# United States Patent

[11] **3,537,400**


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[54] **TIE RENEWAL MACHINES**
**13 Claims, 5 Drawing Figs.**


[52] **U.S. Cl.** ..... **104/9**
[51] **Int. Cl.** ..... **E01b 29/06**
[50] **Field of Search** ..... 104/6, 9, 16, 17; 254/43



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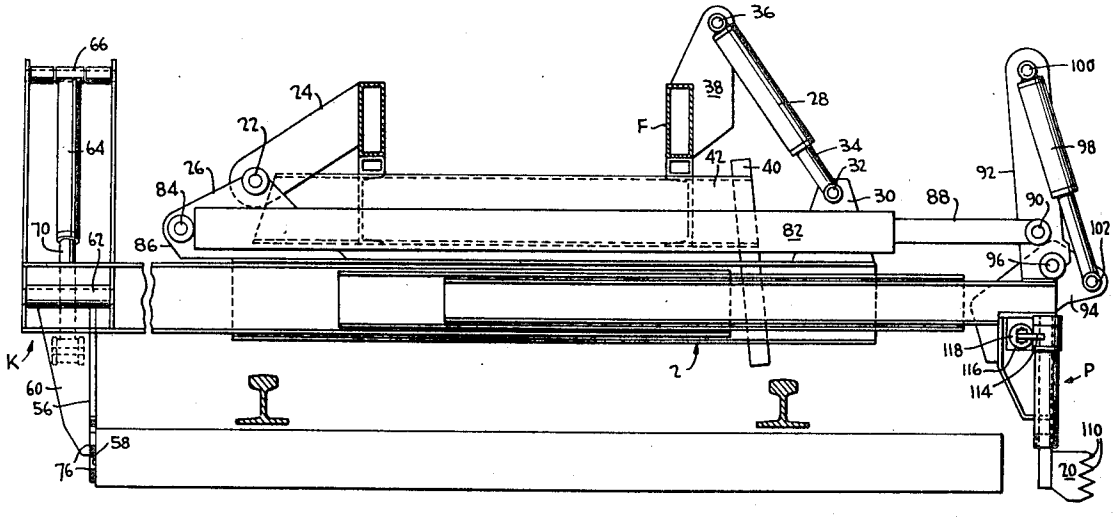
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**ABSTRACT:** A tie renewal machine for removing and replacing the crossties of a railroad track, in which a vehicle movable along the track carries at one side thereof a tie pusher for thrusting engagement against the end of a selected tie to partially eject the tie. At the other side of the vehicle is carried a tie puller having gripping jaws which are spread apart during actuation of the tie pusher to receive between them the partially ejected tie to then grip the same and complete its withdrawal by a pulling action in the direction of the tie length.

