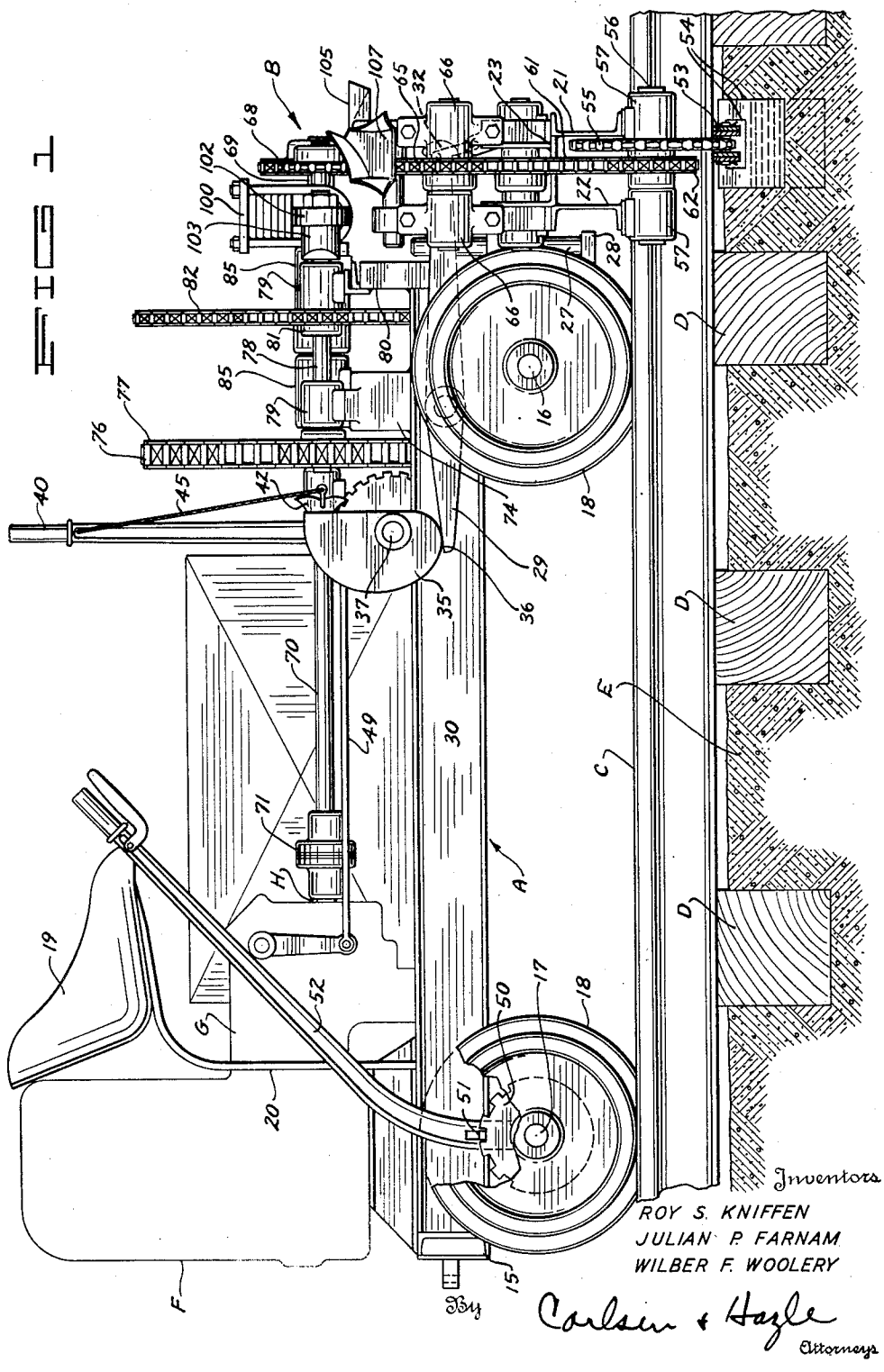
Oct. 31, 1950 R. S. KNIFFEN ET AL 2,527,637

