Feb. 21, 1956 B. H. HESEMANN 2,735,375

RAILROAD TIE REPLACING MACHINE

Filed May 26, 1952 4 Sheets-Sheet 1

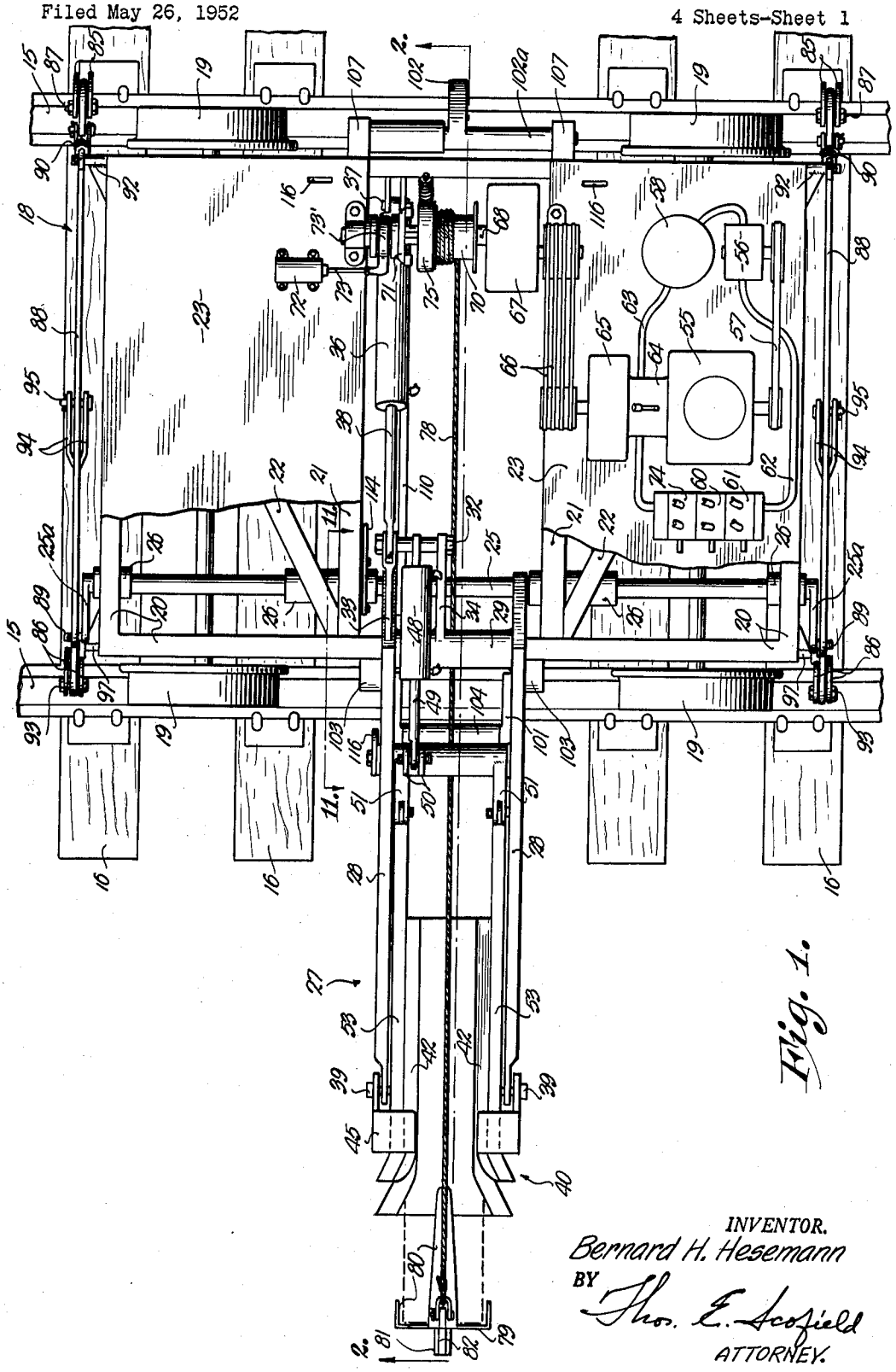


Fig. 1.

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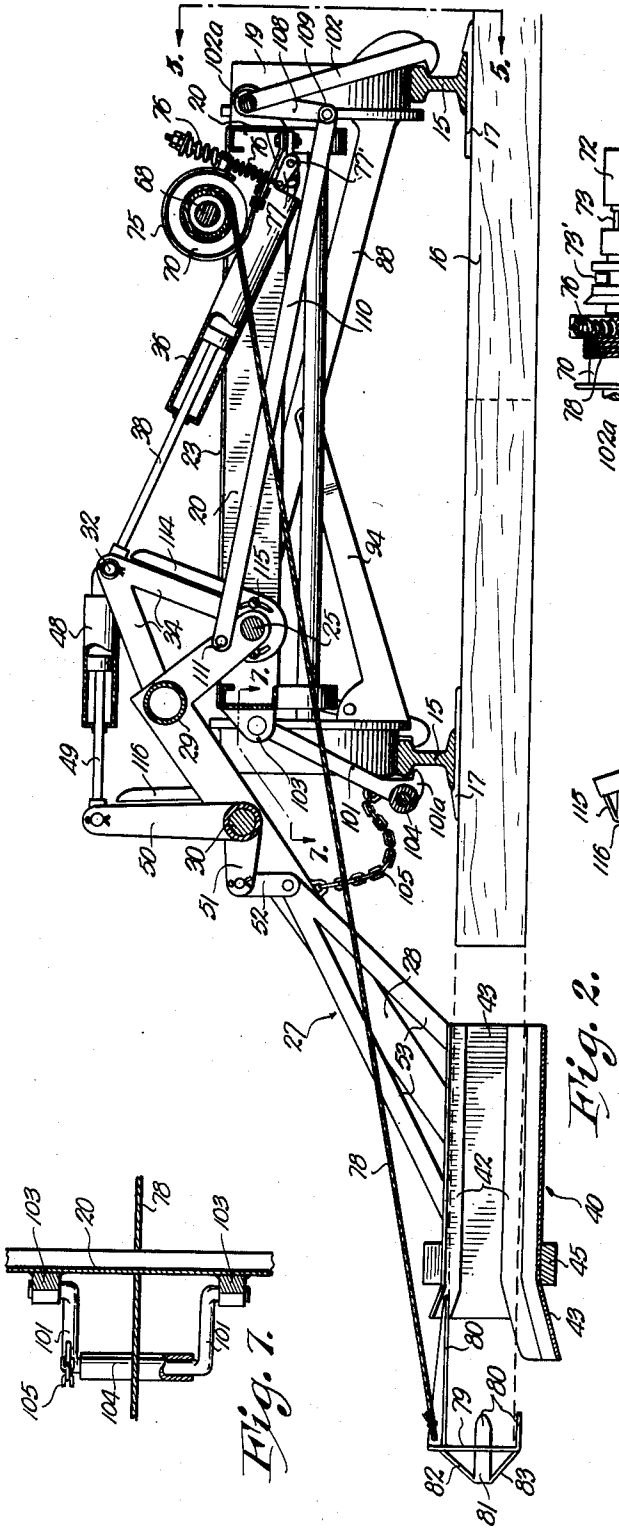


Fig. 2.

