United States Patent [19]

Holley et al.

[11] **3,780,664**

[45] **Dec. 25, 1973**

[54] **MACHINE FOR INSERTING TIES BENEATH A RAILROAD TRACK**

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[73] Assignee: **Mannix Construction, Inc.**, Minneapolis, Minn.

[22] Filed: **May 30, 1972**

[21] Appl. No.: **257,888**

[52] **U.S. Cl.** **104/9**, 104/6

[51] **Int. Cl.** **E01b 29/10**

[58] **Field of Search** 104/6, 9

[56] **References Cited**

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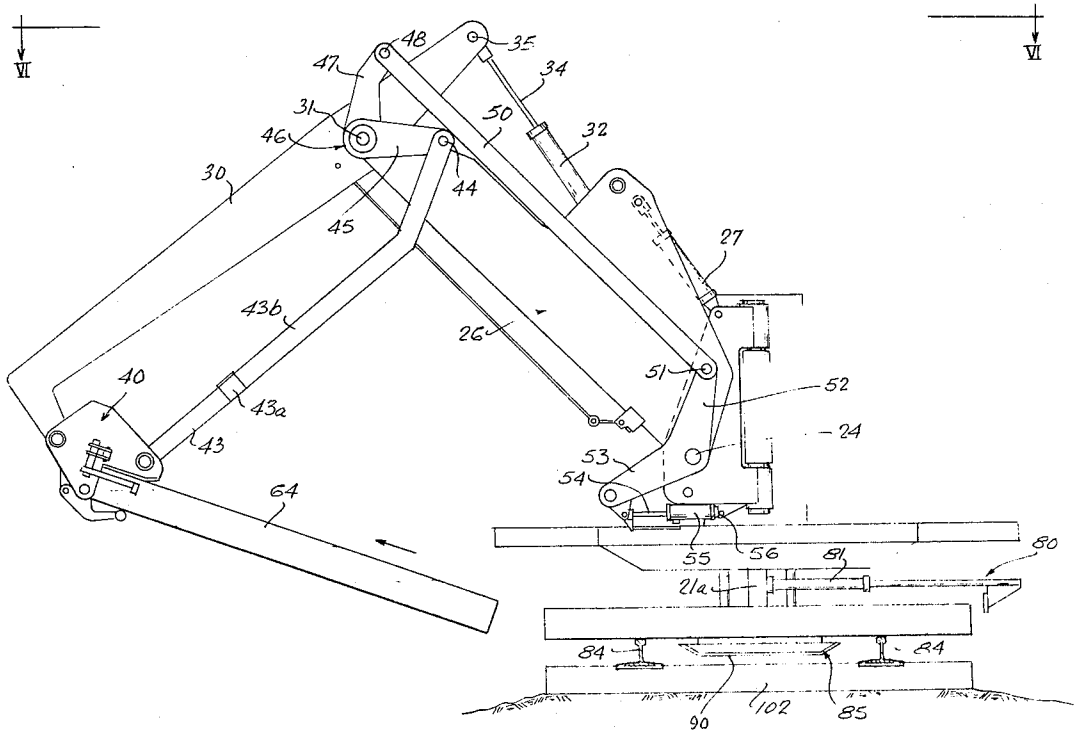
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Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Richard A. Bertsch
Attorney—Richard K. Stevens et al.

[57] **ABSTRACT**

Ties dumped on the rails are withdrawn individually outwardly of the track by a tie clamp mechanism mounted on a jib supported by a boom extending laterally from an on-track vehicle. A pantograph system controls the orientation of the tie clamp mechanism, which grasps each tie firmly. This arrangement enables each such grasped tie to be pushed under the track by an inward swing of the jib.

3 Claims, 14 Drawing Figures



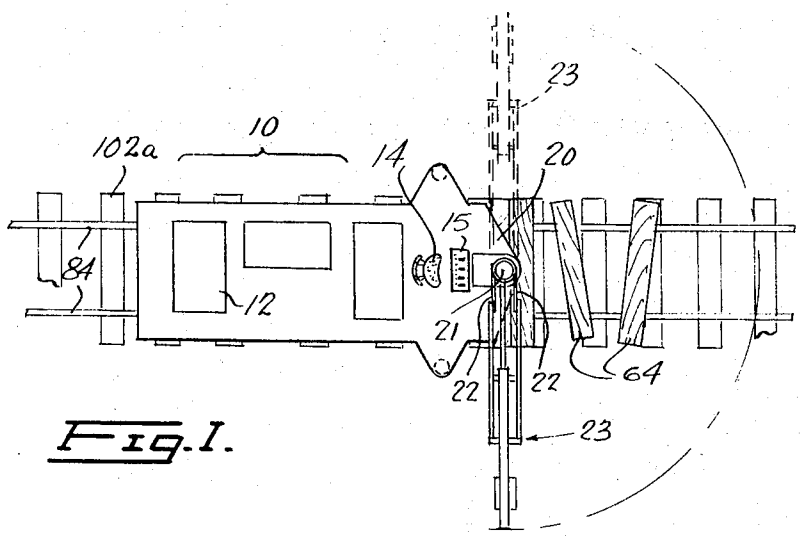


Fig. 1.

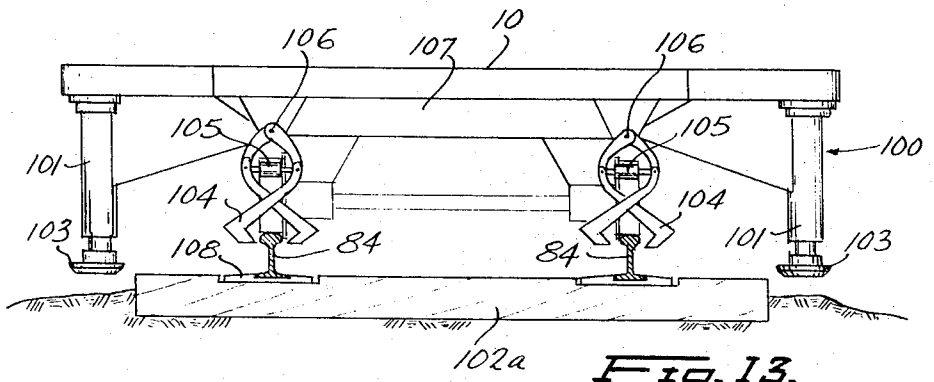


Fig. 13.