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FIG. 1

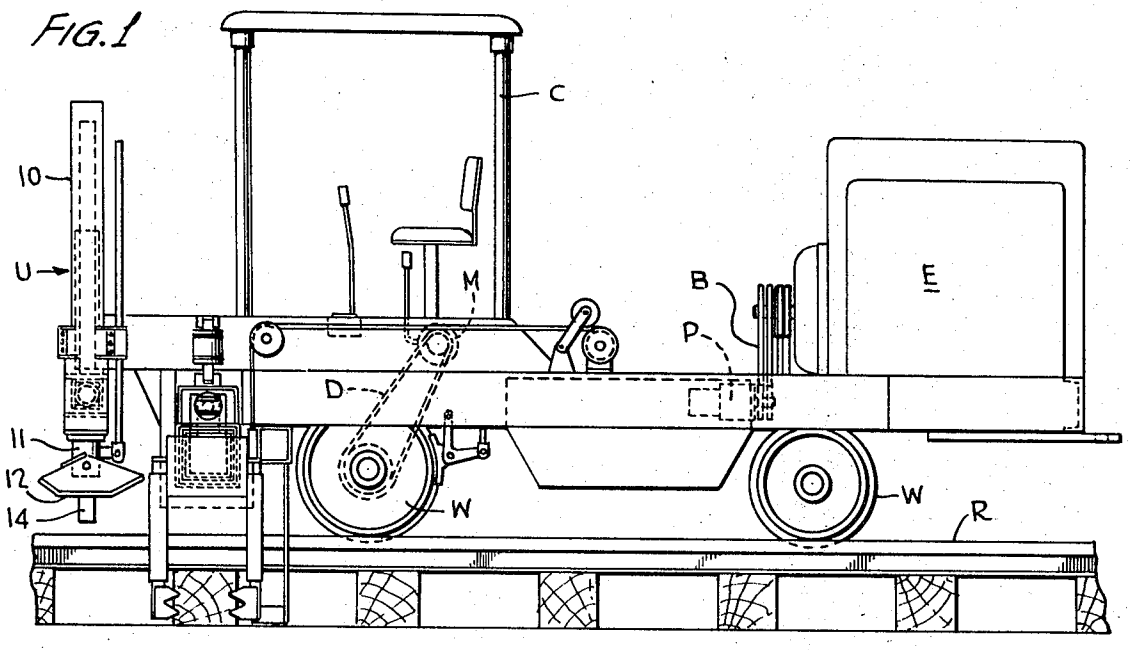



FIG. 4

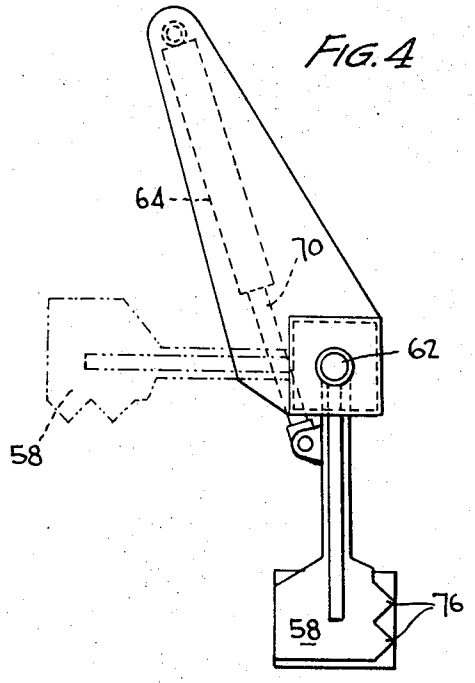
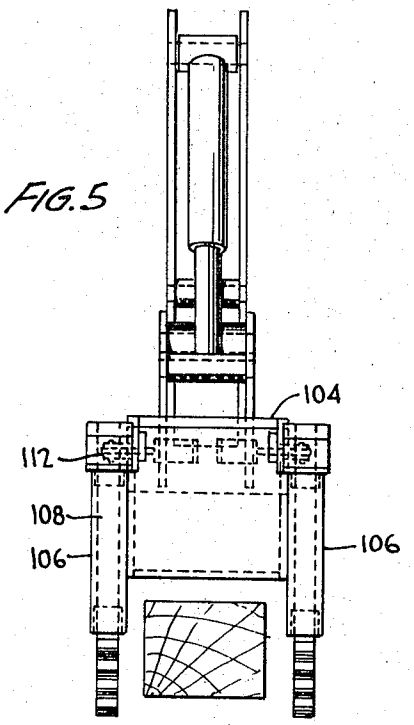