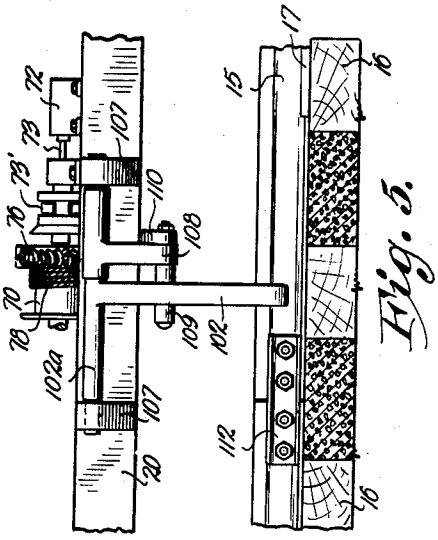


Fig. 5.

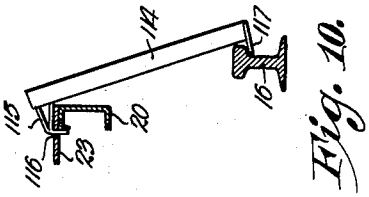


Fig. 10.

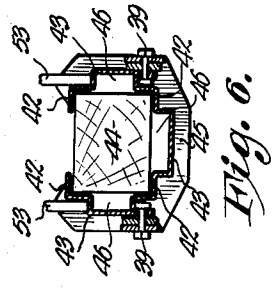


Fig. 6.

Fig. 7.

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RAILROAD TIE REPLACING MACHINE

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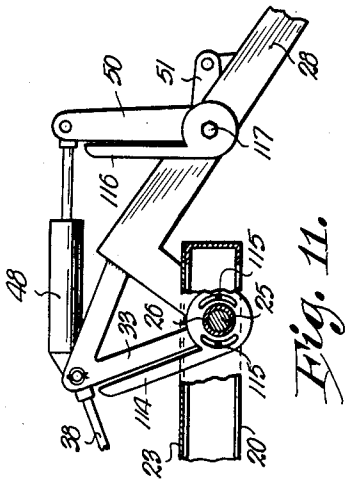


Fig. 11.

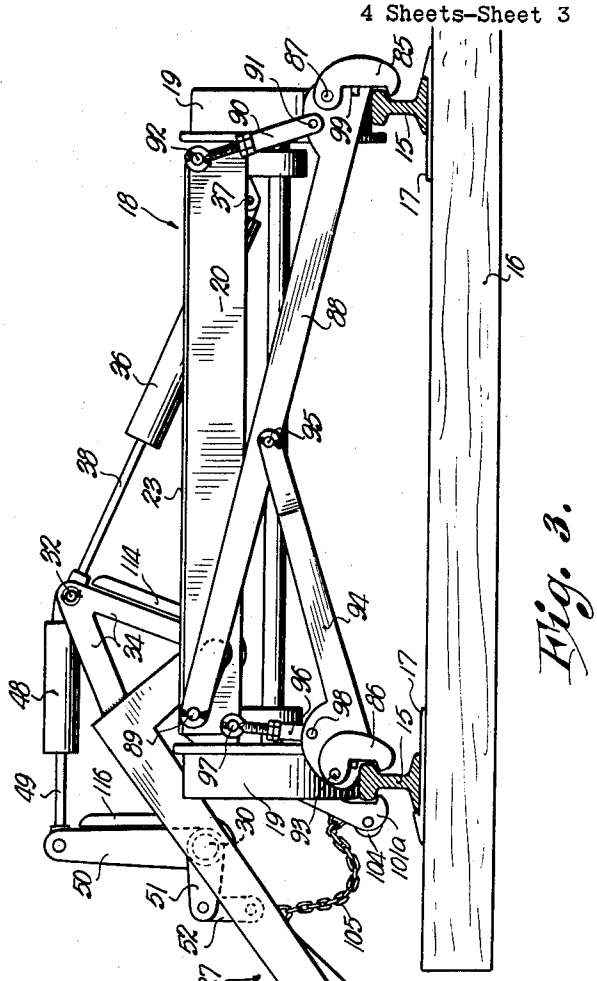


Fig. 3.

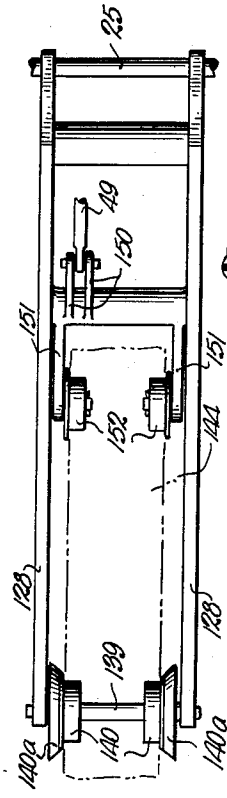


Fig. 12.

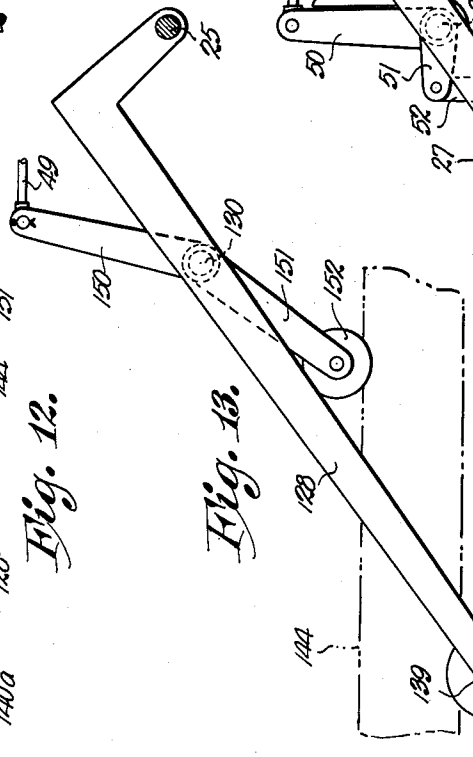


Fig. 13.

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RAILROAD TIE REPLACING MACHINE

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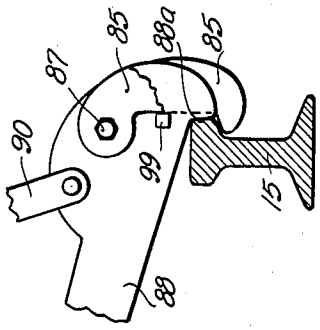


Fig. 8.

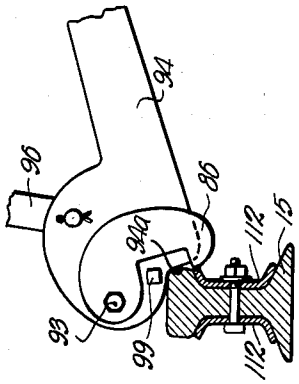


Fig. 9.