BALLAST REMOVING MACHINE

Filed Aug. 23, 1946 6 Sheets-Sheet 1

FIG. 1



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BALLAST REMOVING MACHINE

Filed Aug. 23, 1946 6 Sheets-Sheet 2

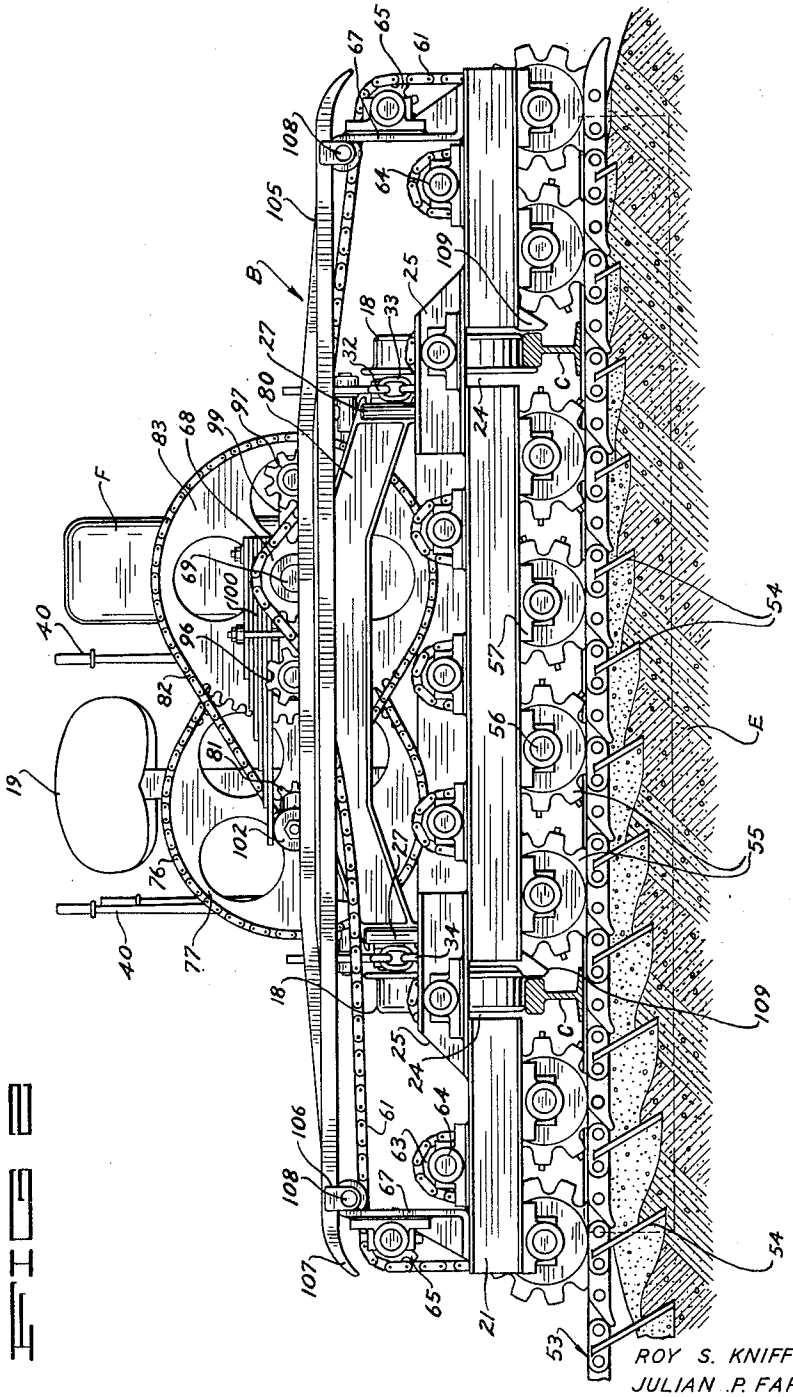

FIG 3

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BALLAST REMOVING MACHINE

Filed Aug. 23, 1946 6 Sheets-Sheet 3

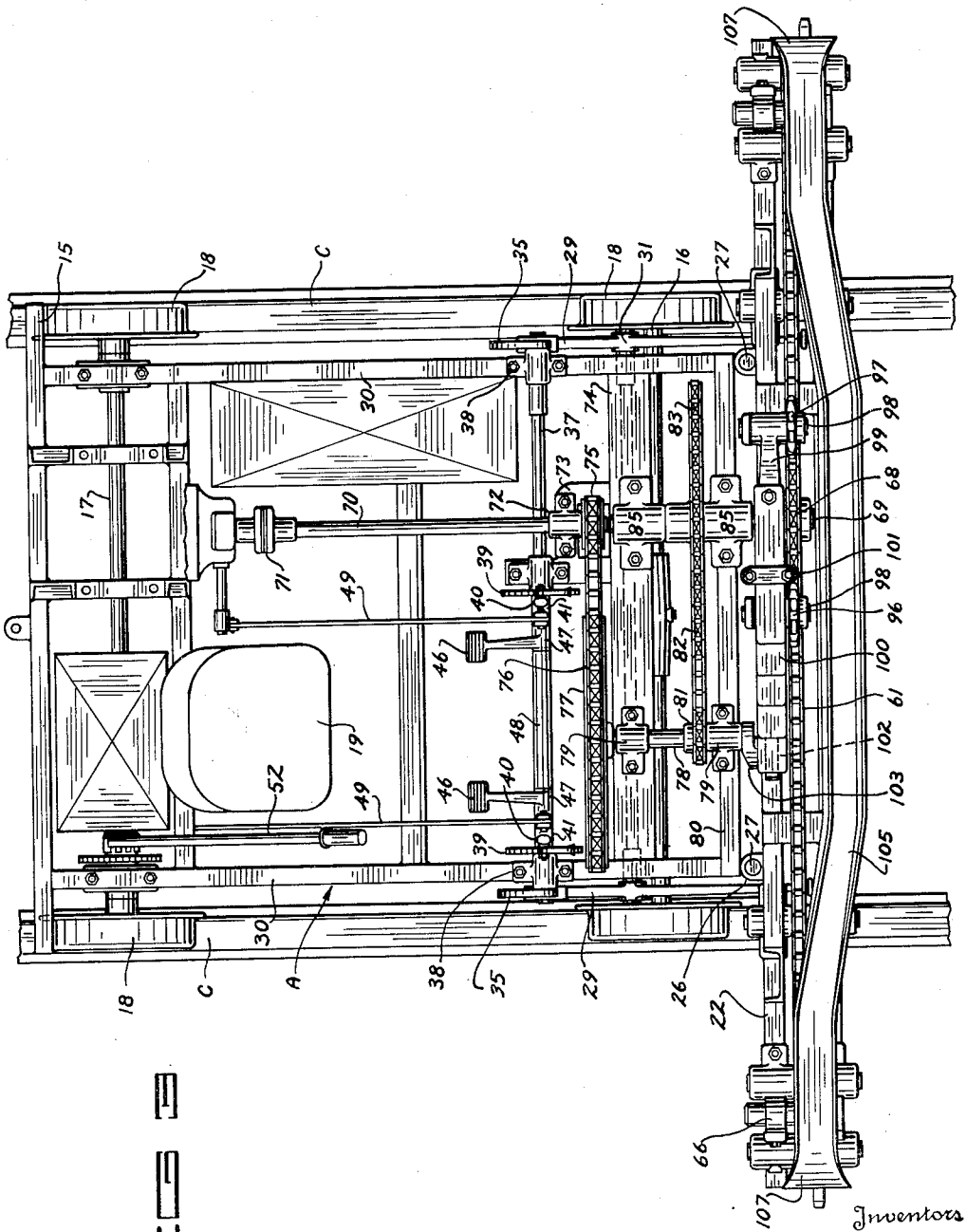

FIG. 3

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BALLAST REMOVING MACHINE