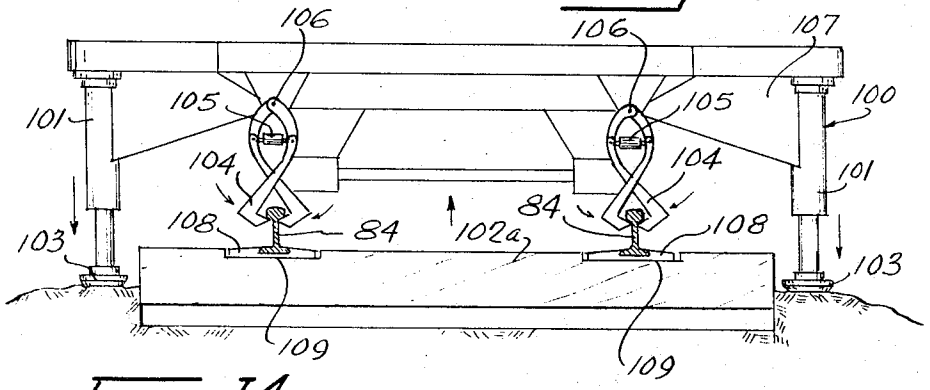


Fig. 14.

Fig. 2.

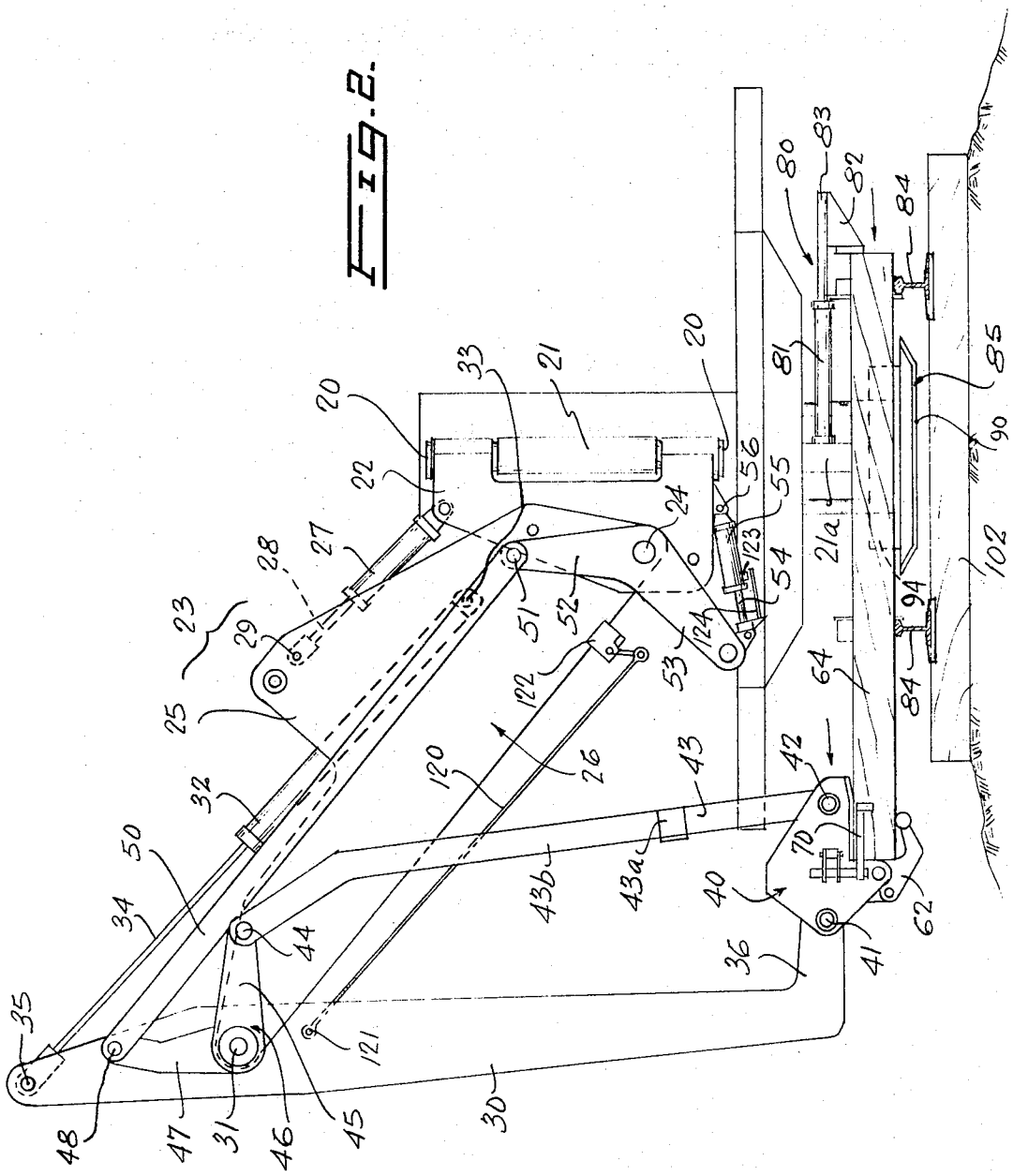

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Fig. 3.