FIG. 5




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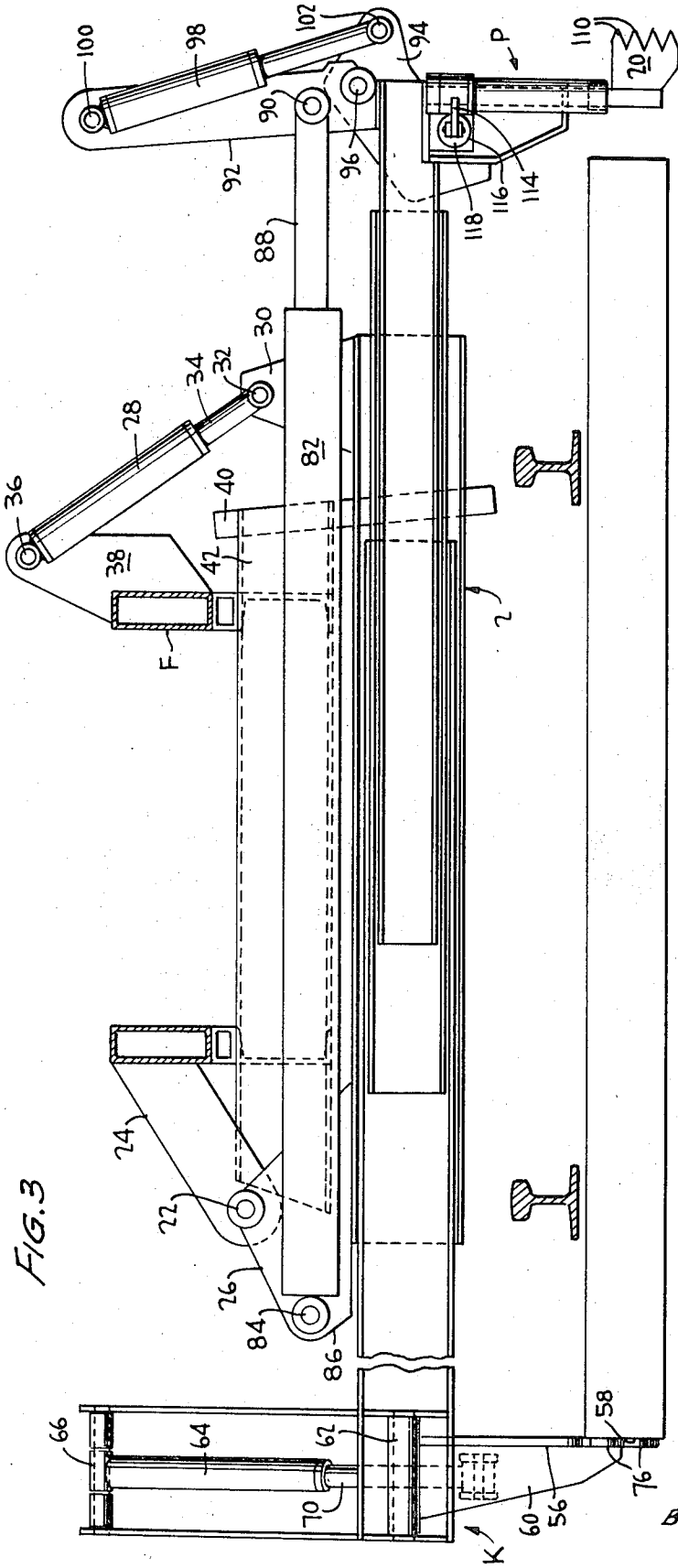



FIG. 3

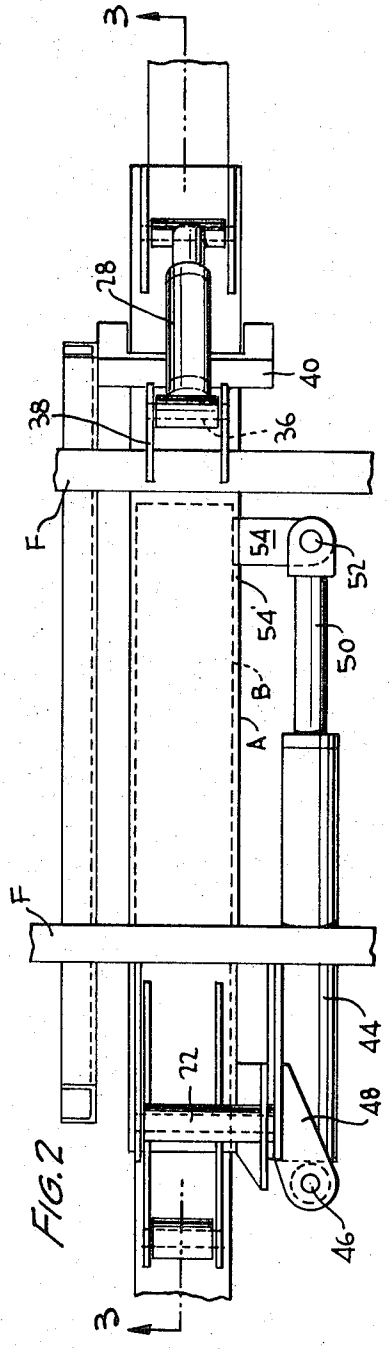



FIG. 2

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# TIE RENEWAL MACHINES

This invention relates to improvements in a railroad tie renewal machine of the type in which a vehicle movable along the railroad tract carries power operated means for gripping and raising the rails clear of the tie to be replaced, while the tie is withdrawn and replaced by movement in an endwise direction.