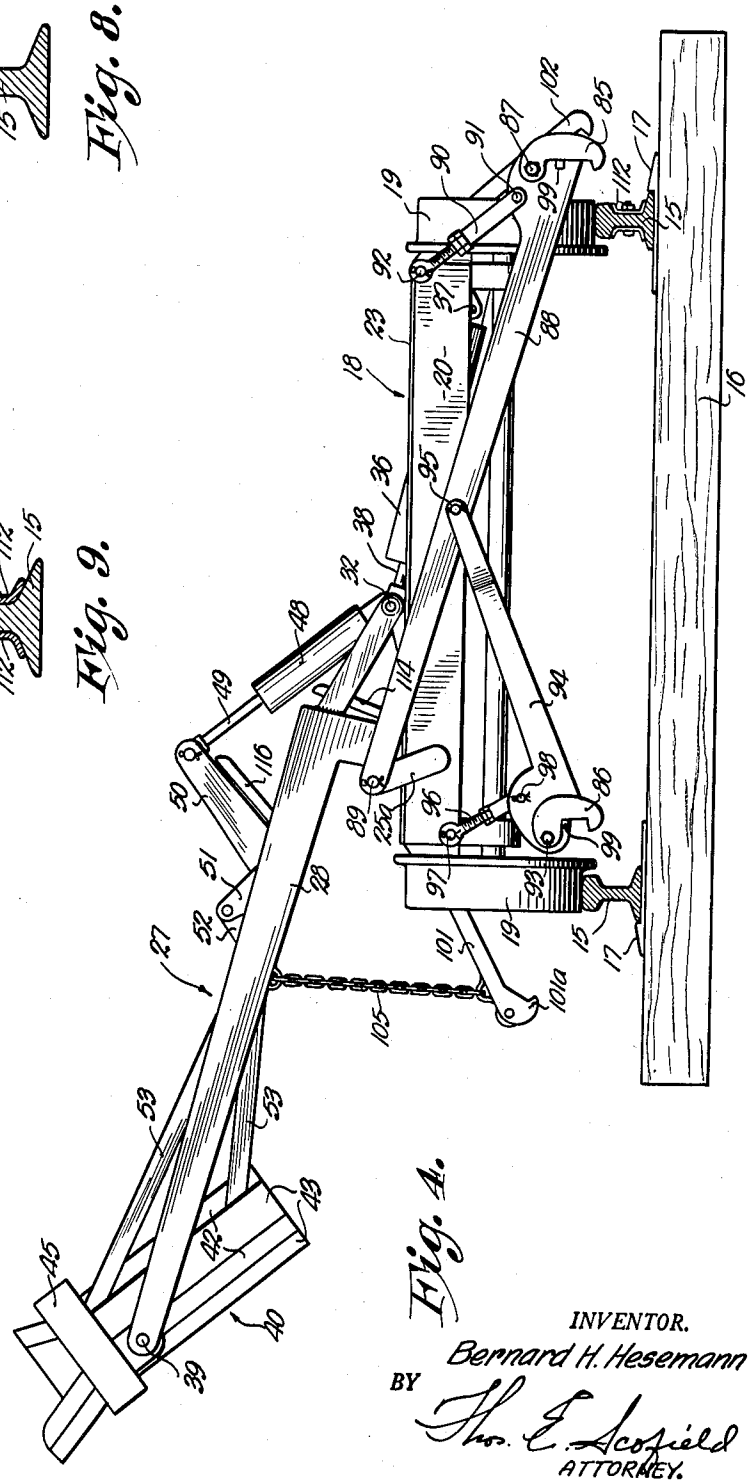


Fig. 4.

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2,735,375

RAILROAD TIE REPLACING MACHINE

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Application May 26, 1952, Serial No. 289,931

26 Claims. (Cl. 104—9)

The present invention relates in general to the repair of railroad trackage and the like; and it deals more particularly with apparatus for removing old ties from an existing road bed and substituting new ties in their place.

The object of the invention, generally speaking, is to provide a relatively simple, substantial, trouble-free and easily operated machine by which the old ties supporting the railroad track can easily and quickly be removed and replaced by new ties, precisely positioned as to elevation relative to existing rails; and without disturbing the rails and with little or no disturbance of the crushed rock or other ballast material of the road bed.

Another object is to provide a machine of the foregoing character, all components of which are mounted on a wheeled truck or carriage that can be propelled rapidly and safely on the railway track to the desired location, and which is easily moved from place to place along the track for the purpose of performing the tie replacement operation. To this end, a further object is to provide a machine that can be shifted from an inoperative to an operative condition conveniently and in a minimum of time, and which can be operated rapidly and economically to replace ties with the least amount of manual labor on the part of the maintenance crew or section hands operating the machine.

Still another object of the invention is to provide novel means for securing my machine in position on the rails when in operation and, in conjunction therewith, to provide means permitting adjustment of the machine to accommodate it to rails of varying size and also to permit working on curves with varying degree of super-elevation.

Other and further objects of the invention, together with the features of novelty whereby the objects are achieved, will appear in the course of the following description.

In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals are employed to indicate like parts of the various views:

Fig. 1 is a plan view of my railroad tie replacing machine, parts having been broken away for purposes of illustration;

Fig. 2 is a vertical cross section taken along the line 2—2 of Fig. 1 in the direction of the arrows;

Fig. 3 is an end elevational view of my machine showing the parts in the same position they occupy in Fig. 2, this representing the "working" condition of the machine; the winch and power drive elements are omitted from this figure in the interest of simplicity and clarity;

Fig. 4 is a view like Fig. 3 but showing the parts in an alternate position, representing the non-working or "traveling" condition of the machine;

Fig. 5 is a fragmentary elevational detail taken as indicated at 5—5 of Fig. 2;

Fig. 6 is a cross-sectional view of my tie guide taken along the line 6—6 of Fig. 2 in the direction of the arrows;

Fig. 7 is a sectional elevation taken along the line 7—7 of Fig. 2 in the direction of the arrows;

Fig. 8 is an enlarged detail of a rail anchoring device employed in my machine, part of one of the jaws or claws having been broken away for purposes of illustration;

Fig. 9 is an enlarged detail of another one of my rail anchors, illustrating a special situation sometimes encountered in connection with the operation of the anchors;

Fig. 10 is a view showing a manual spanner or hold-down clamp that can be used to meet the special situation just mentioned;

Fig. 11 is a fragmentary sectional elevation taken along the line 11—11 of Fig. 1 in the direction of the arrows, part of the truck frame having been broken away for the sake of clarity; and

Figs. 12 and 13 are a plan view and a side elevational view, respectively, showing a modified form of tie guide, the tie being indicated by dot and dash lines.

Referring more particularly to the drawings, the railroad track is conventional, comprising a pair of rails **15** carried on cross ties **16**, the usual tie plates **17** being interposed between the underside of the rails and the upper side of the ties.

The components of my machine are mounted on a small truck **18** having flanged wheels **19** adapted to roll along the track rails; the truck has a rectangular box frame **20** preferably made of welded channels with a pair of intermediate cross members **21** and diagonal braces **22** as shown. Suitable flooring **23** is provided on the end sections of the truck, leaving open the central section between the two cross members **21** of the frame, in order to accommodate certain parts of the mechanism hereinafter described, as well as to permit observation of the tie replacing operation carried out by the machine.

(It should be understood that in practice my truck is provided at each end with a standard form of draw bar to facilitate towing it or connecting it in a train of small work cars; similarly, for movement by hand, and for easy man-handling in general, any suitable type of handle, handle bar or socket for receiving crow bars may be provided on the frame. One or more wheel brakes also are employed for holding the truck against movement on grades. However, all of these adjuncts are entirely conventional in railroad work equipment of the push-car type, and inasmuch as they form no essential part of the present invention, they have been omitted from the drawings for the sake of simplicity and clarity.)

Spaced inwardly from one side of my truck is a longitudinal axle or shaft **25** supported in bearings **26**, the latter conveniently being sleeves which extend through the frame members and are secured thereto as by welding. Shaft **25** carries a rocker arm or boom assembly **27** comprising a pair of identical laterally spaced L-shaped arms **28** welded to the medial portion of the shaft and secured rigidly together by a tubular cross brace **29**, as well as a welded-on cross shaft **30**.