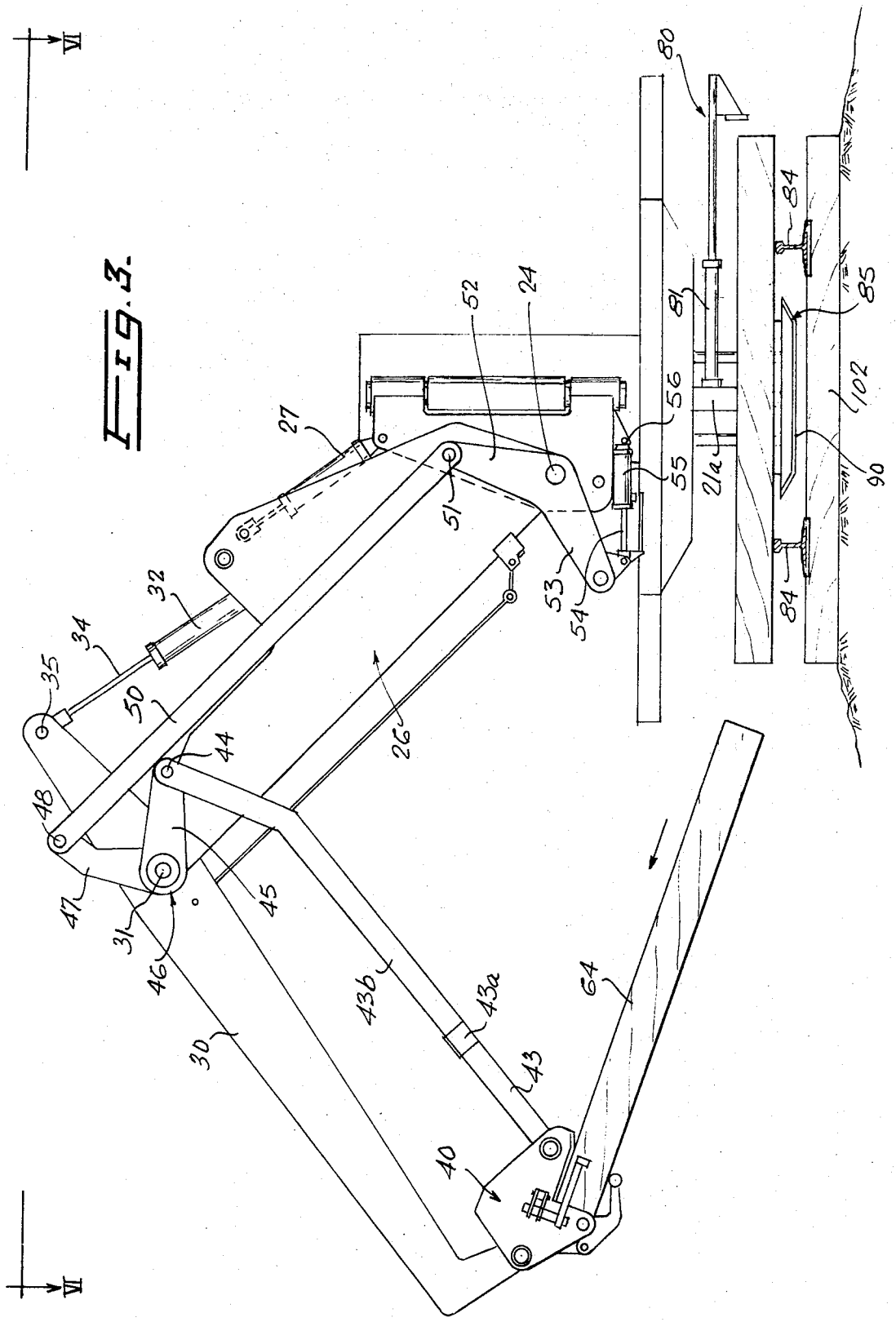

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Fig. 4.

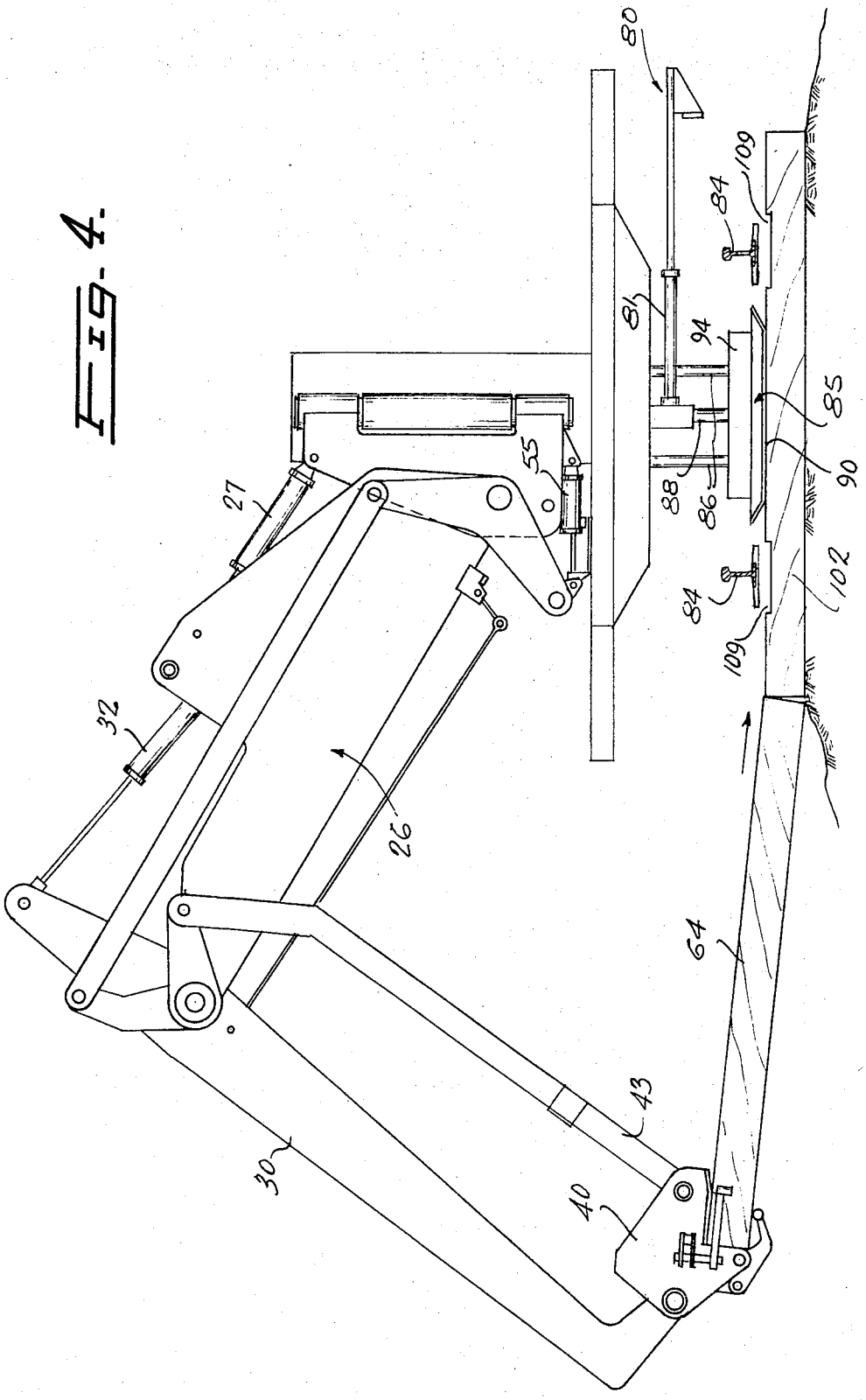
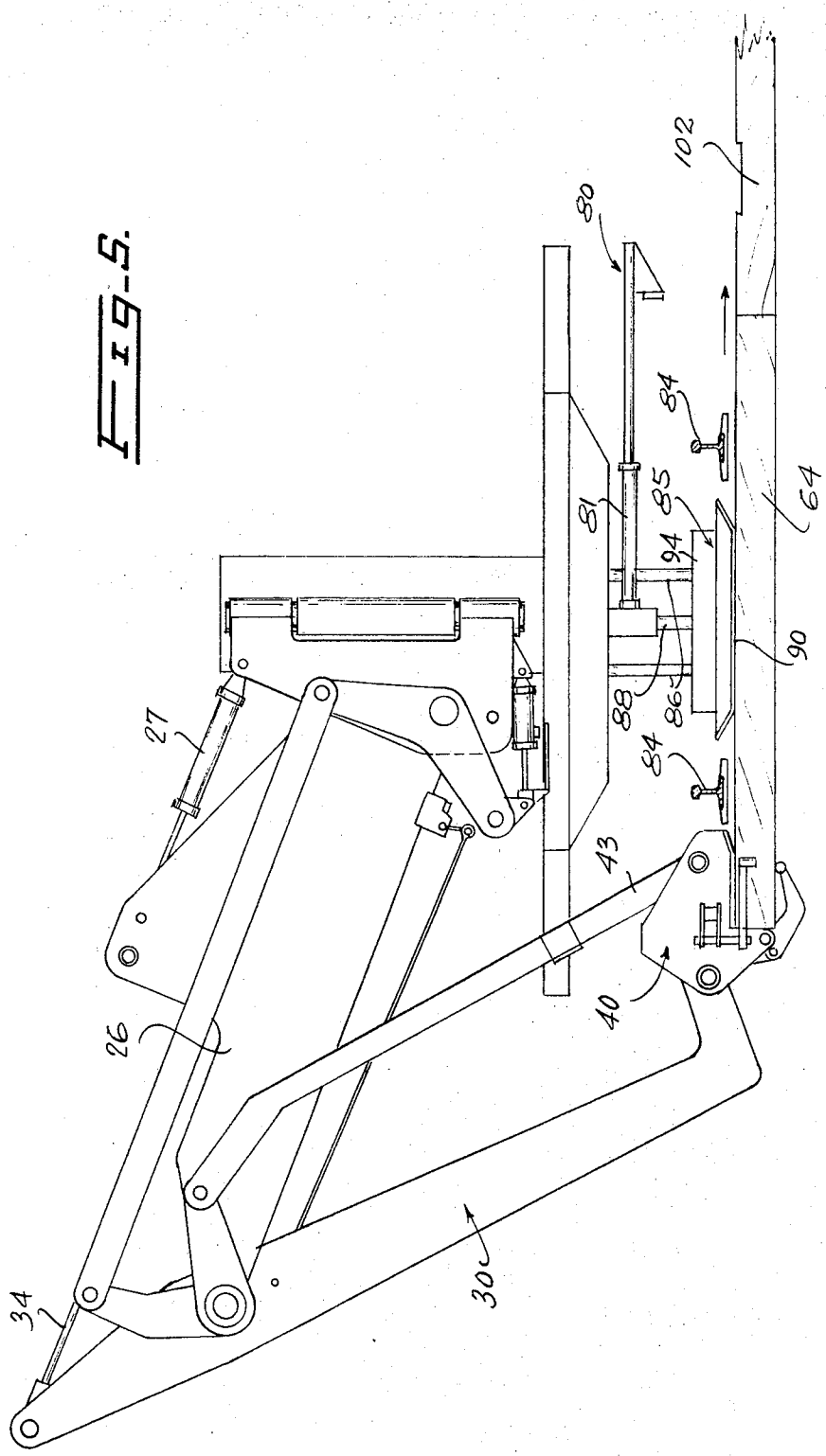