Filed Aug. 23, 1946 6 Sheets-Sheet 4

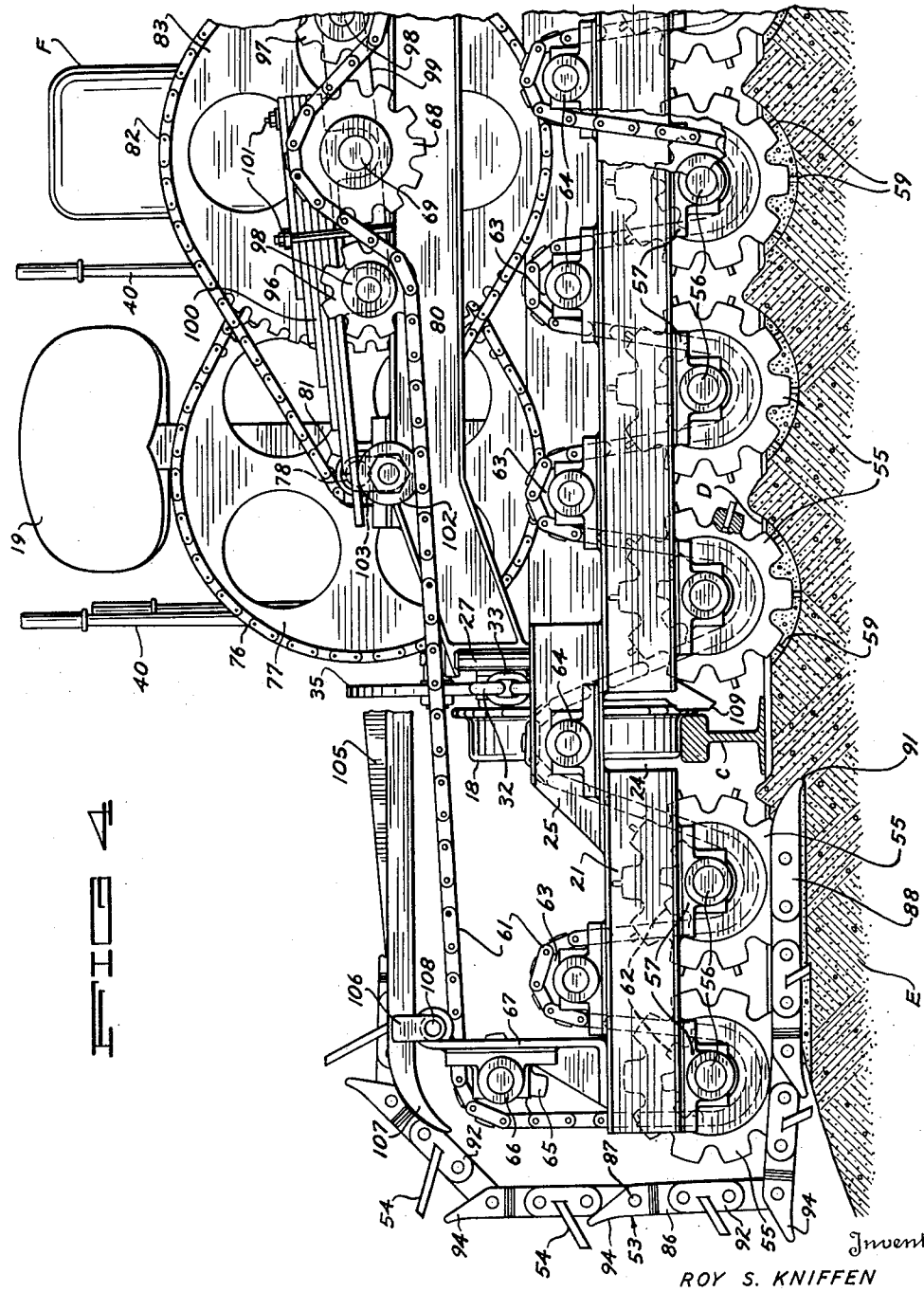

FIG 4

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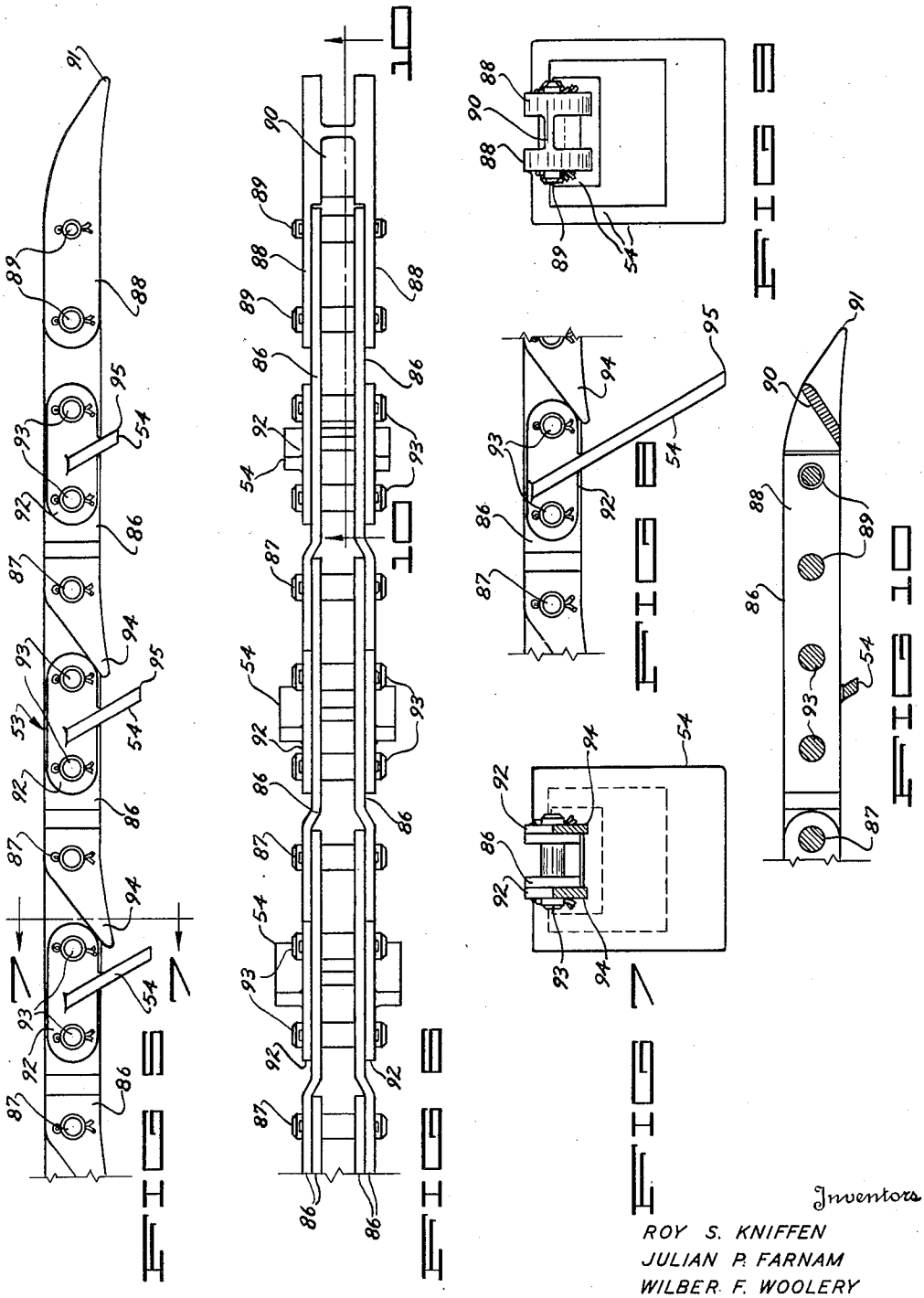
BALLAST REMOVING MACHINE

Filed Aug. 23, 1946 6 Sheets-Sheet 5



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BALLAST REMOVING MACHINE

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FIG 11

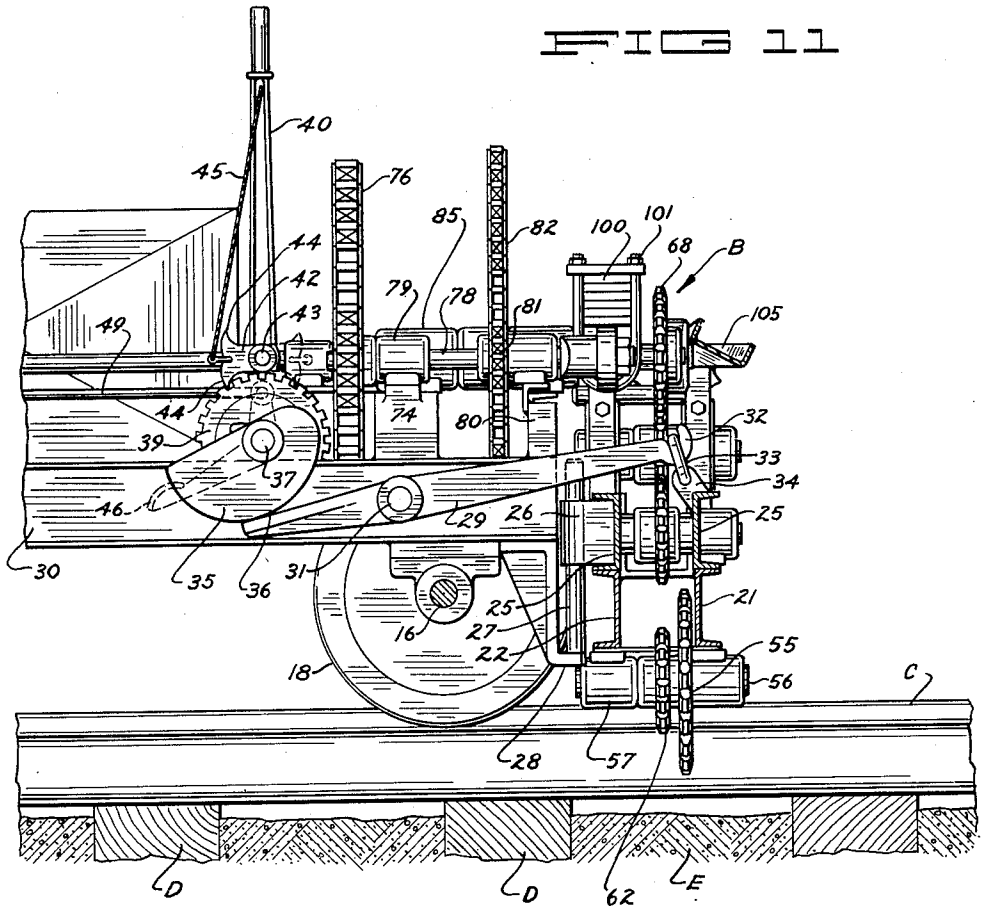
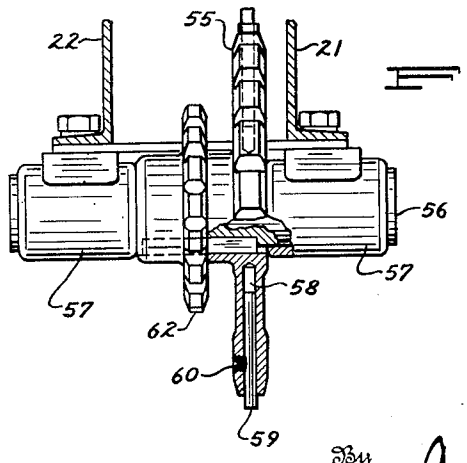


FIG 12



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UNITED STATES PATENT OFFICE

2,527,637

BALLAST REMOVING MACHINE

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Application August 23, 1946, Serial No. 692,636

20 Claims. (Cl. 37—104)

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This invention relates to improvements in ballast removing equipment for railroad maintenance work.