It is customary to provide rail gripping means in the form of releasable hooks supported from the vehicle in engagement with the rail flanges and also to employ a vehicle carried jack operable to elevate both the vehicle and the rails so as to raise the rails slightly above the particular tie to be removed. The tie removal mechanism generally has comprised a single means engageable with one end portion or the other of the tie to exert a lengthwise push or pull on the same to eject it from beneath the rails. This has required that the said means be capable on each actuation of moving the tie substantially its full length. The necessity for such a substantial degree of displacement of the tie has made it difficult to supply mechanism which will operate both for the full range of required movement and also with the necessary degree of force, especially having in mind the necessity for initially breaking the tie loose at the inception of its withdrawal movement.

In this connection, the range of permissible movement of the tie replacing assembly has been limited by the positioning of the rails near the ends of the tie to be replaced and the difficulty of removing the tie despite interference to an undesired degree by the rails.

The present invention has been conceived with these considerations in mind and, therefore, employs a pair of complementary tie handling means or mechanisms on opposite sides of the vehicle for successively engaging and imparting ejection movement to a given tie in the direction of its length. Thus, in accordance with the invention, the means for initially engaging the tie comprises a tie kicker or pusher assembly carried by the vehicle at one side of the railroad tract for thrusting engagement against the end of the tie to partially eject the tie. The tie removal mechanism at the other side of the vehicle comprises a tie puller assembly, including releasable tie gripping jaws which are spread apart during actuation of the tie pusher or kicker to receive between them the end portion of the partially ejected tie, then are brought into gripping engagement with said partially ejected tie end to complete the ejection thereof by a pulling action in the direction of the tie length.

The use of the pusher or tie kicker throughout the initial portion of the tie removal operation permits the application by the kicker of a strong thrust against the end of the tie to initially break it loose from the road bed and commence its removal or withdrawal, whereupon the subsequent action of the tie puller assembly smoothly and rapidly completes the withdrawal.

In the accompanying drawings wherein is illustrated the preferred embodiment of my invention:

FIG. 1 is a side elevation of a tie renewal machine, incorporating the invention, the machine being in the form of a vehicle movable along the rail of a conventional railroad track;

FIG. 2 is a fragmentary and greatly enlarged plan view of the tie kicker and puller assembly of the machine shown in FIG. 1;

FIG. 3 is a cross section on the line 3–3 of FIG. 2;

FIG. 4 is a detailed side elevation of the tie kicker or pusher assembly as seen from the left-hand side of FIG. 3; and

FIG. 5 is a detailed side elevation of the tie puller assembly as seen from the right-hand side of FIG. 3.

Referring now in detail to the accompanying drawings and referring first to the general arrangement of the entire tie renewal machine as shown in FIG. 1, the said machine comprises a vehicle comprising a rigid frame F, supported on conventional flanged wheels W for movement along the rails R of a conventional railroad track. In the instant embodiment the vehicle is of the self-propelled type including an internal combustion engine E transmitting power through the drive belts B and hydraulic pump P to a hydraulic motor M which is in driving relation through the endless flexible drive element D with the front wheels W of the vehicle. The vehicle is controlled from the driver's cab C through a transmission control lever 8.



For raising the tracks clear of the tie to be removed and replaced, there is provided a jack and rail dog assembly designated in its entirety by the reference character U in FIG. 1. This assembly may be of generally conventional construction and operation such as is exemplified in the U.S. Pat. to Kershaw No. 2,908,228, of Oct. 13, 1959 or to Talboys et al. No. 2,355,573. For the purpose of the present description, it will suffice to say that the jack and rail dog assembly comprises jack cylinders 10 affixed to the frame of the vehicle with the piston rods 11 projecting downwardly therefrom and having bases or feet 12 respectively, to be pressed against the road bed to raise the front end of the vehicle above the road bed. Suitable rail dogs or grippers 14 carried by the jack and rail dog assembly are adapted to grippingly engage the respective rails and to be raised together with the rails by action of the jacks to a location slightly above the road bed and clear of the particular tie or ties to be removed, the latter having been disconnected from the rails as by removal of their spikes.