Fig-5.



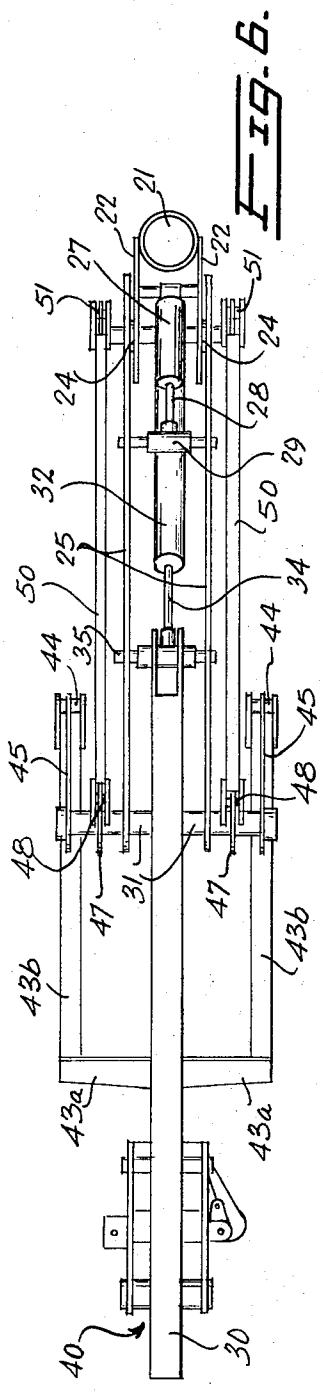


Fig. 6.

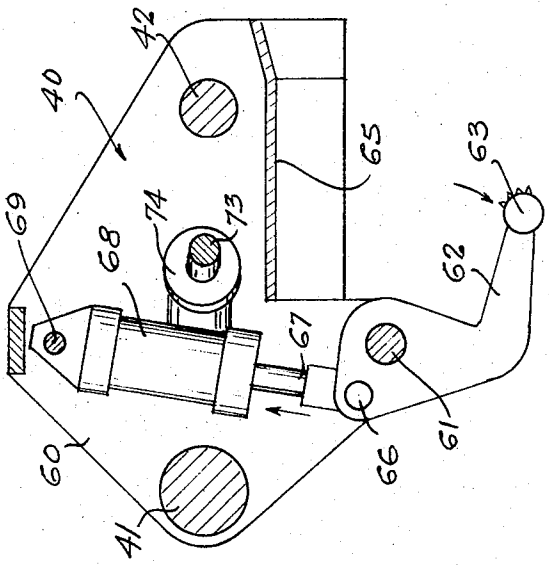


Fig. 8.