A shorter cross pin **32** also is rigidly connected to this assembly by means of a triangular truss framework which is composed of members **33** welded to one of the rocker arms and members **34** welded to the shaft **25** and cross brace **29**. A double-acting hydraulic cylinder **36** hinged to the truck frame at **37** has its piston rod **38** connected to the cross pin **32** to act on the rocker arm assembly or boom for the purpose of swinging same about the axis of shaft **25** and thus raising or lowering the free end thereof as desired (compare Figs. 3 and 4).

The free end of the boom has pivoted thereto at **39** a tie guide **40**. As shown in Figs. 1 to 4 and 6, this guide comprises four angle members **42** and three channels **43** welded along their longitudinal edges to form an open-ended passageway for a tie such as **44**. The mouth of the passageway is flared as illustrated in Figs. 1 to 4 in order to facilitate the introduction of the tie into the guide; and, to the same end, the lower passageway-forming

members project outwardly to form a lip or rest for the tie at the mouth of the guide. The passageway-forming members are embraced by and secured to a collar **45** whose shape is best illustrated in Fig. 6. As will also be clear from the latter figure, the cross section of the passageway is such as to provide longitudinal pockets **46** along the bottom and two sides of the tie, the passageway being open on the top; the purpose of this construction will be made clear presently.

A double-acting hydraulic cylinder **48** anchored to the cross pin **32** has its piston rod **49** connected to an upright arm **50** of a bell crank whose hub is mounted to turn about the cross shaft **30**. The bell crank has a pair of laterally spaced generally horizontal arms **51** connected by links **52** to the side members **53** on the tie guide so that the latter can be rocked about its pivot **39** under control of cylinder **48**.

For the purpose of actuating the two hydraulic cylinders, I provide a conventional hydraulic system including, as shown schematically in Fig. 1, a prime mover **55** (which conveniently is a small gasoline engine), a pump **56** driven by the prime mover through the medium of a belt **57**, a receiver or reservoir **58** for the hydraulic fluid, and a pair of four-way valves **60** and **61** which control cylinders **36** and **48** respectively. The conduits through which the fluid flows to and from the valves in the basic pumping system are shown at **62** and **63**, but the hose connections between the valves and the cylinders have been omittted in the interest of simplicity, it being understood that these are such that the piston rod **38** can be moved either into or out of cylinder **36** at will under control of valve **60**, and piston rod **49** likewise can be moved either into or out of cylinder **48** under the control of valve **61**.

Also driven by the prime mover through the medium of a friction clutch, shown schematically at **64**, a first speed reducer **65**, multiple belts **66** and a second speed reducer **67** is a shaft **68**. The shaft is journaled in a winch **70** and has a jaw clutch **71** splined thereon for axial movement along the shaft into and out of engagement with the winch. Shifting of the clutch **71** into engagement in order to couple the winch to the shaft, or out of engagement for the purpose of uncoupling the two, is effected by a double-acting cylinder **72** whose piston rod **73** has at its end a forked yoke **73'** received in an annular groove in the clutch; this cylinder is controlled by a four-way valve **74** in conventional fashion, the fluid connections between the valve and cylinder having been omitted, however, for simplicity. (While I prefer to control the jaw clutch hydraulically in this manner, such is not absolutely essential, it being obvious that the shifter fork or yoke can be connected to and actuated by a manual lever, if desired.)

Shaft **68** turns counterclockwise as seen in Fig. 2. Associated with the winch is a brake **75** biased by springs **76** and **76'** so that it normally exerts only enough resistance to counterclockwise rotation of the winch to prevent the latter from turning with the shaft **68** when the clutch is disengaged. However, when the winch is turned clockwise, as occurs when a pull is exerted on cable **78** in order to unreel it, this brake has a self-energizing snubber action which resists such rotation to a greater extent. The snubbing action ordinarily is not sufficiently strong to completely lock the winch against unreeling of the cable, but is effective to prevent clockwise "coasting" which would pay out too much of the cable and thus cause snarling; however, this braking effect can be increased, when desired, by applying an external downward force on the spring assembly, and for this purpose I provide an actuating lever **77** connected to a shaft **77'**, the latter being adapted to turn the lever under control of conventional brake-operating means, not shown.

The free end of the cable is secured to a tie cap **79** which comprises a flat plate adapted to abut the end of the tie, with four integral fingers **80** that extend forwardly along the sides, top and bottom of the tie, the uppermost finger being considerably longer than the others. A central post **81** is welded to the rear face of the plate and is connected at its outer end to the upper and lower edges of the plate by welded-on diagonal braces **82** and **83**.

Although fairly obvious, it should perhaps be stated at this point that when my wheeled truck is propelled—manually or otherwise—down the track to the place at which a tie is to be replaced, the boom **27** is held in raised position (see Fig. 4) by a hydraulic cylinder **36**, and in this position the tie guide **40** will clear switch stands, hand rails, cattle guards, etc. along the track. (During such travel, the cable is doubled back upon itself so that the tie cap **79** can rest on the truck deck or flooring **23** for convenience of carrying; alternatively, with no tie in the tie guide, one of the projecting fingers **80** can be loosely hooked over the flared end of the guide to support the cap.) The truck is halted with the boom **27** aligned directly above the tie to be replaced. Then by means of valve **60** cylinder **36** is caused to lower the boom to the position shown in Fig. 3, and, if necessary, cylinder **48** is actuated by valve **61** to level the tie guide **40**, it being understood that these two preliminary adjustments serve to bring the passageway in the guide into horizontal alignment with the defective tie.

A new tie now is introduced into the tie guide by hand, its end first being allowed to rest on the outwardly projecting lower lip at the mouth of the guide and the tie then being advanced horizonatlly through the guide until its end abuts the end of the tie to be replaced. Next, the operator or one of the section hands places the tie cap **79** on the outer end of the new tie, using the diagonal member **82** as a handle to manipulate the cap; this operation, of course, requires him to pull on the free end of the cable to draw it from the winch, but as previously indicated, brake **75** serves to prevent overrunning or coasting of the winch which would cause snarling. In positioning the cap **79** on the end of the tie, the elongated uppermost finger **80** is allowed to rest on the top of the tie and serves to support the cap against accidental displacement until the cable **78** can be drawn taut.

By means of valve **74**, cylinder **72** now is operated to engage the clutch **71** and thus cause winch **70** to turn with the shaft **68**, whereupon the winch begins winding up the cable and drawing the tie cap toward the truck. This, of course, advances the new tie through the tie guide pushing the old tie ahead of it out from under the rails as the new tie moves into place. (It will be understood that the spikes are removed from the old tie in advance of this operation, and, if desired, the tie plates **17** also can be removed although the latter ordinarily is not essential.) By virtue of the central opening between the floored deck sections **23** of my truck, the egress of the old tie and the ingress of the new one are in full view of the operator at all times.

As cable **78** pulls on the tie cap **79** in the course of moving the new tie into place, the elongated uppermost finger **80** on the cap serves to resist any tendency on the part of the cap to turn about the point at which it is attached to the cable and thus come free of the new tie. If the old tie resists displacement, due to being "set" or frozen in place, the post or boss **81** may be struck a heavy blow with a maul to loosen it, considerable tension meanwhile being maintained on cable **78**. Toward the end of the replacement operation, the cap moves completely through the tie guide, this being made possible by the fact that the guide is open on the top to permit the cable and upper finger **80** to move therethrough while the remaining fingers **80** travel without interference through the channels or passageways **46** at the sides and bottom of the guide. When the new tie reaches the desired position under the rails, its advance is halted by operating cylinder **72** under control of valve **74** to disengage the jaw clutch **71**, or alternatively by disengaging the friction clutch **64**, after which the tie cap can be manually removed from the end of the tie in readiness to per-

form a similar replacement operation at another point along the track.