The rail dogs or grippers 14 also serve the function of maintaining the vehicle on the rails in opposition to the lateral displacing force or reaction on the vehicle resulting from the transverse removal thrust or force applied by the machine in removing a tie.

Removal of the ties is effected through a novel tie kicker and puller assembly comprising a tie kicker unit and a tie puller unit respectively, supported on opposite sides of the vehicle for movement in alignment with each other transversely to the rails and to the vehicle itself. The respective units are adapted for successive engagement with opposite ends of the rail and means are provided for effecting their successive and independent transverse movement in a manner such that the tie kicker or pusher or unit designated K in its entirety first exerts a thrust against the one end of the tie, preferably with sufficient impact to initially break it loose and initiate its movement transversely from beneath the rails, such movement continuing until the tie kicker K abuts against one of the rails. Such partial ejection of the tie by the tie kicker acting on one end of the tie urges its other end outwardly between the gripping jaws 20–20 of the tie puller unit which then are moved into gripping engagement with the tie, following which the tie puller unit is moved transversely outward in the same direction to substantially complete the removal of the tie from beneath both of the rails by pulling action.

Bearing in mind the general arrangement and function of the tie kicker and puller assembly as above described, the preferred construction of the same is as follows:

For mounting and guiding the tie kicker and tie puller units K and P, respectively, there is pivotally connected to one side of the vehicle frame F at 22 (FIG. 3) an assemblage of telescopically interconnected rigid tubes or sleeves A through D, respectively, of which the outermost or external sleeve A constitutes a stationary supporting and guide member. The guide sleeve or member A is slung beneath and transversely to the frame so as to project across and above the rails. The pivotal connection 22 between the assemblage of sleeves A, B, C and D is formed by a rigid bracket 24 which is affixed to and projects outwardly from one side of the longitudinal vehicle frame F and is connected by the aforementioned pivot 22 to brackets 26 affixed to one end portion of the external sleeve A.

At its other or free end, the supporting and guide sleeve A is supported from the other side of the vehicle frame F by an extensible and contractable fluid actuated cylinder and piston unit 28 for angular movement about the pivot 22. For this purpose the free end portion of the outer guide sleeve A has brackets 30 thereon pivotally connected at 32 to the piston rod 34 of unit 28, while the base of the cylinder portion of the unit 28 is pivotally connected at 36 to brackets 38 affixed to the vehicle frame F. The assemblage of sleeves A to D is thus

suspended from the vehicle frame for angular adjustment about the pivot **22** in a vertical plane transverse to the rails and to the direction of movement of the vehicle, it being noted that the external guide sleeve A is secured by the pivot **22** against transverse displacement with respect to the vehicle frame F.

It will be noted that the sleeves are interconnected against relative rotation about their common longitudinal axis, as by forming them of rectangular cross section.

For confining the sleeve assemblage to swinging movement in the desired vertical plane, there preferably is provided a guide **40** of inverted U-shape affixed to the frame member **42** and having its parallel depending legs on opposite sides of the assemblage.

The aforementioned assemblage of sleeves includes the sleeve or slide B which is telescopically disposed within the guide sleeve A with one end normally projecting outwardly from the left-hand end of the sleeve A as seen in FIG. **3** of the drawings. This sleeve B comprises a portion of the tie kicker unit K. As will be apparent from FIG. **3**, lateral projection and retraction of this sleeve B by telescoping action from and into the tube A is selectively achieved through a fluid actuated piston and cylinder unit **44**, the cylinder of which is pivotally connected at **46** (see FIG. **2**) to a bracket **48** carried by the sleeve A.

The piston rod **50** of the tie kicker unit is connected at **52** to an arm **54** affixed to the sleeve B, which arm projects outwardly through and is movable along a longitudinal slot **54'** in the outer sleeve A.

The fluid actuated cylinder and piston unit **44** of FIG. **2** thus exemplifies a suitable means for laterally moving the sleeve B and the tie kicker unit K, of which it constitutes a part, in a direction parallel to the crossties of the railroad track.

As shown in FIGS. **3** and **4**, the kicker unit comprises a rigid arm **56** arranged to depend from the outer end of the sleeve B and having an operative lower end or a foot **58** for operative engagement with the end of a crosstie to exert an endwise thrust and/or impact against the crosstie. Preferably this arm **56** is provided with a reinforcing web **60** as illustrated.