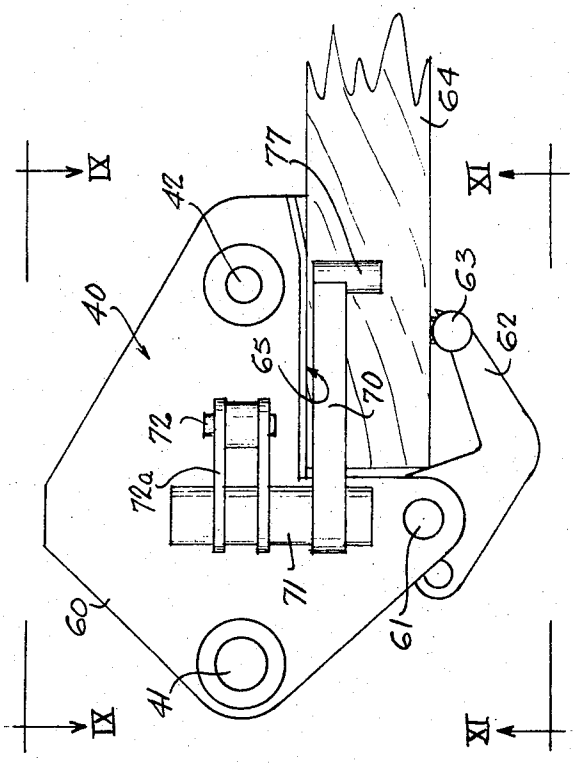


Fig. 7.

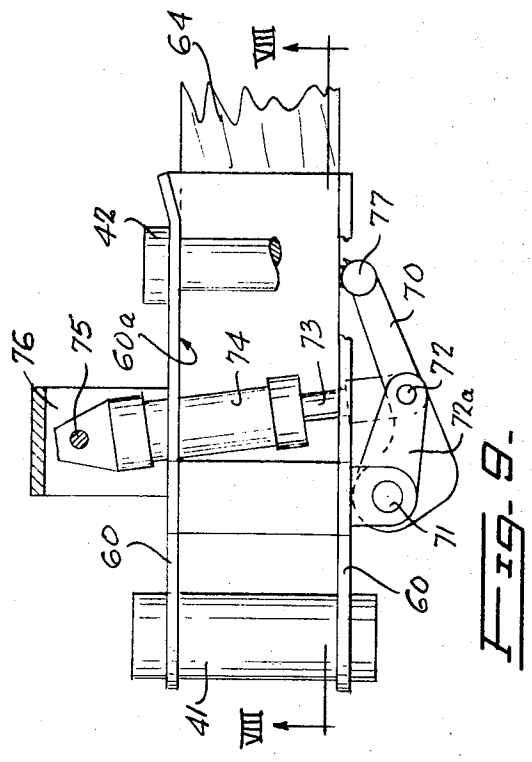


Fig. 9.

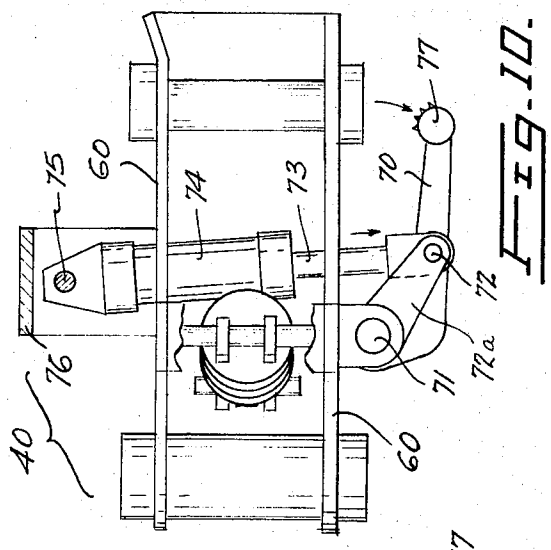


Fig. 10.

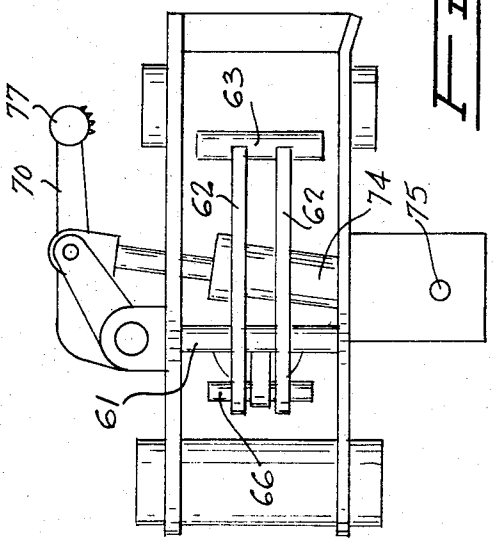


Fig. 11.