In this field, the removal of the ballast from the roadbed, whether for cleaning and replacement, or in laying new ties, has long been a troublesome, time and labor consuming problem. The ballast has a tendency to become very firmly packed and hardened over a period of time, and this fact, complicated by the difficulty of getting under the rails and cleaning out the ballast cleanly clear across the roadbed, between the ties, leads to the many difficulties encountered in the operation. The use of strictly manual labor for the work, although long the established custom, is costly and thus far to our knowledge no completely successful machine has been devised to accomplish the work. Such machines have been either too cumbersome, heavy and expensive, or have been unsafe and difficult to remove from the track when necessary, and in some cases at least have not operated to completely remove the ballast, leaving some for removal by hand labor.

It is the primary object of our invention to provide a machine for this purpose which will be comparatively light and compact, inexpensive and durable, and safe and convenient in operation. A further object is to provide a machine which will completely and cleanly remove the ballast both between and outside of the rails and which may be operated with a minimum of manual labor.

Other important objects and advantages of our invention will be made apparent in the course of the following specification, reference being had therein to the accompanying drawings, wherein:

Fig. 1 is a side view of the machine showing it in operating position on the track.

Fig. 2 is a front end view, on a slightly reduced scale, showing the rails and roadbed in transverse vertical section.

Fig. 3 is a plan view of the machine, on the scale of Fig. 2, and with the power plant omitted.

Fig. 4 is an enlarged, fragmentary front end view, similar to Fig. 2, but showing the machine just starting its operation.

Fig. 5 is an enlarged fragmentary elevation of the scraping or ballast ditching or scarifying element, which is hereinafter called the chain.

Fig. 6 is a plan view of the chain as seen in Fig. 5.

Fig. 7 is a cross sectional view along the line 7—7 in Fig. 5.

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Fig. 8 is an enlarged, fragmentary elevational view.

Fig. 9 is an end view.

Fig. 10 is a longitudinal sectional view along the line 10—10 in Fig. 6.

Fig. 11 is a longitudinal vertical sectional view of the forward part of the machine, showing certain parts in different positions from the showing of Fig. 1.

Fig. 12 is an enlarged fragmentary sectional detail view.

Referring now more particularly and by reference characters to the drawing, A designates generally a small railway car to and upon which the ballast remover unit per se, designated generally at B, is mounted. The car A comprises a rectangular frame 15 having front and rear axles 16—17 at the ends of which are disposed the usual flanged wheels 18 adapted to run on the rails C of the track. The rails are supported on ties D laid in the ballast E of the roadbed in usual manner.

Mounted at the rear of the car A is a power plant F in the form of a conventional internal combustion engine and the power shaft of this engine emerges forwardly from a clutch and transmission housing G, as indicated at H. An operator's seat 19 is provided near the rear of the car and is supported upon a stand 20. If desired the car may, of course, be powered for travel along the track by the engine F although it is not here so shown. Instead the rear axle 17 is shown as fitted with a notched wheel 50 with which cooperates a pawl 51 on a hand lever 52 pivotally mounted on the axle and extending upwardly and forwardly alongside the seat 19. By engaging the pawl with the wheel 50 and moving the lever the operator may obviously work the car along the track as may be desired.

The ballast remover unit B comprises a main transverse frame structure which, in use, is positioned across and forwardly of the front end of the car A. This frame structure comprises parallel channels or beams 21 and 22 which are rigidly braced and connected and supported one forwardly of the other by U-shaped brackets 23 and any other suitable bracing. The length of these beams 21 and 22 is such that they extend at each end outwardly well beyond the rails C (Fig. 2) and in alignment with the rails the beams are cut out as shown at 24 so that this frame may be lowered below the tops of the rails. Short tie beams 25 welded to the upper edges of the beams 21 and 22 span the cut-outs 24 to hold the beams rigid. Apertured lugs 26 are secured

to and extended rearwardly from the rearmost tie beams 25 and are adapted to fit over upright support and guide pins 27 which are rigidly secured to brackets 28 hung from the forward ends of the car A. This mounting obviously permits the frame, and all elements supported thereon, to be raised and lowered with respect to the car and track.

For thus adjusting the frame there is provided a lift mechanism comprising levers 29 positioned one to each side of the car A and fulcrumed intermediate their ends, on the car frame sides 30, at 31. The levers 29 extend forwardly from the car and at their front ends are hooked at 32 to releasably, upwardly engage rings 33 which are attached to the front tie beams 25 by lugs 34 secured thereto. The pivots 31 support the levers 29 for up and down movements at their forward ends and such movements will obviously correspondingly adjust the frame. At their rear ends the levers 29 bear upwardly on the irregular surface of adjusting cams 35, the upper surfaces 36 of the levers being flattened to properly bear on the cams. These cams 35 are secured at the ends of a shaft 37 supported crosswise on the car in bearings 38 secured to the sides 30 thereof. At spaced points, inwardly of the cams, notched disks 39 are also secured to the shaft and adjacent each disk there is a hand lever 40 pivotally mounted by a tubular hub 41 upon the shaft. The hand levers 40 are so spaced apart and located as to be conveniently grasped by the right and left hands of our operator seated on seat 19, and the operator may thus obviously oscillate the levers in a fore and aft direction. On each hand lever is a swinging pawl 42 pivoted at 43 and having oppositely projecting teeth 44. The pawls 42 may rest on the disks 39 and by swinging the pawls either forward or rearward of their pivots 43 the teeth 44 may be selectively engaged with the notches in the disks. Thus by properly positioning the pawls and working the hand levers 40 back and forth the cams 35 may be turned in either direction, and the curvature of their cam edges is such that movement in one direction will push rear ends of the levers 29 downwardly to raise the frame, while opposite movements will allow this frame to descend. As a convenience in shifting the pawls 42 about, light cords or chains 45 are attached to their free ends and fastened near upper ends of the hand levers 40.

