder **103***a* is connected as at **107** to a bracket **108** welded to the column **76**.

An operator's seat **109** is located in front of a valve bank **111**. In view of the fact that the hydraulic system as such forms no part of my invention it is not believed that a detailed description thereof is necessary or desirable. Suffice it to say that the individual valves of the valve bank **111** control the fluid under pressure generated by the gasoline engine—hydraulic pump unit **17** whereby through suitable connections not shown, fluid may be supplied under pressure, selectively, to any of the several motors and cylinders shown. Obviously, and where necessary, flexible hose is used to transmit the fluid under pressure to those mechanisms which move up and down relative to the frame. Thus, either of the units C or W may be raised or lowered independently of each other and one of them may be used without the other, or all may be used together. In the drawings the several hydraulic lines leading to the motors and to the cylinders have been broken away for the sake of clarity.

From the foregoing the method of constructing and using my improved ballast removing apparatus together with the several advantages thereof may now be readily explained and understood. With the digging units C and W being driven by their respective power sources the units W are lowered from their raised positions to their working positions by means of the hydraulic cylinders **99**. Once in lowered position the cylinder **103***a* may be actuated to rotate the columns **76** on the posts **73** whereby the digging wheels **88** proper are moved under the ends of the crossties. In somewhat similar manner the columns which support the digging units C are lowered by means of the cylinders **25**. It will be noted that due to the parallelogram arrangement of the supporting structure controlled by cylinders **25**, the columns **39** move outwardly and downwardly while remaining vertical. They thus are placed at the proper level below the crossties so that upon actuation of the cylinders **68** the columns **39** are rotated, bringing the digging units C under the crossties. It will be understood, of course, that during the placing operation of all the cutters they are being driven through their respective power sources, comprising the motors **94** for the wheels **88** and the motors **33** for the chains **48**. With the units both under the rails at each side the apparatus is moved down the track whereby removal of the ballast takes place as indicated in Fig. 1 of the drawings.

It is to be especially noted that there is a definite cooperation between the ballast removing unit C and W. Since the rotary units W are in the lead they remove a good part of the ballast from the ends of the crossties, clearing the way for the relatively long chain type cutters to drag the ballast from the center of the roadbed out into the cleared spaces. I have found this to be very important inasmuch as the length of the chain cutters, when taking a full cut, is likely to be such that they will clog near the ends of the crossties. This is particularly true with wide ballast beds. Still further, by having the cutters C follow immediately behind the wheels W rather than in performing the operation of the wheels W by a prior machine, I eliminate likelihood of so disturbing the ballast which has been removed by the wheels W as to interfere with the removal of the ballast by the chains. In other words, the simultaneous operation of the wheel type diggers W and the chain type ballast remover C, both supported on a single piece of equipment, permits the entire ballast removing operation to be carried out with one pass, and with one crew, and without the likelihood of the ballast caving in or otherwise being disturbed as might be the case if the operation of the wheel W were performed and subsequently the operation of the ballast remover C were performed. In actual practice the principles of my invention have proved extremely satisfactory. The parallelogram support for the rugged, heavy ballast removing elements is especially desirable and beneficial for the long chain type ballast removers. It will be apparent that the columns **39** are held substantially vertical and hence that plates **47** carrying the chains **48** are held substantially horizontal in all positions of the parallelogram linkage supporting the columns. Therefore, a simple rotation of the entire column properly positions the chains **48** beneath the crossties where they can efficiently remove the ballast.

It is to be noted also that the wheel type diggers do not undercut the tie ends beyond where the existing rails lie. The rail and crossties themselves thus are still supported and will in turn support the machine during the final undercutting operation. In this connection it will be seen that the chain type undercutters are located behind the rear wheels **16** of the apparatus so that the final, entire undercutting operation takes place behind the apparatus whereby the apparatus is loacted upon solidly supported track at all times. My improved apparatus also cuts a level subgrade so that even though the track is open, that is, has no ballast to hold it in place, trains can be passed over the track section. It also is possible to replace the two chain type undercutters with a single longer one whereby to undercut the entire length of the track and dispose all of the material along one side of the track.

From the foregoing it will be seen that I have devised an improved ballast removing apparatus which is capable of removing the ballast from beneath a railroad track with the rails and ties in place. With my improved apparatus it is possible completely to remove the ballast from beneath the track, having a subsequent crew replace the ties, a subsequent crew replace the ballast and tamp the same, all working as a team and all in minimum time and with minimum expense and effort.