Preferably provision is made for retraction of the arm **56** to a transport position above and clear of the ties during movement of the vehicle, and for projecting the arm downwardly with substantial force to its operative position.

For this purpose, the rigid arm **56** is pivotally connected at **62** to the outer end portion of the sleeve B for angular movement about an axis extending in the direction of the extension and contraction movement of the sleeve B.

For selectively angularly adjusting the arm **56** between its projected and retracted positions as indicated in full and broken lines, respectively, in FIG. **4**, a fluid actuating piston and cylinder unit **64** (shown in FIGS. **3** and **4**) has its cylinder pivoted at **66** to a rigid frame or yoke **68** which in turn is affixed to outer end of the sleeve B. The piston rod **70** of such unit is pivotally connected at **72** to the arm **56** by way of suitable brackets **74** on said arm at a location eccentric of the pivotal axis **62** of the arm. The cylinder and piston units **64** may thus be actuated selectively to position the arm **56** either in its depending operative position as shown in full lines in FIG. **4** or in its raised inoperative position as shown in broken lines in said FIG. It will be understood that in its lowered operative position the tie engaging foot **58** at the lower free end of the arm is positioned for flush endwise thrusting engagement with the end of a tie.

In the case of certain ties, the ends of which project outwardly beyond the rails to an abnormal extent, it may prove impossible or impractical to project the arm **56** outwardly sufficiently for engagement with the tie end. With this contingency in mind, the tie engaging foot or plate **58** is formed along one edge with a series of sharpened teeth or serrations **76** adapted to bite into the side face of the tie when swung forceably downwardly. By thus biting into the side of the tie, the plate or foot **58** is enabled to transmit a substantial amount of endwise thrust against the tie to serve its function of forcing the tie, at least partially, from beneath the rails and into position for gripping engagement by the tie puller unit P.

It is to be understood that the tie kicker assembly or unit of the invention as above described, only partially removes the tie from beneath the tracks and thus is but one of the two cooperating units or mechanisms for jointly achieving the tie removal.

The other or second such unit is the tie puller unit P, illustrated in FIGS. **1**, **3** and **5**, the normally relatively spaced gripping jaws **20–20** of which are positioned for reception between them of a tie which is partly ejected from beneath the rails by the tie kicker unit, the tie puller being thereafter operable to grip and pull the tie substantially entirely from beneath the rails. This tie puller assembly is supported from the vehicle for movement in alignment with the movement of the tie kicker unit K, but is preferably adapted for a sufficient range of operative movement to enable it to complete the removal of the tie in a single operation.

Accordingly in the preferred embodiment, the tie puller assembly P is carried at the free end of the innermost sleeve D of the several telescopically interconnected sleeves, which said sleeve is freely telescopically received within the sleeve C. Both sleeves C and D normally project outwardly somewhat from the main guide sleeve A, and the intermediate sleeve C is freely telescopically received and guided within the sleeve B of the tie kicker unit. Transverse alignment of the units throughout their transverse movement is thus assured.

Preferably a plurality of roller bearings, not shown, are associated with the respective sleeves to facilitate their relative telescoping movement.

Lateral or transverse movement of the tie puller unit P is achieved through a fluid actuated piston and cylinder unit **82** (shown in FIG. **3**), which extends parallel to the sleeves A—D and has one end thereof connected through the pivot **84** and bracket **86** to the guide sleeve A. The piston rod **88** at the other end of this fluid actuated unit is connected to the outer end portion of the sleeve D by way of the pin **90** and the brackets **92**.

To permit raising of the tie puller unit P from its depending operative position as illustrated in FIGS. **3** and **5**, to an upwardly swung or retracted transport position, the frame of the tie puller unit comprises a pair of relatively spaced plates **94–94** extending on opposite sides of the sleeve D and pivotally connected at **96** to the brackets **92** for pivotal movement about an axis extending in the direction of the length of the rails.

Angular movement of the tie puller unit is achieved through a fluid actuated cylinder and piston unit **98** having its cylinder pivotally connected at **100** to the brackets **92** and having its piston rod pivotally connected at **102** to the frame plates **94**, eccentrically to the axis of angular movement **96** of the tie puller unit.

