This invention relates to railroad track working equipment. In one aspect, the invention is more particularly directed towards a combination of an under-track device with an on-track wheeled vehicle, the latter being so constructed and arranged as to be capable of placing the under-track device beneath the track and removing it therefrom as required.

Apparatus of this general category is disposed in James W. Christoff's United States patent application Serial No. 842,047, filed September 24, 1959 (now Patent No. 3,054,359, issued September 18, 1962), which prior application illustrates an on-track vehicle comprising an elongated beam mounted on parts which have wheels engaging the rails. Jacks and rail-engaging dogs are spaced apart longitudinally and transversely of the beam so that the beam can be hooked to the track and the beam and track can be elevated. With the track in elevated condition, a transversely projecting boom carrying a cable is employed to drag an under-track device of the ballast plow or ballast sled type from a position beside the track to a position beneath the track, or vice versa.

The apparatus of the present invention may be considered as an improvement over such prior apparatus in two respects: (a) It can be made to accomplish the basic function of the prior apparatus, but more simply and expeditiously, and (b) it can perform additional functions not possible with the prior apparatus.

More specifically, the apparatus of the present invention can be employed to convey an under-track device to the site, as well as to place it beneath the track at the site.

Furthermore, it can be used to position under-track devices of a type other than ballast-handling devices beneath the track. For example, it may serve to position and propel beneath the track a tie-ejector mechanism for the removal of loose or deteriorated ties.

A further feature of the invention is construction of an under-track device in two separable parts, each for independent insertion and removal from beneath the track (preferably from opposite sides) and each for independent mounting on the on-track vehicle.

In another aspect, the invention is concerned with improvements in a tie-ejector mechanism itself.

These and related features will become apparent from the specific description which follows, from the drawings, and from the appended claims.

The accompanying drawings illustrate apparatus embodying the various features of the invention. In these drawings:

FIGURE 1 is a general side view of one form of apparatus according to the invention;

FIGURE 2 is a perspective view of a portion of the apparatus of FIGURE 1, shown on a larger scale;

FIGURE 3 is a transverse section of the apparatus, taken on the line III—III of FIGURE 1;

FIGURE 4 is a view similar to FIGURE 3 showing the manner of removal of a tie;

FIGURE 5 is a further view similar to FIGURE 3 demonstrating the manner of moving a part of the tie-ejector mechanism to its inoperative position;

FIGURE 6 is a fragmentary plan view of a tie-ejector roller taken on the line VI—VI in FIGURE 3;

FIGURE 7 is a section taken on the line VII—VII of FIGURE 6.

FIGURE 8 is a view similar to FIGURE 2 illustrating an alternative embodiment;

FIGURE 9 is a side view of a different form of under-track device demonstrating another manner in which the invention may be applied in practice; and

FIGURE 10 is a transverse section showing the apparatus of FIGURE 9 taken on a line looking rearwardly.

FIGURE 1 shows an on-track vehicle 20 consisting essentially of a rigid beam or framework 21 supported on the rails 22 of the track 23 by a cart means in the form of a front cart 24 and rear cart 25. The front cart 24 is secured by a yoke 26 to an under-track device 27 which is presumed to be a conventional ballast plow, but could just as well be any other under-track device of the ballast handling type such as a ballast sled. Hydraulic cylinders 28 and 29 provide for vertical adjustment of the respective ends of the beam 21 at carts 24 and 25. A liner head 30, the transversal and vertical positional means of which on the beam 21 can be hydraulically controlled, is mounted between the carts 24 and 25, for correcting track misalignment. A pair of lifting jacks 31a and 31b (see FIGURE 2) are mounted on respective sides of the beam 21, somewhat rearwardly of the front cart 24, and, with companion rail dogs 32a and 32b, may be used to elevate the track at this end of the apparatus. Similar lifting jacks 33 and rail dogs 34 are mounted on the beam 21 near the rear cart 25.

All the parts so far described form the subject or earlier patents and patent applications. The manner of use of the jacks and rail dogs for elevating the track has been described in application Serial No. 842,047, already referred to. Details of the carts, their adjustment relative to the beam, the connection of the front cart to the ballast plow or sled, the function of the liner head 30, and the manner of toting the under-track device along the track by a locomotive through cables 35 secured to the device 27, are described in James W. Christoff's prior United States application Serial No. 777,389, filed December 1, 1938, now abandoned. Typical ballast plows and sleds of basic design are described in United States Patents No. 2,921,390, issued January 19, 1960, and No. 2,769,172, issued October 30, 1956. It is accordingly not proposed to deal further in the present specification with details of the apparatus so far described.