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 of 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 removing ballast from beneath the crossties of a railroad track, a vehicle having wheels for supporting the same from the rails, upstanding frame members on the vehicle, parallelogram linkage pivotally connected adjacent its inner end to the upstanding frame members and extending over a side of the vehicle, means for raising and lowering the outer end of the linkage, a vertically disposed ballast tool supporting column rotatably mounted on the outer end of the linkage, an elongated horizontally disposed undertrack ballast removing tool mounted adjacent the lower end of the column, means to rotate the column about its longitudinal axis thereby to move the ballast removing tool from non-working position removed from beneath the crossties to working position therebeneath, and a driven shaft in the column operatively connected to the tool for driving the same.

2. In apparatus for removing ballast from beneath the crossties of a railroad track, a supporting vehicle having a frame mounted on wheels adapted to run upon the rails, upstanding disposed members on the vehicle, a pair of vertically spaced parallel links pivotally connected adjacent their inner ends to the upstanding members, a vertical post-like member pivotally connected to said links adjacent the outer ends thereof, vertically aligned bearings operatively mounted on the post-like member, a vertically disposed ballast removing tool supporting column mounted for rotation in said bearings, an elongated chain-type ballast removing tool mounted on the lower end of the column and adapted for extending beneath the railroad track, power means operatively interposed between the vehicle frame and the links for raising and lowering the links, power means for oscillating the column in said bearings, a power shaft inside the column operatively connected to the bal-

last tool, and power means mounted to move with the links and operatively connected to the shaft within the column for driving the ballast removing tool.

3. In apparatus for removing the ballast from beneath a railroad track, a supporting vehicle having a main frame, forward and rear vertically disposed upstanding members carried by the vehicle, sets of parallel, vertically spaced links pivotally connected at their inner ends to said upstanding members and extending outwardly over the edge of the vehicle, vertical members pivotally connecting said sets of parallel links adjacent the outer ends thereof, horizontal cross members connecting the vertical members, power means for raising and lowering the linkage assembly just described and the vertical members on the ends of the links being held in a substantially vertical position by said parallel links during movement thereof, vertically aligned bearings carried on the horizontal cross members, a tool carrying column mounted for oscillation in said bearings, power means for oscillating the column mounted on the cross members and operatively connected to the column, an elongated chain type digging unit mounted on the lower end of the column and of a length to extend substantially half-way across the track, a shaft inside the column operatively connected to the digging unit, and power means operatively supported from a cross member and operatively connected to the shaft inside the column for rotating the same.

4. Apparatus as defined in claim 3 in which there are two of the digging units, supporting and drive mechanism, one of which is located on an opposite side of the vehicle from the other.

5. In apparatus for removing ballast from beneath the cross ties of a railroad track, a vehicle having a frame supported from the rails by wheels, a horizontally disposed ballast removing wheel unit supported from the frame and extending under the ends of the crossties, a chain type ballast removing unit supported from the frame rearwardly of the ballast removing wheel unit relative to the direction of movement of the vehicle, said chain removing unit being long enough to extend at least substantially one-half way across the railroad track, and said ballast removing wheel unit being of a diameter to provide a clear path adjacent the outer end of the cross ties into which ballast being removed from further inwardly of the track by said chain removing unit may be dragged, thereby preventing clogging of the chain removing unit.

6. Apparatus as defined in claim 5 in which said ballast removing units are supported on parallelogram linkage, and power means is provided for moving the linkage supports independently of each other and additional power means is provided for positioning the ballast removing wheel and chain under the track and to remove them therefrom.

7. In apparatus for removing ballast from beneath the crossties of a railroad track, a vehicle having a main frame supported for movement along the rails by wheels, a pair of ballast removing wheel units mounted on the vehicle in position to overhang the sides thereof and to enter beneath the crossties and remove ballast from beneath the same, means supporting the ballast removing wheels for rotation in horizontal planes for movement under the ends of the crossties inwardly of the track, means to rotate the wheel units, elongated ballast removing chain units mounted on the vehicle in position to remove ballast from under the crossties rearwardly of the wheel units relative to the direction of movement of the vehicle, means supporting the chain units for operation in horizontal planes and for movement under the ends of the crossties and inwardly of the track, and means to drive the chain units whereby as the vehicle moves along the track ballast is removed from beneath substantially the entire width of the track in one pass of the vehicle thereover.

8. Apparatus as defined in claim 7 in which the ballast removing wheel units are of such diameter that there are cleared spaces adjacent the outer ends of the chain units whereby to eliminate clogging of the chain units adjacent their outer ends.

9. Apparatus as defined in claim 8 in which the means to rotate the ballast removing wheel units and the means to drive the chain units are mounted for movement with the respective means supporting said wheel and chain units.

References Cited in the file of this patent

UNITED STATES PATENTS

2,207,854	Foreman et al.	July 16, 1940
2,552,649	Protzeller	May 15, 1951
2,609,619	Jones	Sept. 9, 1952

FOREIGN PATENTS

517,574	France	Dec. 20, 1920
1,013,578	France	Apr. 30, 1952