In the preferred embodiment, the tie puller unit comprises a crosshead **104** carried by the frame plates **94–94** for angular movement therewith and this crosshead **104**, in turn, has rigidly affixed thereto on its opposite sides, a pair of relatively spaced depending sleeve bearings or housings **106–106** which rotatably receive and support the rounded shanks or stems **108**, respectively, of the toothed gripping jaws or dogs **20**. It will be seen that the relatively fixed spacing between the gripper or dog shanks **108–108** is substantially greater than the width of a crosstie so that when the grippers or dogs **20** are rotated to their retracted or disengaged positions as illustrated in full lines in FIGS. **3** and **5**, the crosstie may be moved freely into operative position between them to be subsequently engaged by the dogs **20**. It will be further apparent that the toothed or serrated operative edges **110** of the respective grippers or dogs **20** are located eccentrically to the rotational axis of the gripper shafts **108** so that they may be readily swung into relatively converging relation with each other and thus into operative penetrating and gripping engagement with the opposite side walls of the tie. The toothed edges of the grippers **20** are directed and converged generally in the direction

of thrust to be transmitted by them to the tie, whereby their gripping engagement with the tie will be increased in accordance with the thrust that they exert upon the tie.

Affixed to each shank **108** is an arm **112** the free end of which is connected to the piston rod **116** of a fluid actuated piston and cylinder unit **118**, of which the cylinder is anchored to the crosshead **104** of the unit.

The fluid actuated cylinder and piston units **118** are of the double acting type and capable of positioning the gripper jaws or dogs either substantially parallel to each other in their inoperative position for reception therebetween of the partially ejected tie, or in their operative position in which they are swung into operative engagement with the tie.

In the operation of the above-described invention, the vehicle is moved along the railroad track until the tie kicker and tie puller units K and P, respectively, are brought into transverse alignment with the particular tie to be removed. The vehicle is brought to rest in this position, following which the rail dogs **14** are engaged with the rails R and the jack cylinders **10** are actuated so that the rails are elevated slightly above and free of the crosstie, substantially to the position illustrated in FIG. **3**, the crosstie having been disconnected from the rails. During transport of the vehicle to its work position, the tie kicker unit K and the tie puller unit P will both have been raised to their inoperative upwardly swung positions. For operation on the crosstie they will then be swung downwardly and positioned just outwardly of the respective ends of the crosstie. In the event the particular crosstie end opposite the tie kicker unit K should project unusually outwardly from the line of ties so as to interfere with the downward swinging of the tie kicker arm **56**, the latter is swung forcibly into engagement with the vertical side wall of the tie, causing its teeth **76** to partially penetrate the side wall and thus to afford a grip for transmitting a lengthwise thrust to the tie. Ordinarily, however, the arm **56** is swung downward to a vertical depending position, in which its tie engaging foot **58** is aligned with the crosstie for flush engagement with the tie end.

In either event, the piston and cylinder actuating unit **44** for the tie kicker unit K is then actuated to move the kicker unit and its arm **56** inwardly towards the adjacent rail, thereby thrusting the crosstie in the direction of its length partially outwardly from beneath the rails until such time as the arm **56** engages the adjacent rail.

Such partial displacement of the crosstie will have moved its opposite end portion between the relatively spread apart gripper jaws or dogs **20** which, up to this time, will have been positioned just outwardly of the end of the tie. The fluid actuated units **118** are then actuated to rotate the tie dogs **20** to bring their toothed ends into gripping engagement with the opposite side walls of the tie, following which the tie puller cylinder and piston unit **82** will be extended to urge the sleeves C and D and the tie puller unit T outwardly away from the rails, whereby to remove the tie from beneath the rail.

During each extraction any tendency of the leading end of the tie to deviate upwardly from the intended horizontal path of withdrawal, can be readily overcome by suitable adjustment of the fluid actuated unit **28**.

Once the tie has been withdrawn from beneath the rails, the tie dogs or grippers **20** are released, and the extended cylinder and piston unit is retracted to its shortened or contracted position, following which a new tie may be inserted in any usual manner to replace the tie thus removed.