(If the site of the next replacement operation is near at hand, boom **27** will of course simply be raised to its Fig. 4 position, then moved to the new site and again lowered for use as explained hereinbefore. However, at any time when the truck must be moved for a relatively long distance down the track, or if my machine is to be left standing without use for a considerable period of time, I prefer to raise the boom as high as possible by means of hydraulic cylinder **36** and then manually push the free end upwardly further to cause pivot **32** to pass over center; having done this, cylinder **36** can be operated under control of valve **60** to force piston rod **38** outwardly and raise the boom to an approximately vertical position over the truck. This brings the center of gravity of the boom-and-tie guide assembly to a position between the truck wheels, so helps stabilize the truck on the railroad rails, and at the same time it eliminates the problem of roadside clearance, permitting the truck to be moved without danger at relatively high speeds along the track.)

Now, it will be evident that during the period when a new tie is being pulled into place by the winch and is pushing out the old tie, my truck is subjected to a very considerable force tending to move it laterally from the rails toward the tie cap, which force also manifests itself as a torque tending to overturn the truck by lifting the right-hand wheels (Fig. 2) from the track. In addition, various forces are induced by the re-action of cylinders **48** and **36** as they properly position the tie to grade. An important feature of my invention, therefore, resides in the provisions I have made for resisting these forces, particularly the lateral thrust and torque, and maintaining the truck anchored securely to the rails during the tie replacement operation.

To this end, it will be seen, referring to Figs. 1, 3 and 4 that I provide at each end of my truck a pair of claws or jaws **85** and **86** adapted to grip the respective rails and lock the truck thereto. Each jaw **85** is pivoted at **87** on a swingable arm **88** whose end is pivotally connected at **89** to a crank *25a*, the latter being welded or otherwise secured to shaft **25**. The end of arm **88** nearest the jaw is suspended by a link **90** which is hinged to the arm at **91** and to the truck frame at **92**, the link being adjustable in length to permit the jaws to be raised or lowered slightly to accommodate varying rail dimensions.

The jaws **86** are pivoted at **93** to a second arm **94** whose end is hingedly connected to arm **88** at **95**. A second adjustable link **96** pivoted to the truck frame at **97** and to arm **94** at **98** supports the free end of the latter.

When my truck is in traveling condition, that is to say when boom **27** is raised as shown in Fig. 4, it will be clear that all of the jaws are swung away from the rails and will clear frogs, switches and crossings so as not to impede movement of the truck along the railroad track. There always is a tendency for jaws **85** to swing clockwise about their pivots **87**, and similarly for the jaws **86** to swing clockwise about their pivots **93**, due to the manner in which the respective pivots are offset with respect to the center of gravity of the jaws; but stop lugs **99** are provided on the arms **88** and **94** in the path of the jaws to limit such movement and hold the jaws in the position illustrated.

When boom **27** is lowered to its Fig. 3 position as described hereinbefore, crank *25a* turns counterclockwise with shaft **25**, swinging arms **88** and **94** downwardly in a path which causes the free ends of jaws **85** and **86** to move under the rail flanges and then lift slightly so that the truck wheels are drawn tightly down against the rails. As can best be seen in Fig. 8, arm **88** has a shoulder *88a* which now abuts the outer edge of the flange of the rail farthest from the tie guide **40**; arm **94** has a similar flange *94a* which abuts the inner edge of the flange of the rail nearest the guide. These shoulders serve to resist the lateral thrust imposed on the truck by the action of the

winch in drawing a new tie into place, it being understood that the jaws or claws **85** and **86** prevent lifting of the truck wheels and supplement the holding action of the shoulders.

In addition to the rail gripping jaws **85** and **86** which are positioned approximately at the four corners of my truck, I also provide, midway between the ends of the truck and on either side thereof, two further claws **101** and **102**. As may best be appreciated from Figures 2 and 7, the first of these takes the form of a freely swingable bail whose two legs straddle cable **78** with their upper ends pivotally received in apertured lugs **103** on the truck frame, there being a pair of claw elements *101a* at the lower extremity of each leg. On the cross member forming the bight of the bail, there is a freely rotatable sleeve **104** against which cable **78** rides after the tie cap **79** passes through the tie guide **40** in the course of advancing a new tie into place; this prevents the cable from rubbing on any stationary part or on the rail and thus eliminates unnecessary wear while at the same time reducing the frictional resistance which the winch must overcome in placing the tie. One leg of the bail is connected by a chain **105** to the boom **27** so as to lift claw **101** clear of the rail when the boom is raised to traveling position as shown in Fig. 4.

The remaining claw **102** is integral with a spindle *102a* whose ends are received in apertured lugs **107** on the opposite side of the truck frame, so the claw is freely swingable. Rotatably mounted on the spindle is the hub of a depending lever arm **108** whose free end carries a horizontal stub or roller **109** positioned behind the claw as shown in Figs. 2 and 5. Also connected to the free end of the lever arm is a thrust link **110** whose other end is hinged at **111** to one of the rocker arms **28**. Thus, when the boom **24** is raised from its Fig. 2 position, thrust link **110** moves roller **109** into contact with the underside of claw **102** and swings the latter clear of the rail as shown in Fig. 4.

It will be clear from the foregoing that all of the claws or jaws are engaged and disengaged from the rails automatically under control of the boom and, when engaged, they grip the rails at six different locations, i. e., at the four corners of the truck and midway of the truck on each side. Now, it sometimes may happen that at one of these locations there is a rail splice plate **112** (see Figs. 4, 5 and 9) which prevents the claw or jaw from moving under the rail flange. In such event, no strain is imposed on any of the parts of my machine, and no damage can occur to the power-operated mechanism which is lowering the boom and moving the various jaws toward rail-gripping position, because each jaw is freely swingable in a rearward direction if its path is blocked by a splice plate (see Fig. 9). Moreover, inasmuch as each jaw or claw is swingable in this fashion indepedently of the others, the failure of any one jaw to move into rail gripping position does not in any way prevent the remaining jaws from functioning in intended fashion to anchor my truck to the rails.

In most instances, such failure of any one jaw or claw to grip the rail due to the presence of a rail splice in its path does not sufficiently impair the over-all anchoring action, as accomplished by the remaining jaws, to require any corrective measures. However, in the event it is necessary or desirable to compensate for any of the jaws being thus rendered ineffective, I provide my machine with several manually positionable spanner clamps of the type shown in Fig. 10. As will be evident, each of these comprises a bar **114** having at its upper end a bracket **115** insertable over the frame of my truck, apertures **116** being provided in the floor **23** of the truck to facilitate this; and at the lower end of the bar, there is a lug **117** adapted to engage the underside of the rail flange to prevent upward displacement of the truck frame when the spanner clamp is in place. One or more of these manual units may be used in various places along either side of the truck to supplement the action of the automatically operated jaw

clamps if exceptional circumstances make this necessary.

Returning now to the operations involved in lowering the boom 27 and bringing the open-ended passageway in tie guide 40 into generally horizontal alignment with the defective tie to be replaced, it will be clear to those versed in the art that because different railroad rails, such as 15, vary in their vertical dimension and different tie plates such as 17 vary in their thickness, the height at which my truck rides above the ties themselves will not always be the same in every replacement operation. The fact that the free end of the boom may be raised or lowered at will under control of cylinder 36 and the tie guide may be turned slightly in either direction about its pivot 39 under control of cylinder 48 makes it possible to compensate for the aforementioned variations and insure that the guide is in every instance properly aligned with the defective tie regardless of the height at which the truck is riding above the road bed.