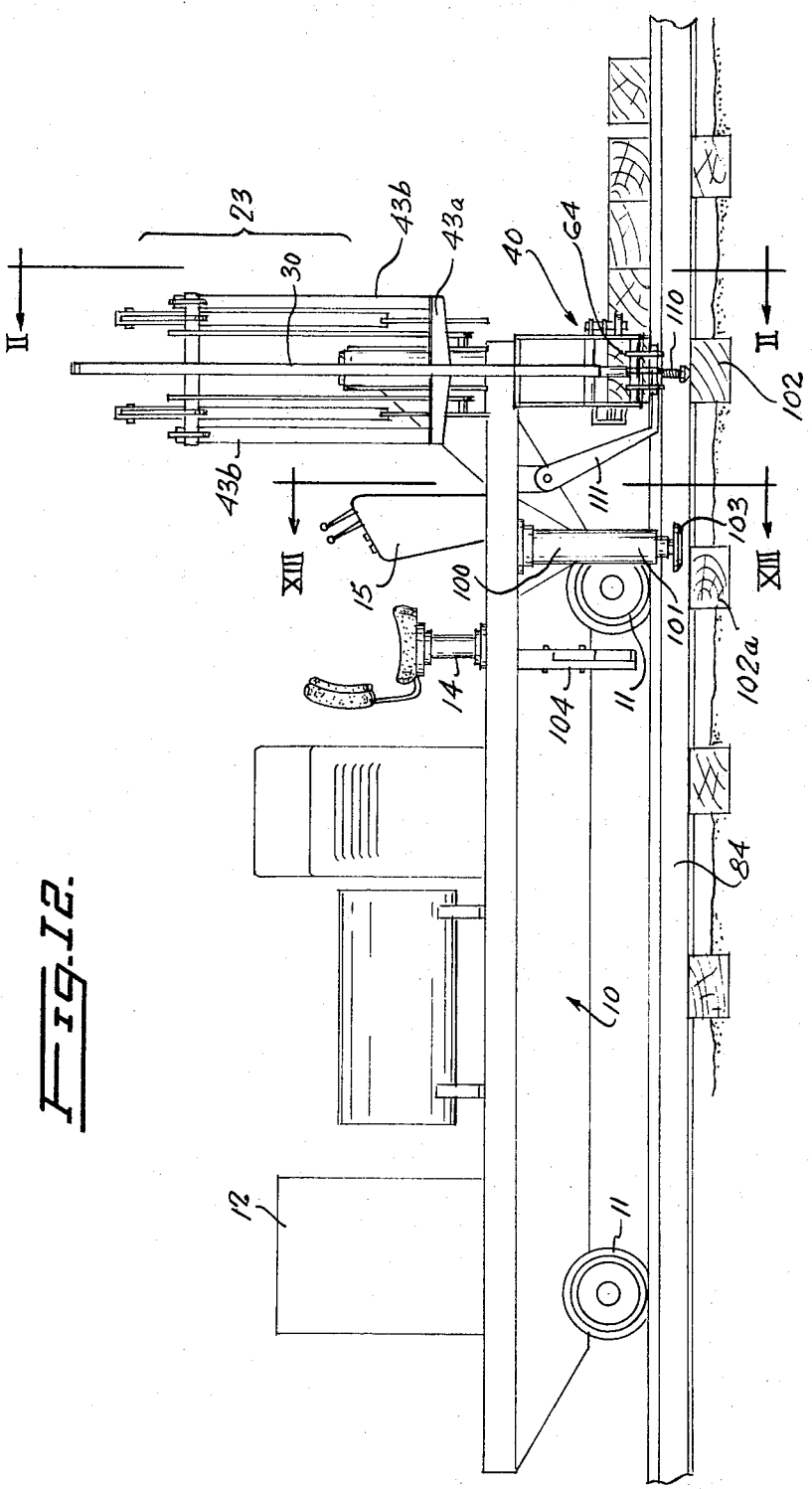

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43a
40
64
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110
II
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102
436
111
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XIII
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100
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102a
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104
11
84
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12
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Fig. 12.

MACHINE FOR INSERTING TIES BENEATH A RAILROAD TRACK

This invention relates to a machine for inserting ties beneath a railroad track.

An object of the invention is to provide a machine capable of inserting a new tie and thereby simultaneously forcing the old tie to be replaced out from beneath the track.

A further object is to provide a machine capable of carrying out such operation speedily and automatically, requiring comparatively little manual labour.

A further object is to provide a machine that can alternatively be used for extracting a tie from beneath the track.

Other objects and features of the invention will become apparent from the following specific example.

One machine constructed according to the invention is illustrated diagrammatically in the accompanying drawings, it being emphasized that this machine is shown by way of example only, and not as limiting the scope of the invention, which latter is defined in the appended claims.

In the drawings:

FIG. 1 is a small scale plan view of the machine;

FIG. 2 is a front view of the machine of FIG. 1 on a larger scale and showing the mechanism in a first position, this view being taken on the line II—II in FIG. 12, but with certain background parts omitted;

FIGS. 3 to 5 are views similar to FIG. 2, but each showing the mechanism in a further position in its sequence of operation;

FIG. 6 is a partial plan view taken on the line VI—VI in FIG. 3, but omitting the track and vehicle portions of the machine;

FIG. 7 is an enlarged fragmentary side view of a tie clamp mechanism;

FIG. 8 is a further view of the tie clamp mechanism shown in a different position and taken as a section on the line VIII—VIII In FIG. 9;

FIG. 9 is a plan view of the tie clamp mechanism as seen on the line IX—IX in FIG. 7;

FIG. 10 is a view similar to FIG. 9, but showing the parts in a different position;

FIG. 11 is an underside view of the tie clamp mechanism as seen on the line XI—XI in FIG. 7;

FIG. 12 is a side view of the machine, as seen from the left of FIG. 2;

FIG. 13 is a fragmentary section taken on the line XIII—XIII in FIG. 12; and

FIG. 14 is a view similar to FIG. 13, but showing the parts in a different position.

THE VEHICLE (FIGS. 1 and 12)

The machine illustrated comprises an on-track vehicle shown generally at **10**, having track wheels **11**. The vehicle includes a diesel engine **12** or other source of motive power both for driving traction motors (not shown) connected to a pair of the wheels **11** and for energizing the various hydraulic cylinders described below. The vehicle **10** also includes an operator's seat **14** and a control console **15**.

THE TIE INSERTING MECHANISM (FIGS. 1 to 6 and 12)

Brackets **20** projecting forwardly from the vehicle **10** support the top and bottom of a vertically pivotally mounted sleeve **21** to which a pair of parallel main plates **22** of a tie inserting mechanism **23** are welded.

By this method of mounting, the mechanism **23** can be manually rotated 180° from the full line to the broken line position of FIG. **1**, i.e. to operate from laterally beyond whichever side of the track is desired. Additionally, the mechanism **23** can be turned to extend directly forwardly along the track, a position used when the machine is not in operation but is required to be able to travel along the track without striking adjacent objects.

As best seen in FIGS. **2** and **6**, the plates **22** support a pair of pins **24** serving to mount a pair of plates **25** pivotally on the plates **22**. The plates **25** together form a boom **26**, pivotal movement of this boom **26** being controlled by a hydraulic cylinder **27**, the piston **28** of which is connected to the boom **26** at **29**.

On the free end of the boom **26** there is mounted a jib **30**, pivoted on a pin **31**. Swinging movement of the jib **30** about the pin **31** is controlled by a hydraulic cylinder **32** connected at **33** to the boom **26** and having its piston **34** connected to the jib **30** at **35**.

At its bottom end, the jib **30** supports a tie clamp mechanism **40**, details of which will be described below. Suffice to say at this point that the tie clamp mechanism **40** is pivotally mounted at one end by a pin **41** on the end of a foot portion **36** of the jib **30**. The tie clamp mechanism **40** is further supported by a pin **42** pivoting it to a vertical pantograph link **43**. For symmetry of forces, the link **43** is forked at **43*a*** to continue as a pair of spaced links **43*b*** which at their upper ends are each connected by a pin **44** to an arm **45** of a bell crank lever **46** that is freely pivotable about the pin **31**. The other arms **47** of the bell crank levers **46** are pivotally connected at their upper ends by pins **48** to the ends of respective horizontal pantograph links **50** which extend along the outer sides of the boom **26** to be connected at their other ends by pins **51** to a further pair of bell crank levers **52** pivoted about the pins **24**. The other arms **53** of the bell crank levers are joined together and to the piston **54** of a cylinder **55** pivotally mounted about pins **56** to the undersides of the plates **22**. This cylinder **55** thus acts as a pantograph actuating cylinder for controlling the orientation of the tie clamp mechanism **40**.