The shaft 37 serves also as a convenient support for a pair of foot pedals 46 each of which is pivoted at 47 on the shaft and held in spaced relation by a sleeve 48. These foot pedals may be connected in any appropriate manner by rods 49 to control the clutch and throttle (not shown) of the engine F.

The actual digging and scraping element for removing the ballast takes the form of an open-ended length of heavy chain designated generally at 53 the individual links of which carry shovels or scarifying blades 54. The chain is operated by, and in use meshes in succession with, a series of heavy hold down sprockets or gears 55 arranged between the frame beams 21 and 22 and supported in transversely spaced relation upon shafts 56 journaled in bearings 57 secured beneath said beams. The axes of the gears 55 are longitudinally and horizontally extended and the gears are so rotated that they all turn in one direction so that, as the chain is fed beneath the gears it will be forced transversely from one side of the roadbed to the other, beneath the rails C as will be presently described in more detail. The gears 55 are, of course, provided both between and outside of the rails C as clearly shown, and are so located that as the beams 21 and 22 are lowered the gears may be moved down below the level of the ties D and into the ballast. Each tooth of the gears, except those at the ends of the assembly, has a radially extending and outwardly opening socket 58 (Fig. 12) in which is secured a cutting bit or tool 59 which projects beyond the tooth for a purpose later to appear. Set screws 60 secure the bits 59 in place allowing their replacement when worn by contact with the ballast.

The hold down gears 55 are rotated by an operating sprocket chain 61 which runs around the lower sides of operating sprocket wheels 62 secured on the shafts 56. Between each sprocket wheel 62, the chain 61 runs over idler sprocket wheels 63 journaled in bearings 64 atop the beams 21 and 22 and at the ends of the transverse frame assembly the chain further runs over idler sprocket wheels 65 journaled in bearings 66 secured to brackets 67 mounted on and connecting the ends of the beams. Thus the upper span of chain 61 is brought well above the frame and at its center the chain runs over a drive sprocket gear 68 secured to a forwardly extending shaft 69. Obviously the drive arrangement is such that the rotation of the shaft 69 and drive sprocket gear 68 will run the chain 61 around all of the operating and idler sprocket wheels, running the hold down gears 55 all in the same direction and at the same speed.

The shaft 69 is driven from the engine F by means which will now be described. A propeller shaft 70 is connected to the power shaft H of the engine by a coupling 71 and extends forwardly above the car through a bearing 72 supported by a bracket 73 (Fig. 3) from a cross member 74 secured upon the car. At its forward end the shaft 70 carries a sprocket gear 75 over which runs a chain 76 also engaging a larger sprocket wheel 77 laterally offset from the gear 75. The wheel 77 is secured upon the rear end of a shaft 78 which is supported at spaced points by bearings 79 one of which is secured upon the cross member 74. The other bearing 79 is secured upon a similar cross member 80 at the forward end of the car. A small sprocket gear 81 is secured upon the shaft 78 between the bearings 79 and cooperating with this gear is a chain 82 which runs also over a large sprocket wheel 83. The wheel 83 is secured upon a rear portion of the shaft 69, which is supported, coaxially with respect to shaft 70, in bearings 85 secured to the cross members 74 and 80. It will thus be seen that shaft 69 will be driven by engine F with a considerable speed reduction afforded by the two chains 76 and 82.

The scraping and scarifying element will now be described. As stated above this element comprises an open-ended length of heavy chain 53 having a plurality of long links each comprising side bars 86 which overlap at adjacent ends and are pivotally connected by transverse pins 87. On one end of the chain there is provided an entering point or needle having side bars 88 secured to the adjacent ends of the link bars 86 by spaced cross pins 89. The needle bars 88 are connected by a transverse web 90 which angles downwardly and rearwardly and the bars are also turned downward slightly and pointed as designated at 91. For convenience in description this end of the chain, having the needle just described is termed the forward end. The scarifying scrapers or

shovels 54 are secured to attachment plates 92 so spaced and located that they may fit alongside the link bars 86, to which they are then attached by cross pins 93. The pins 87, 89 and 93 are all evenly spaced apart along the length of the chain, to fit or mesh with the teeth on the hold down gears 55 as will be apparent.

The chain 53 can flex or bend in only one direction and for this purpose the rear ends of the link bars 86 have downwardly angling tails or stop fingers 94 which extend beneath and upwardly engage the forward ends of the adjacent attachment plates 92, when the chain is straight, as clearly shown in Fig. 5. Thus upward "breaking" or jackknifing of the chain links about the pivot pins 87 is prevented, but opposite movement is unimpeded.

The scrapers or shovels 54 angle downwardly and forwardly from the chain and at lower edges are beveled or sharpened as designated at 95. The blades are welded to the attachment plates 92 and as clearly shown the blades increase in width and length or depth progressively from the front end of the chain to the rear.