In working on a given section of track, however, the height of the rails and the thickness of the tie plates ordinarily will be uniform so that, in each tie replacement operation performed in that section, boom 27 usually will be lowered to the same position and guide 40 will be adjusted to the same angle with reference to the boom. I therefore find it desirable to provide indexing means with the assistance of which the operator can quickly and easily make the preliminary adjustment or adjustments necessary for establishing the guide in a predetermined position, known to be the proper one for all, or most, tie replacement operations carried on in the given section of track.

To this end, as best shown in Figs. 1, 2 and 11, I provide a first index finger 114 carried by a centrally apertured circular plate that is concentric with shaft 25; encircling one of the sleeve bearings 26, this plate is secured to one of the frame members 21 by means of screws 115 which extend through arcuate slots in the plate. In order to adjust this indexing device, the boom 27 first is lowered to its Fig. 3 position, the height of the free end of the boom being carefully adjusted to insure correct alignment of the tie guide with an existing tie as explained hereinbefore. Then, with screws 115 loosened slightly, finger 114 is turned until one edge thereof is aligned accurately with an edge of the truss member 33 extending radially from shaft 25, after which the screws 115 are tightened to lock the finger in place. Thereafter, in lowering the boom preparatory to each tie replacing operation, the operator need only bring the edge of the truss member 33 again into parallel alignment with finger 114 in order to be sure that the free end of the boom is in proper position.

A second indexing finger 116 is employed similarly in connection with arm 50 of the bell crank through which the tie guide 40 is turned about its pivot 39 under control of cylinder 48. As shown in Fig. 11, this finger normally is fixedly clamped to the rocked arm 28 by a cap screw 117, but by temporarily loosening the screw, it can be turned in either direction about the axis of the bell crank as and when such readjustment of its position is needed.

Let it be assumed, for example, that finger 116 is adjusted so that with the edge of the bell crank arm 50 aligned with it, as illustrated, the tie guide will be absolutely horizontal when the boom is lowered to the position which brings truss member 33 into alignment with the first indexing finger 114. It will be understood that in raising and lowering the boom in the course of moving my truck from the situs of one tie replacing operation to another, there usually is no need for operating cylinder 48 and consequently arm 50 remains in line with finger 116 without readjustment for each operation. However, it sometimes facilitates the introduction of a new tie if the tie guide 40 is canted slightly up or down from horizontal in the particular tie replacing operation, in which case cylinder 48 will, of course, be operated under control of valve 61 to produce the desired inclination of the tie guide; in such instances, index finger 116 makes it very easy for the operator to quickly restore the tie guide to its normal or uncanted position.

In connection with the foregoing it should perhaps be mentioned that, by proper actuation of cylinder 48 while the tie is entering, the forward end of the new tie can be depressed slightly as it passes through the central portion of the roadway. This causes the lower leading edge of the tie to excavate a slightly concave depression which is under the central portion of the tie when the latter reaches its final position. As a result, the end portions of the tie immediately under the rails rest on heavily compacted, undisturbed road bed material while the medial section is relieved, eliminating tie breakage which otherwise tends to occur at the center of the ties under heavy traffic loads. At the same time the precision placement of the ties to grade virtually obviates all tamping, filling, jacking, and aligning problems.

To further illustrate the versatility of my machine, let us consider the special problem that exists in connection with replacing ties on a narrow bridge or overpass where the available working space is little or no wider than the length of the ties themselves, there being no shoulder or other support on which the section hands can stand on the side of the trackway. Customarily, this requires the erection of special scaffolding or rigging, or the use of other special equipment, the old tie first being removed and the new tie then being started from a mid-air position over the side of the bridge and advanced between the rails and the bridge floor or beams.

With my machine, however, a new tie can be placed in the tie guide in the normal safe manner while the machine stands on the approach to the bridge or on the grade leading to the overpass. After the tie cap also has been positioned on the end of the tie as described hereinbefore, cylinder 36 is actuated to lift the free end of the boom slightly, and at the same time cylinder 48 is actuated to turn the tie guide 40 counterclockwise about its pivot 39 a sufficient amount to maintain the tie substantially horizontal. With the guide thus elevated, but only enough to clear obstacles, the truck is rolled onto the bridge or overpass and brought to the position where the new tie is to be installed. Then the tie guide is lowered under control of cylinder 36, again being kept level by simultaneous operation of cylinder 48; this, of course, causes the truck to be anchored to the rails at the same time, and the tie now can be advanced under the rails under control of the winch in the usual fashion, with no one working in an unsafe position and without the use of any special equipment.

In the foregoing operation, during the period that the truck is being rolled into position on the bridge or overpass it is desirable that the tie guide carrying the new tie be kept as low as possible and still provide proper clearance. In this connection, it should be noted that, since all of the rail-gripping claws or jaws are freely swingable, they can be turned manually about their pivots to lift them from their normal depending position and thus increase ground clearance. In the case of jaws 85, for example, it is only necessary to flip the jaws upwardly and they will come to rest in a position approximately 180° counterclockwise from that shown in Figs. 3 and 4. In practice the swingable character of the rail gripping elements is found useful to prevent them from catching on the guard or safety rails usually provided on bridges, when other considerations make it difficult or undesirable to raise the boom and the boom-controlled arms 33, 94, and 102 high enough to provide the necessary clearance.

Figs. 12 and 13 illustrate a modified form of tie guide which can be used in lieu of the guide 40 described hereinbefore. This employs a boom comprising a pair of laterally spaced rocker arms 128 welded or otherwise affixed to the horizontal shaft 25 and adapted to be swung up and down about the shaft as an axis under control of a hydraulic cylinder, not shown, in a same fashion as has been described in connection with the use of cylinder 36. At the outer end of the boom there is a spindle 139 car-

rying a pair of rollers **140** having beveled centering flanges **140***a*.

Approximately midway of the boom, a bell crank is mounted to turn on the cross spindle **130**, this having an upstanding bifurcated arm **150** whose end is connected to the piston rod **49** of a hydraulic cylinder like **48** (see Figs. 1 to 4) which controls the movement of the bell crank. Extending diagonally downward from the hub of the bell crank are a pair of arms **151** each carrying a flanged roller **152**.

The new tie **144** is inserted into this guide by allowing it to rest on the lower rollers **140** and then advancing it manually under the rollers **152** until it abuts the end of the tie to be replaced. Thereafter, the tie cap is placed on the outer end of the new tie, and the winch is employed as described hereinbefore to complete the placement of the new tie and the ejection of the old one. Throughout the advance of the new tie under control of the winch, an upward thrust always is exerted on its leading end by the ballast of the road bed, this serving to maintain the tie in contact with the rollers **140** and **152** as it passes through the guide. The spacing of the rollers, of course, provides ample clearance for the fingers **80** of the tie cap as the latter passes through the guide.

As will be evident, rollers **152** can be adjusted upwardly or downwardly under control of the hydraulic cylinder whose piston rod **49** is connected to the bell crank, and this produces the same result as was accomplished in the case of guide **40** by tilting of the guide about its pivots **39**; that is to say, this arrangement affords a means for controlling the angular aspect of the tie with respect to the arms **128** as it passes through the guide so that the new tie can be horizontal, or canted slightly upward or downward from horizontal as it advances. Although not illustrated in Figs. 12 and 13, it also will be understood that an index finger like **116** can be provided on one of the arms **128** in order to facilitate rapidly positioning arm **150** of the bell crank to a predetermined position, as has been described.