I claim:

**1.** A tie renewal machine comprising a vehicle movable along the rails of a railroad track, a tie kicker and a tie puller, respectively, supported on opposite sides of said vehicle normally at locations outwardly of the ends of the ties, means supporting said tie kicker and said tie puller from the vehicle and for guiding said tie kicker and said tie puller respectively for rectilinear horizontal movement independently of each other and in alignment with each other transversely to the rails, said tie puller comprising a pair of opposed jaws arranged for relative spreading and gripping movement respectively in a plane parallel to the rails, said jaws depending below the rails and normally being spread apart to lie on opposite sides of a tie engaged and partially displaced by said tie kicker, said tie kicker depending below the rails for thrusting engagement with a selected tie, a first power means for urging said tie kicker toward the rails to partially displace the tie from therebeneath and to a location between said tie grippers, means for urging the said tie grippers into operative gripping engagement with the tie, and a second power means for moving said grippers horizontally away from the rails in a lengthwise direction with respect to the tie to complete the withdrawal of said tie, said first and second power means being operable to move said tie kicker and said tie puller independently of each other.

**2.** A tie renewal machine as defined in claim **1** in which said means for supporting and guiding the tie kicker and the tie puller comprises supporting and guiding means carried by the vehicle above the rails, slides carried by said means for horizontal rectilinear movement in alignment with each other transversely to the rails on opposite sides of said track, and power means for selectively moving each of said slides independently of the other, said tie kicker being supported by one said slide and said tie puller being supported by the other said slide.

**3.** A tie renewal machine as defined in claim **2** in which said supporting and guiding means for the tie puller is connected to the vehicle for swinging adjustment in a vertical plane parallel to the ties, and including power means for swingably adjusting said supporting and guiding means.

**4.** A tie renewal machine as defined in claim **1**, said tie kicker comprising a rigid arm pivotally carried by said supporting and guiding means for angular movement about an axis parallel to the rectilinear movement of said tie kicker, said arm having a free end defining a foot for abutting endwise engagement with a tie.

**5.** A tie renewal machine as defined in claim **4** in which said foot includes sharpened teeth projecting there from in the direction of said angular movement for penetrating engagement with the side of a tie.

**6.** A tie renewal machine as defined in claim **5** including a power means for angularly moving said tie kicker arm.

**7.** A tie renewal machine as defined in claim **1**, in which said tie kicker and said tie puller are connected to said supporting and guiding means for angular movement between lowered operative positions in which they extend to the level of the ties and raised inoperative positions in which they are supported above the level of the ties.

**8.** A tie renewal machine as defined in claim **7**, including power means for angularly moving said tie kicker and said tie puller respectively between their operative and inoperative positions.

**9.** A tie renewal machine as defined in claim **1** in which said tie puller comprises a crosshead, said jaws including supporting shanks respectively supported from said crosshead in spaced relation for rotation about vertical axes, each jaw including horizontally directed teeth projecting therefrom eccentrically to its said axis, and power means for simultaneously rotating said shanks.

**10.** A tie renewal machine as defined in claim **1** in which said means supporting and guiding the tie kicker and the tie puller comprises a first sleeve carried by the vehicle above and transversely to the rails, a second sleeve telescopically and nonrotatably supported by said first sleeve and having a portion projecting from one end thereof, the tie kicker being carried at the projecting portion of the second sleeve, a third sleeve telescopically and nonrotatably associated with said above-mentioned sleeves and having a portion projecting from the other end of said first sleeve, the tie puller being carried at said projecting portion of the third sleeve, and power means for selectively telescopically moving said second and third sleeves relatively to the first sleeve.

**11.** A tie renewal machine as defined in claim **10** in which said first sleeve is pivotally connected to the vehicle for verti-

cal swinging movement and including power means for causing such movement.

12. A tie renewal machine as defined in claim 11 in which one end of said first sleeve is pivotally connected to the vehicle for vertical swinging movement on the side of the vehicle from said tie puller, an extensible and contractable fluid actuated unit being interconnected between said vehicle and the other end of said first sleeve.



13. A tie renewal machine as defined in claim 10 including extensible and contractable power means connected between said first sleeve and said second sleeve and extensible and contractable power means connected between said first sleeve and said third sleeve, said power means being operative for selectively laterally extending and retracting each of said second and third sleeve with respect to the first sleeve.