THE TIE CLAMP MECHANISM (FIGS. 7 to 11)

The tie clamp mechanism **40** consists of a pair of plates **60** supporting at their bottom edges a pin **61** on which a clamping jaw **62** is pivotally mounted. At its free end, the jaw **62** carries a transversely extending toothed head **63** adapted to bite into a tie **64** in the manner shown in FIG. **7**, in order to clamp such tie firmly between such head and a downwardly facing horizontal surface **65**. Movement of the jaw **62** between its two positions shown in FIGS. **7** and **8** is controlled by connection of the jaw by pin **66** to the piston **67** of a hydraulic cylinder **68**, the far end of which is pivotally mounted by pin **69** between the plates **60**.

In addition to this vertically movable jaw **62** the tie clamp mechanism has a horizontally movable clamping jaw **70** pivotally supported on the mechanism by a pin **71** and actuated by connection through pin **72** and link **72*a*** to the piston **73** of a hydraulic cylinder **74**, the other end of which is connected by a pin **75** to an extension structure **76** extending outwardly from the side of the mechanism **40**. The jaw **70** also carries a toothed gripping head **77** for biting into the side of the tie **64** as seen in FIG. **9** to clamp the same between the head and a vertical surface **60*a*** formed on the inside of one of the plates **60**.

THE TIE LOADING MECHANISM (FIGS. 2 to 5)

Also pivotally mounted on the main vertical support by an inner sleeve 21*a* that can be rotated within the sleeve 21, is a tie loading mechanism 80 which consists of a hydraulic cylinder 81 and a butt plate 82 mounted on the end of the piston 83 of this cylinder. Contraction of the cylinder 81 from the position shown in any one of FIGS. 3 to 5, to the position shown in FIG. 2, will cause the butt plate 82 to force the tie 64 resting on the rails 84 towards the left and into the tie clamp mechanism 40 for the purpose more fully described below.

THE TIE FOOT MECHANISM (FIGS. 2 to 5)

A tie foot mechanism 85 is mounted on vertically extending rods 86 (FIG. 4) vertically slidable in fixed sleeves (not shown) secured to the vehicle just rearwardly of the main support sleeve 21. A fixedly mounted hydraulic cylinder has its piston 88 connected to the mechanism 85 which serves two purposes. In its elevated position shown in FIG. 2, a vertically extending pusher plate 94 acts to push ties 64 along the top of the rails 84, in order to orient the first of these ties correctly with the tie loading mechanism 25. In its lowered position (FIG. 5) the mechanism 85 can bring a hold-down plate 90 to bear against the tie 64 that is in the process of being inserted beneath the rails 84.

THE RAIL JACKING SYSTEM (FIGS. 12 to 14)

An optional portion of the machine is a rail jacking system 100 mounted on the vehicle 10 slightly rearwardly of the tie inserting mechanism 23, as shown in FIG. 12. This jacking system 100 consists of a pair of hydraulic jacks 101 located outwardly of the ends of the track ties 102 and having feet 103 adapted to engage the roadbed when the cylinders 101 are extended (FIG. 14). The system 100 also includes a pair of rail clamps 104 for engaging the heads of the rails 84, the clamps 104 being operated by hydraulic cylinders 105. These clamps 104 are suspended by pins 106 from the undercarriage 107 of the vehicle 10, so that expansion of the cylinders 101 serves to raise the entire vehicle as well as the rails 84, as shown in FIG. 14. This figure also demonstrates that the tie 102*a* which is spiked to the rails 84 by means of tie plates 108 that engage grooves 109 in the tie is also raised. It will be appreciated that this tie 102 *a* is, as shown in FIG. 12, rearward of the tie inserting mechanism 23.

In contrast to the tie 102*a* (and all other ties that remain spiked to the rails and hence are elevated by the jacking system), the tie 102 located at the tie inserting mechanism 23 is not elevated with the rails at this time (see FIGS. 4 and 5). The spikes of the tie 102 will have already been removed manually, since it will have been judged to require replacement. The apparatus is thus capable of selective replacement of ties. Support members 111 (FIG. 12) depending from the vehicle carry tie plate holder magnets 110 that lift the tie plates 108 clear of the tie 102. These magnets 110 are also optional, since, after raising the rails with the jacking system, the tie plates can be removed manually.

OPERATION OF THE MACHINE

Prior to use of the machine, a series of new ties will have been dumped from a rail car at locations spaced along the rails 84. These ties are shown at 64 in FIGS. 1 and 12. They tend eventually to form a bunch of two or three ties immediately in front of the machine. Each time the machine is moved forwards by means of its traction motors, in order to align the tie inserting mechanism 23 with an old tie beneath the track that is to be replaced, the pusher plate 94 will push the bunch of ties forward and align the rearmost one with the mechanism 23.

The first stage in the replacement operation consists of movement of a new tie 64 to the left by the tie loading mechanism 80, while the tie clamp mechanism 40 is in its innermost position with jaws 62, 70 open ready to grasp the tie. Once the tie 64 has thus been pushed into the mechanism 40 by the mechanism 80, these jaws are closed to grasp the tie firmly. This is the condition shown in FIG. 2.

The parts are then moved to the position shown in FIG. 3, this movement consisting of contraction of the cylinder 32 to tilt the jib 30 and thus withdraw the tie 64 from above the rails. During at least the initial stages of this movement, the orientation of the tie clamp mechanism 40 is maintained sufficiently erect to avoid the tie 64 binding against the rails 84, such control being exercised through the pantograph actuator cylinder 55.

Once the inner end of the tie 64 has cleared the edge of the track (FIG. 3), the parts can be lowered to the position shown in FIG. 4, by a combination of movements of the cylinder 27 controlling the boom 26; cylinder 32 controlling the jib 30; and cylinder 55 controlling the pantograph mechanism and hence the orientation of the tie clamp mechanism 40. As will be noted from FIG. 4, these movements bring the inner end of the new tie 64 to abut against the outer end of the old tie 102.

Inward movement of the jib 30 is now carried out to bring the parts to the position shown in FIG. 5 in which the tie 64 has been inserted beneath the rails 84, the old tie 102 having been pushed out by this movement.

As a variant of this operation the conditions shown in FIG. 4 can be modified to maintain the boom 26 more elevated, while the downward tilt of the tie clamp mechanism 40 is more pronounced, at the commencement of the insertion operation. The inward end of the new tie 64 will still butt against the outer end of the old tie 102. The effect of this variation is to cause the tie 64 to sweep through a more arcuate course during the insertion step, although it finally comes to rest in basically the same position, namely that of FIG. 5. Which style of operation is chosen will depend on ballast conditions.