Regardless of which type of tie guide is employed, it should perhaps be stated that in introducing a new tie into the guide preparatory to forcing it under the rails and pushing out the old tie, it often is desirable to interpose between the leading end of the new tie and the trailing end of the old tie a short spacer block whose cross section is smaller than that of the ties. This is particularly true when the new tie is of somewhat larger cross section than the old tie (as is often true, for example, due to wear, rotting or other deterioration of the latter) because in such case the leading end of the new tie must to a certain extent act as a plow, gouging out the bottom and sides of the path left through the roadbed by the departure of the old tie.

Insertion of a spacer block of reduced cross section between the old tie and the new one has two beneficial effects. First, it provides a space for receiving the ballast or road bed material gouged out by the plow action of the leading end of the new tie. Second, bearing in mind that the ballast or earth material under the old tie is heavily compacted, the provision of this space largely relieves the old tie of the upward heaving action that tends to raise its aft end after it advances clear of the first rail.

Also, in lieu of the mode of operation described, it will be self-evident to those versed in the art that the old tie can first be removed in a separate operation using, instead of a new tie, a push pole or bar smaller in diameter than the tie and having a suitable adapter received in the tie cap and guide; after such removal of the old tie, a new one can be installed to the required elevation by my machine, the leading lower edge of the tie being used as the cutting edge and eliminating the need for a special plow or similar device.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinbefore set forth, together with other advantages which are obvious and which are inherent to my apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the appended claims.

Inasmuch as many possible embodiments of the invention may be made without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a railroad tie handling machine of the character described, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis parallel to the track, said boom when lowered projecting laterally from the truck so that its free end is beside the track, a tie guide carried by the boom at the free end thereof for receiving a tie and holding same with its longitudinal axis disposed generally crosswise of the track, mechanism connected to the boom for raising and lowering the free end thereof, thereby to adjust the elevation of said guide, and adjustment means operative at any elevation of the guide for varying the inclination of the tie relative to horizontal.

2. In a railroad tie handling machine of the character described, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis normal to the ties in said track, a tie guide pivotally supported on the boom at the free end thereof to turn about an axis parallel to said first axis, said boom when lowered projecting laterally of the truck so the guide is beyond the ends of the ties in said track, said guide containing an open-ended tie passageway disposed crosswise of said axes, and adjustable linkage between said boom and guide for turning the latter about said second axis, thereby to adjust the inclination of said passageway relative to the boom.

3. A machine as in claim 2 wherein said adjustable linkage includes a fluid-operated cylinder having operative connection to said boom and said guide for turning the latter about said second axis.

4. In a railroad tie handling machine of the character described, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis normal to the ties in said track, power-operated mechanism connected to said truck and boom respectively for raising and lowering the latter, a tie guide pivotally supported on the boom at the free end thereof to turn about an axis parallel to said first axis, said boom when lowered projecting laterally of the truck so said guide is beyond the ends of the ties in said track, said guide containing an open-ended tie passageway disposed crosswise of said axes, and adjustable linkage between said boom and guide for turning the latter about said second axis, thereby to adjust the inclination of said passageway relative to the boom.

5. In a railroad tie handling machine of the character described, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis parallel to the track, said boom when lowered projecting laterally from the truck so that its free end is beside the track, a tie guide carried by the boom at the free end thereof for receiving a tie and holding same with its longitudinal axis disposed generally crosswise of the track, manually controlled mechanism connected to the boom for raising and lowering the free end thereof, thereby to adjust the elevation of said guide, an indexing device associated with the boom and adjustable to different positions corresponding to different elevations of said guide, thereby to facilitate adjustment of the guide to any predetermined elevation as determined by the

adjusted position of said indexing device, and other adjustment means operative at any elevation of the guide for varying the inclination of the tie relative to horizontal.

6. In a railroad tie handling machine of the character described, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis parallel to the track, said boom when lowered projecting laterally from the truck so that its free end is beside the track, a tie guide carried by the boom at the free end thereof for receiving a tie and holding same with its longitudinal axis disposed generally crosswise of the track, manually controlled mechanism connected to the boom for raising and lowering the free end thereof, thereby to adjust the elevation of said guide, an indexing device associated with the boom and adjustable to different positions corresponding to different elevations of said guide, thereby to facilitate adjustment of the guide to any predetermined elevation as determined by the adjusted position of said indexing device, manually controlled adjustment means operative at any elevation of the guide for varying the inclination of the tie relative to horizontal, and a second indexing device associated with said last means and adjustable to different positions corresponding to different inclinations of the tie, thereby to facilitate adjustment of the latter to any predetermined inclination as determined by the adjusted position of said second indexing device.

7. In a railroad tie handling machine of the character described, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis parallel to the track, said boom when lowered projecting laterally of the truck so its free end is beside the track, a tie guide carried by the boom at the free end thereof for receiving a tie and holding same with its longitudinal axis disposed generally crosswise of the track, a tie cap comprising a plate member adapted to abut the end of the tie farthest from the track with fingers extending forwardly from said plate along the sides of the tie, means for applying a longitudinally directed force on said cap to advance the tie and cap through said guide toward the track, and channels in said guide registering with said fingers to permit free passage of the fingers through the guide.

8. In a railroad tie handling machine, a truck adapted to travel on a railroad track, a boom pivoted on the truck to swing up and down about an axis parallel to the track, said boom when lowered projecting laterally of the truck so its free end is beside the track, a tie guide carried by the boom at the free end thereof and having an open-ended guide passageway for receiving a tie and holding same with its longitudinal axis disposed generally crosswise of the track, a tie cap comprising a plate member adapted to abut the end of the tie farthest from the track with fingers extending forwardly from said plate along the sides of the tie, a winch on said truck having a cable attached to said cap for drawing same toward the truck, thereby to advance the tie and cap through said guide, said guide passageway being open on the top to permit movement of the attached end of said cable through the guide, and channels in the guide registering with said fingers to permit free passage of the fingers through the guide.

9. In a tie handling machine of the character indicated, a tie guide adapted to be positioned beside a railroad track and containing an open-ended passageway aligned generally crosswise of the track for receiving a tie, a tie cap comprising a plate member adapted to abut the end of the tie farthest from the track with fingers extending forwardly from the plate along the sides of the tie, means for applying a longitudinally directed force on said cap to advance the tie and cap through the guide toward the track, and channels in the guide registering with said fingers to permit free passage of the fingers through the guide.

10. In a railroad tie handling machine of the character indicated, a tie guide adapted to be positioned beside a railroad track and containing an open-ended passageway aligned generally crosswise of the track for receiving a tie, a tie cap comprising a plate member adapted to abut the end of the tie farthest from the track with fingers extending forwardly of the plate along the sides of the tie, a winch positioned beyond the opposite end of the tie at a point offset laterally from the longitudinal axis of the tie, said winch having a cable whose end is connected to said cap for drawing the cap toward the track upon operation of the winch, thereby to advance the tie and cap through said guide, said guide passageway being open along one side to permit free movement of the attached end of said cable through the guide, and channels in the guide registering with said fingers to permit free passage of the fingers through the guide.

11. A machine as in claim 10, wherein said winch has a self-energizing brake for frictionally resisting rotation of the winch in a direction to unwind the cable.

12. In a railroad tie handling machine of the character indicated, a tie guide adapted to be positioned beside a railroad track and containing an open-ended passageway aligned generally crosswise of the track for receiving a tie, a tie cap comprising a plate member adapted to abut the end of the tie farthest from the track with fingers extending forwardly from the plate along the sides of the tie, a winch positioned beyond the opposite end of the tie at a point offset laterally from the longitudinal axis of the tie, said winch having a cable whose end is connected to said cap for drawing the cap toward the track upon operation of the winch, thereby to advance the tie and cap through said guide, said guide passageway being open on one side to permit free movement of the attached end of said cable and one of said fingers through the guide, channels in the guide registering with the others of said fingers to permit free passageway of the latter fingers through the guide, said one finger being longer than said other fingers to assist in maintaining the cap in place on the end of the tie.