Oscillating mechanism is provided for actuating the scraping element with a back and forth movement as it travels beneath the hold down gear 55, and this mechanism comprises a pair of small sprocket wheels 96 and 97 which downwardly engage and mesh with the operating chain 61 at opposite sides of the drive sprocket gear 68. These sprocket wheels 96 and 97 are journaled at forward ends of stub shafts 98 carried at the opposite ends of a walking beam or lever 99 which is pivotally supported upon the shaft 69, behind sprocket gear 68. A heavy leaf spring 100 is secured by bolts 101 atop the lever 99 and projects therefrom laterally out over a roller 102 carried at the end of a crank 103 which is secured to the forward end of the shaft 78. The crank 103 is thus rotated by the drive mechanism and as it moves upward under the spring 100 it will rock the spring and lever 99 clockwise as viewed from the front, moving the sprocket wheel 97 in a downward direction and tightening the upper span of chain 61 between the sprocket gear 68 and the right hand end or side of the machine. At the same time sprocket wheel 96 will be moved upwardly slacking the chain 61 slightly at the opposite side of the gear 68. This action will thus cause a sharp jerking impulse to be imparted to the chain 61 in a direction such that the digging chain 53 will accelerate and move forward sharply a short distance, while it travels on beneath the gears 55. As the crank 103 moves downward the sprocket wheels 96 and 97 move respectively downward and upward, as seen in Fig. 4, giving the chains a slight halting movement between the forward impulses to accentuate the jerking action.

When not in use the chain 53 may rest, upside down, in a transversely extending trough 105 supported at its ends upon the brackets 67 as designated at 106. The trough has its ends downwardly curved and flared as shown at 107 and located over the end sprocket gears 55. In the fastenings 106 are embodied openings 108 through which bars (not shown) may be thrust to act as handles in carrying the ballast remover unit when it is removed from the car as will presently appear.

Depending from the beams 21 and 22 are rail stops 109 (Figs. 2 and 4) adapted to engage the sides of the rails C to resist the thrust against the frame as the chain 53 moves through the ballast as will be clearly understood.

In operation, the machine is moved along the track as required to bring it to the desired point of operations, and during such movement the frame is elevated (Fig. 11) by operation of the levers 40 so that the hold down gears 55 will clear the roadbed and ties. The digging chain 53 is also carried at this point in the trough 105. When the desired point along the track is reached, the ballast moving unit is lowered by the levers 40 until the gears 55 reach the ballast line. The engine F is, of course, now in operation and the rotation of the gears 55 will cause them to dig into the ballast, as seen in Fig. 4, breaking up the surface of the ballast in advance of operation of the chain 53, if the downward movement of the frame is continued to the proper point. The bits 59 will take at least a part of the wear incidental to this digging action of the gears. The digging chain 53 is now pulled down, at its forward end, off the trough 105 and the needle end is fed beneath the end gear 55 which, as it meshes with the pins 89 will push the needle toward the next gear in line, which will in turn engage the chain and travel it along. As the chain is thus pulled into and through its working movement it will feed down off the trough 105 and a man at this side of the machine will have no difficulty in starting the chain and keeping it in place until its tail end comes off the trough, as will be apparent.

As the chain travels its needle end will pass in succession beneath the rails, until this end reaches the opposite side of the track, whereupon another operator stationed thereat may lift the chain, buckle it over and feed it back onto the trough 105 until the chain is again at rest full length on the trough, ready for a repeat operation. As will be readily seen the forceful passage of the chain beneath the rails will cause the blades 54 to scrape the ballast ahead and deposit it at the side of the roadbed, leaving a trench clear across the roadbed. Repeated operations may be made to clear out any desired part of the ballast and the machine may be readily moved ahead or back, and the chain raised or lowered as may be required. The jerking action of the chain as it travels greatly facilitates its work in breaking up the firmly packed ballast, and the penetration of the chain into the ballast is helped by the gradually increasing size of the scraper blades. The upward inflexibility of the chain prevents it from buckling due to the upward reaction of the ballast, and this stiffness of the chain, in combination with the shape of its needle end makes it possible to pass the chain beneath the rails, from one gear 55 to another at opposite sides thereof as will be clearly evident.

The open-ended chain, as contrasted to previous devices of our knowledge which use an endless chain for digging, is a safety feature of importance since at no time is the machine fastened to the rails by the chain, and removal of the machine to clear the track is not interfered with by the chain. The unit B may be lifted off the car, by releasing the chain 61 from the sprocket wheels 68, 96 and 97, and then lifting the frame until the lugs 26 clear the pins 27. The machine is thus readily separated into two units to facilitate removal from the track, storage, or the like.

It will be noted that the ballast will be removed to an even depth clear across the roadbed and an even bed thus provided for laying the ties or to receive new or reclaimed ballast. It is pos-

sible, too, to remove the ballast to a level well below the lower edges of the ties. This is a marked convenience in lowering the track, since by cleaning out the ballast between ties, moving the ties over to drop into the cleaned spaces, and then reballasting, the grade may be lowered with comparatively little labor and time involved.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described our invention, what we claim to be new and desire to protect by Letters Patent is:

1. In a machine of the character described, for forming a transverse channel in the ballast beneath railroad rails, a frame supported over the rails, an open-ended chain having scrapers, and mechanism for supporting and pushing said chain endfirst through the ballast to move a part thereof out from beneath the rails.

2. In a machine of the character described for moving ballast out laterally from beneath the rails of a railroad track, a frame supported above the rails, an open-end chain having ballast scraping blades, and mechanism for engaging and pushing the chain crosswise beneath the rails from one side of the track to the other.

3. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising a parted chain having scrapers, and means for downwardly engaging the chain and forcing it endfirst through the ballast from one side of the roadbed to the other whereby the scrapers will push out the ballast to the side.

4. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising in combination, an open-ended chain having a series of scrapers, and a series of sprocket gears operatively arranged to engage the chain and push it endfirst through the ballast and beneath the rails and for holding the chain down against the upward reaction of the ballast upon the scrapers.

5. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising in combination, an open-ended chain having a series of scrapers, and a series of sprocket gears operatively arranged to engage the chain and push it endfirst through the ballast and beneath the rails and for holding the chain down against the upward reaction of the ballast upon the scrapers, the said chain being inflexible in one direction to hold the links thereof from jackknifing upwardly between the sprocket gears.

6. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising in combination, an open-ended chain having a series of scrapers, and a series of sprocket gears operatively arranged to engage the chain and push it endfirst through the ballast and beneath the rails and for holding the chain down against the upward reaction of the ballast upon the scrapers, the said chain being inflexible in one direction to hold the links thereof from jackknifing upwardly between the sprocket gears, the said chain having a pointed entering member at the end which moves first through the ballast.

7. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising in combination, an open-ended chain having a series of scrapers, and a series of sprocket gears operatively arranged to engage the chain and push it endfirst through the ballast and beneath the rails and for holding the chain down against the upward reaction of the ballast upon the scrapers, the said chain being inflexible in one direction to hold the links thereof from jackknifing upwardly between the sprocket gears, the said chain having a needle member at its end for penetrating through the ballast and said needle member having an angular guide surface operative to prevent its moving angularly down through the ballast and causing the chain to lose contact with the sprocket gears.

8. A ballast remover for digging and moving ballast out to one side of a railway roadbed from beneath the rails, comprising a ballast moving element having a series of links, a series of sprocket gears for engaging the links and pushing said element endwise across the roadbed beneath the rails, said sprocket gears being spaced apart transversely across the width of the roadbed and located both between and outside of the rails, the links being connected for flexing movement in one direction only whereby to pass between the gears without upwardly buckling, and ballast digging members on the links.

9. A ballast remover for digging and moving ballast out to one side of a railway roadbed from beneath the rails, a chain having a series of links, a series of sprocket gears supported across the roadbed and operative to successively engage the chain and force it endwise through the ballast and below the rails, scraper elements on the links, and cooperating means between the links to hold them from upwardly buckling as they pass between the sprocket gears.

10. A ballast remover for digging and moving ballast out to one side of a railway roadbed from beneath the rails, a digging chain having a series of scraping elements, a series of sprocket gears supported across the width of the roadbed and operative to engage the chain and force it endwise through the ballast from one side of the roadbed to the other, and means for intermittently accelerating the sprocket gears and the travel of the chain to assist the chain and the scrapers in breaking loose and moving the ballast.

11. A ballast remover for digging and moving ballast out to one side of a railway roadbed from beneath the rails, a digging chain having a series of scraping elements, a series of sprocket gears supported across the width of the roadbed and operative to engage the chain and force it endwise through the ballast from one side of the roadbed to the other, and mechanism operating on the sprocket gears for imparting forward jerking impulses to the chain as it travels beneath the sprocket gears to assist in breaking out and moving the ballast.

12. A ballast remover for digging and moving ballast out to one side of a railway roadbed from beneath the rails, a digging chain having a series of scraping elements, a series of sprocket gears supported across the width of the roadbed and operative to engage the chain and force it endwise through the ballast from one side of the roadbed to the other, and the sprocket gears having digging means for engaging and breaking up the surface of the ballast before the chain is moved through by the gears.

13. A ballast remover for digging and moving ballast out to one side of a railway roadbed from beneath the rails, a digging chain having a series of scraping elements, a series of sprocket

gears supported across the width of the roadbed and operative to engage the chain and force it endwise through the ballast from one side of the roadbed to the other, and the sprocket gears having replaceable radially projecting bits for breaking up the ballast surface in advance of the travel of the chain therethrough.

14. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising an open-ended chain having a plurality of scraper blades, a series of sprocket gears supported across the roadbed and adapted to downwardly engage the chain and force it endfirst through the ballast and beneath the rails, and the said scraper blades increasing in size along the length of the chain and in a manner such that the smaller blades will first engage the ballast followed by blades of increasing size in succession.

15. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising an open-ended chain having a plurality of scraping elements spaced along its length, a frame supported transversely above the roadbed, a series of hold down gears spaced across the frame and operative to downwardly engage the chain and feed it endwise across the roadbed and beneath the rails, a sprocket chain operative to rotate said gears, and oscillating mechanism for periodically pulling said sprocket chain sharply in one direction to impart forward accelerating impulses to the scraping elements as they travel through the ballast.

16. A ballast remover for moving ballast out to one side of a railroad roadbed from beneath the rails, comprising an open-ended chain having a plurality of scraper blades, a series of sprocket gears supported across the roadbed and adapted to downwardly engage the chain and force it endfirst through the ballast and beneath the rails, and means operative to engage the rails and resist the backward thrust upon the chain and gears as the scraper blades push through the ballast.

17. In a machine for removing ballast out to the side of a railroad roadbed from beneath the rails, a frame supported crosswise above the roadbed, a series of hold down sprocket gears carried by the frame and spaced apart across the roadbed, an open-ended chain having a series of digging elements, a trough supported above the frame and having its ends positioned over the end gears of the series, and the chain being adapted to be supported between ballast removing operations in an upside down position in the trough and to be fed endwise therefrom downwardly beneath the gears for movement by the gears across the roadbed and then lifted and fed back onto the opposite end of the trough and returned to an inoperative position on the trough as the operation is completed.

18. In a ballast removing device, an elongated heavy open-ended chain having a series of pivotally connected links, scraping elements projecting in one direction from the links, and cooperating means on the links for restraining them against flexing movements in a direction opposite that in which said scraping elements project.

19. In a ballast removing device, an elongated heavy open-ended chain having a series of pivotally connected links, scraping elements projecting in one direction from the links, cooperating means on the links for restraining them against flexing movements in a direction opposite that in which said scraping elements project, and a needle member on one end of the chain having a pointed end and an angular guide surface for engaging and guiding the chain through the ballast.

20. In a machine for removing ballast out to the side of a railroad roadbed from beneath the rails, a frame supported crosswise above the roadbed, a series of hold down sprocket gears carried by the frame and spaced apart across the roadbed, an open-ended chain having a series of digging elements, means for operating the sprocket gears to thrust the chain end first through the ballast, and a trough supported above the frame for supporting the chain when not in use and as it is fed down at one end into engagement with the sprocket gears.

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