Depending on track conditions, as a preliminary to this operation, it may be desirable for some or all of any ballast located at the ends of the tie 102 to be removed manually.

During movement of the ties under the track, and particularly that of the incoming tie 64, the hold-down plate 90 of the tie foot mechanism 85 may assist in guiding the ties and especially in inhibiting any tendency that the leading end of an incoming tie might have to tilt upwardly and strike the far rail, as a result of resistance to its movement exerted by the ballast bed through which it is travelling.

However, it is a feature of the present machine that normally little reliance will have to be placed on the hold-down plate. This feature arises from the ability of the machine to control accurately the orientation of the tie clamp mechanism 40 by means of the pantograph linkage and control, i.e. the link 43 extending to the cylinder 55. Thus, during the tie insertion phase, the leading end of the tie can be held down by a corresponding downward tilting orientation of the mecha-

nism 40, the combination of the jaw 62 and the surface 65 providing such a firm grip on the tie that it can tilt hardly at all relative to the mechanism 40.

In a similar manner, the combination of the jaw 70 and the surface 60*a* holds each tie so firmly against lateral swinging, i.e. in the longitudinal direction of the track, that newly inserted ties come to rest extending accurately transversely of the track, even though the ballast pockets into which they are inserted may embody some misalignment in this regard.

When the tie replacement movements have been completed, the jacking system 100 (assuming that it has been in use) is operated to lower the track, and the rail clamps 104 are loosened to release the rails.

The clamping jaws 62 and 70 of the tie clamp mechanism 40 are released and the tie insertion mechanism 23 is returned to an elevated position ready for the vehicle to be moved forward by the operator to align it with the next tie beneath the track that is to be replaced, whereupon the foregoing operation is repeated.

It has been mentioned above that the jacking system 100 is optional. The reason this system is provided is to enable the tie plates 108 to be lifted out of the grooves 109 of the tie to be replaced. These grooves may be deliberately formed in a new tie, but more often they arise as a result of use of the track, the grooves being cut by the tie plates which are forced down into the ties through the continual pounding of trains. In some tracks little or no such plate cutting of the ties is observed. The degree of such plate cutting will normally be dependent upon the weight and frequency of traffic, and the age and quality of the ties. It will thus be apparent that the present machine can dispense with the jacking system and still operate satisfactorily in locations where no appreciable plate cutting is observed. Even when some plate cutting is present, it may still be possible to slide the tie plates out from beneath the ties and the rails manually, in advance of the machine, without resorting to jacking of the whole track with the machine on it.

As an alternative mode of operation, the machine can be used to remove a tie, the jaws of the mechanism 40 being brought into position for clamping on to the end of a tie under the track and pulling it outwardly, for release once clear of the track.

It will be observed that the pantograph linkage system, which constitutes means for controlling the orientation of the tie clamp mechanism 40, has its pivoting parts 46 and 52 mounted to rotate about the axes defined by pins 31 and 24, which are the same axes as are used to define the respective pivoting movements of the jib 30 on the boom 26, and the boom 26 on the base plate 22. As a consequence, the boom and jib assembly, which constitutes means for controlling the location of the tie clamp mechanism, can be moved from one position to another without effecting the orientation controlling means and hence without changing the orientation of the mechanism 40, leaving such orientation solely under the control of the operator through the cylinder 55 and independent of the location of such mechanism 40.

FIG. 2 shows a rod 120 connected between the jib 30 at 121 and a detecting switch 122 on the boom 26. A further switch 123 on the cylinder 55 interacts with a rod 124 to detect the position of the piston 54. Other conventional sensors and limit switches (not shown) are provided at appropriate locations for sensing the status of the mechanism.

The sequence of operations can be determined manually by the operator controlling the various hydraulic cylinders; or preferably a conventional form of automatic controller can be used to bring about operation of each of the various cylinders in the required sequence and upon completion of the previous operation as detected by a sensor or limit switch.

We claim:

1. A machine for inserting ties beneath a railroad track, comprising:

a. an on-track vehicle for movement along the track,

b. a tie clamp mechanism including jaw means for grasping an end of a tie and holding said tie firmly against movement relative to the mechanism, and

c. means mounting said tie clamp mechanism on the vehicle laterally of a side of the track, including first means for controlling the location of said mechanism and second means for controlling the orientation of said mechanism for moving said mechanism from a first position in which it is horizontally oriented and inwardly located above the track for receiving and grasping an end of a tie resting on the track rails, through a second position in which said mechanism is outwardly located upwardly and away from the track for drawing the grasped tie off the rails and beyond the side of the track and is oriented to tilt the tie downwardly to bring the inward end thereof into position for insertion beneath the track, to a final position in which said mechanism is horizontally oriented and inwardly located below the rails for insertion of the tie,

d. wherein said first means for controlling the location of the tie clamp mechanism comprise

i. main plate means mounted on said vehicle,

ii. a boom pivotally mounted at one end on said main plate means about a first axis,

iii. a jib pivotally mounted on a remote end of said boom about a second axis,

iv. means pivotally mounting said tie clamp mechanism on a lower portion of said jib about a third axis, and

v. means for pivoting said jib about said boom and said boom about said plate means to move the tie clamp mechanism between its said positions,

e. and wherein said second means for controlling the orientation of the tie clamp mechanism comprise

vi. actuating means mounted on said main plate means, and

vii. a pantograph linkage system pivotally connected at one end to a portion of said tie clamp mechanism displaced from said third axis, and connected at its other end to said actuating means for controlling the orientation of said mechanisms,

viii. said pantograph linkage system including members pivotally mounted to rotate about said first and second axes whereby control of the orientation of said mechanism is independent of the location thereof.

2. A machine according to claim 1, wherein said jaw means comprise

f. a first surface and a first jaw pivotable about a first axis for cooperating with said surface to clamp said tie end therebetween to hold the tie against down-

ward tilting relative to the tie clamp mechanism, and

g. a second surface and a second jaw pivotable about a second axis transverse to the first axis for cooperation with said second surface to clamp said tie end therebetween to hold the tie against lateral swinging relative to the tie clamp mechanism.

3. A machine according to claim **1**, wherein said first means for controlling the location of the tie clamp mechanism comprise means at an end of said vehicle defining a vertical pivotal axis, said main plate means being mounted on said vertical axis to be pivotable through 180° between positions extending transversely of the track towards respective sides thereof.

* * * * *