13. In railroad tie handling apparatus of the character described, a tie guide having an open-ended tie passageway therethrough, said guide comprising longitudinal angle members defining the corners of said passageway and forming tracks to receive the corners of said tie, and longitudinal channel members interconnecting said angle members, the web of each channel member being spaced away from the side of the tie.

14. A machine as in claim 1 wherein said guide comprises a first set of laterally spaced rollers on which a tie is adapted to rest, and a second set of laterally spaced rollers adapted to engage the top of the tie, the rollers of both sets having flanges to engage the sides of the tie; the respective sets of rollers being offset so that they are out of vertical alignment, and one of said sets being mounted on said boom for movement up and down independently of the other set, thereby to vary the inclination of the tie relative to horizontal.

15. A machine as in claim 14 having a fluid-operated cylinder operatively connected to said boom and to said independently movable set of rollers for moving the latter up and down.

16. In a railroad tie handling machine of the character described, a truck mounted on the usual track rails, a boom pivoted on the truck to swing up and down about an axis parallel to the rails, said boom when lowered projecting laterally of the truck so its free end is beside the track, a tie guide at the free end of the boom for receiving a tie when the boom is lowered and holding the tie with its longitudinal axis disposed generally crosswise of the track, a winch on the truck spaced above said axis of the tie, said winch having a cable with means for attaching the free end of the cable to the end of the tie farthest from the track, thereby to advance the tie through said guide toward the track upon operation of

the winch, a freely swingable bail pivoted to the truck with its two legs straddling said cable at a point intermediate said winch and said attaching means, said bail depending from its pivot so its bight portion is below the cable, a roller on said bight portion for engagement with said cable, and means linking said bail to said boom whereby upward swinging movement of the boom is effective to swing said bail upwardly about its pivot.

17. A machine as in claim 16 wherein said bail has adjacent its bight portion at least one rail gripping claw adapted to underlie the rail flange when the boom is lowered.

18. In a railroad tie handling machine of the character described, a truck mounted on the usual track rails, said truck having a horizontal generally rectangular frame, a boom pivoted to the truck to swing up and down about an axis parallel to the rails, power-operated mechanism connected to the boom for raising and lowering same, rail gripping jaws mounted on the truck frame at the four corners thereof, each of said jaws being movable between an operative position and an inoperative position, linkage mechanically connecting all of said jaws to said boom for automatically shifting the jaws simultaneously into operative position upon lowering of the boom and restoring them simultaneously to inoperative position upon raising of the boom, said boom when lowered projecting laterally from the truck so its free end is beside the track, a tie guide at the free end of the boom for receiving a tie when the boom is lowered and holding said tie with its longitudinal axis disposed generally crosswise of the track, a rail-gripping claw on one side of the truck frame approximately midway between two of said jaws, said claw being movable between an operative position and an inoperative position, and linkage mechanically connecting said claw to said boom for automatically shifting the claw into operative position upon lowering of the boom and restoring the claw to inoperative position upon raising of the boom.

19. In a tie handling machine of the character described, a truck mounted on the usual track rails, a boom pivoted to the truck to swing up and down about an axis parallel to the rails, power-operated mechanism connected to the boom for raising and lowering same, a plurality of rail-gripping claws hingedly depending from the truck for swinging movement upwardly to an inoperative position and downwardly to an operative position, an actuator for each claw connected to said boom and operated thereby upon upward movement of the boom to apply a force on the claw urging same upwardly toward inoperative position, each actuator effective to withdraw said force under control of the boom upon downward movement of the latter, said claws being freely swingable independently of one another and each tending always to swing downwardly toward operative position under the influence of gravity upon withdrawal of said force by its actuator.

20. In a railroad tie handling machine of the character described, a truck mounted on the usual track rails, a boom pivoted to the truck to swing up and down about an axis parallel to the rails, said boom when lowered projecting laterally from the truck so its free end is beside the track, a tie guide at the free end of the boom for receiving a tie when the boom is lowered and holding the tie with its longitudinal axis disposed generally crosswise of the track, a crank connected to the boom to turn therewith, an arm hinged at one end to said crank, a suspension link swingably connecting the other end of said arm to said truck to support same in depending relation to the truck, and a rail-gripping jaw at said last end of the arm effective to travel into and out of operative position under control of said crank upon raising and lowering of the boom.

21. A machine as in claim 20 wherein said jaw is pivotally mounted on said arm and depends from its pivot in freely swingable relation to the arm.

22. A machine as in claim 20 wherein said arm has integral therewith a rigid shoulder positioned adjacent said swingable jaw to abut the side of the rail flange when said jaw is in rail-gripping position.

23. In a railroad tie handling machine of the type employing a truck mounted on the usual track rails, said truck having thereon power means connectable to a tie positioned at roadbed level and operable to forcibly advance the tie axially under the rails; the improvement which comprises a plurality of arms, each having at one end a shoulder adapted to engage the side of a rail flange to resist the lateral thrust imposed on the truck by operation of said power means, a suspension link swingably connecting said one end of each arm to the truck to support same in depending relation to the truck, means swingably supporting the other end of each arm on the truck for movement in a predetermined arcuate path whereby each of said shoulders is adapted to travel from said flange-engaging position to an inoperative position spaced from the flange, means on the truck connected to said arms for shifting said shoulders from one of said positions to the other at will and holding them in either position, and a freely swingable claw pivoted on each arm adjacent the shoulder of said arm, each claw depending from its pivot in a position to normally advance under the rail flange upon movement of the associated shoulder from said inoperative position to said flange-engaging position.

24. A machine as in claim 23 wherein each of said suspension links is adjustable in length.

25. In a tie handling machine of the type employing a truck mounted on the usual track rails, said truck having thereon power means connectable to a tie positioned at roadbed level and operable to forcibly advance the tie axially under the rails; the improvement which comprises a plurality of truck stabilizers carried by the truck, each having a shoulder adapted to engage the side of a rail flange to resist the lateral thrust imposed on the truck by operation of said power means, said stabilizers movably mounted on the truck to travel from said flange-engaging position to an inoperative position spaced from the flange, means on the truck connected to said stabilizers for shifting them from one of said positions to the other at will and holding them in either position, and a freely swingable claw pivoted on each stabilizer, each claw depending from its pivot in a position to normally advance under the rail flange upon movement of the associated stabilizer from said inoperative position to said flange-engaging position.

26. In a railroad tie handling machine of the type employing a generally rectangular truck mounted on the usual track rails, said truck having thereon power means connectable to a tie positioned at roadbed level and operable to forcibly advance the tie axially under the rails; the improvement which comprises a truck stabilizer carried by the truck at each of its four corners, each stabilizer having a shoulder adapted to engage the side of a rail flange to resist the lateral thrust imposed on the truck by operation of said power means, said stabilizers movably mounted on the truck to travel from said flange-engaging position to an inoperative position spaced from the flange, means on the truck connected to all of said stabilizers for shifting them in unison from one of said positions to the other at will and holding them in either position, and a freely swingable claw pivoted on each stabilizer, each claw depending from its pivot in a position to normally advance under the rail flange upon movement of the associated stabilizer from said inoperative position to said flange-engaging position.

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