On its respective lateral faces the beam 21 carries outwardly projecting fixed structures 36a and 36b (FIGURE 3). Each such structure pivotally supports a shaft 37a or 37b mounting a movable assembly 38a or 38b which supports an under-track device of the tie-ejector type. The purpose and principal functions of a tie-ejector device have already been explained in James W. Christoff's and Richard A. Peppin's prior United States application Serial No. 850,793, filed November 4, 1959, now Patent No. 2,990,787, issued July 4, 1961, as a continuation-in-part of application Serial No. 780,451, filed December 15, 1958, now abandoned. The tie-ejector of the present apparatus is an improvement over the forms of tie-ejector disclosed in these last-mentioned prior applications.

The movable support assemblies 38a and 38b are identical with each other (in mirror image) and accordingly only one will be described in detail. Since assembly 38b is shown in the perspective view of FIGURE 2, it is this one that will be described in detail. It consists of a sleeve 40 of rectangular cross-section, which is mounted on arms 41 to turn with the shaft 37b under the control of a double-acting hydraulic cylinder 42 which acts on the shaft 37b through a crank arm 43. In the operative position shown in FIGURES 2 and 3, the sleeve 40 slidingly houses a
vertically disposed, inner rectangular tube 44 which supports at its lower end a horizontal tube 45 that projects inwardly under the track about as far as the nearer rail 21. The tie 20, roller 46 and associated parts. Tube 45 will be seen to house a hydraulic motor 47 driving the roller 46b through a chain drive 48. At its end remote from the tube 45, the roller 46b is supported in a bearing 49 mounted on a cantilevered structure 50 projecting outwardly from the tube 45 and defining a pair of plates 51 sloping downwardly and away from each side of the roller (see also FIGURE 7).

Two features are of particular note about the roller assemblies, now Patent No. 2,990,787 issued July 4, 1961. Firstly, it will be observed that, not only do the plates 51 slope downwardly away from the roller 46b, but the roller projects a substantial distance upwardly beyond the upper edges of the plates. This freedom from the upper surface of the roller is important for proper function of the device, as will appear later from the description of its operation. Secondly, the teeth structure of the rollers is especially suited to the propulsion of ties rapidly transversely of the track. At a given section, such as that of FIGURE 7, the roller 46b has four sharp-tipped teeth 52 spaced 90° apart around the roller periphery. Moving axially of the roller from this section, there is first a gap 53 with no teeth, then a second set of teeth 52, and then a set of four teeth 54 spaced around the roller. A staggered relation to the teeth 52. Then there is another gap 53, a second set of teeth 54, and then a set of teeth 52 which begins the cycle again. This arrangement by which the surface of the roller is liberally provided with discrete projecting teeth has been found to have excellent tie biting qualities. The shortness of the teeth, and the axial depth of the teeth, and the provision of spaces between adjacent aligned teeth, facilitates each individual tooth penetrating the timber of a tie and exerting a propulsive force thereon.

Situating above each respective roller 46a, 46b, in the longitudinal direction, and slightly outwardly of the rails to support the rear ends of the ties 20, in a transverse direction, are tie hammers 56a and 56b. Each tie hammer consists of a double-acting hydraulic cylinder fed through fluid lines and pivotally mounted at its upper end to a bracket 57 (FIGURE 2). Bracket 57 is adjustable transversely of the track. The structure 58 is secured to the rail 21, upon which legs the structure 58 may be moved between limits of vertical adjustment and then be fixed in any desired position. A chain 60 may be used to swing the hammers rearwardly.

In operation, the assembly consisting of the under-track ballast handling device 27, on-track vehicle 20, and under-track tie ejector, is towed along the track by cables 35, the yoke 26 transmitting the towing pull to the vehicle 20 and, in turn, carrying the tie ejector mechanism. It will be noted that, whereas the under-track device 27 rests on the roadbed and serves to support the span of track in elevated condition, the tie-ejector mechanism is held just clear of the smooth roadbed that the under-track plow or sled leaves behind it. Although the tie-ejector mechanism travels along behind the plow or sled, and may therefore properly be considered an under-track device, it need not normally rest on the roadbed; nor does it have any direct connection to the primary under-track device which precedes it. The connection which these under-track devices do have, and which ensures their synchronous travel along the track, is established through the on-track vehicle 20.

This spacing above the roadbed of the tube 45 and roller-support structure 50 is maintained by a clamp 61 which is secured to the inner vertical tube 44 above the sleeve 40 to limit downward travel of the inner tube. Clamp 61 can be loosened and repositioned at will for adjustment purposes. Rollers 62, freely pivotally mounted in a fitting 63 secured to the sleeve 40, project through slots in the sleeve 40 to bear on surfaces of the tube 44 to facilitate sliding of such tube within the sleeve.

Although this arrangement, with the parts of the tie-ejector mechanism riding clear of the roadbed, is preferred, it is possible to fit a slider or roller on the trailing end of the roller-support structure 50 and arrange for such slider or roller to engage the roadbed and thus provide additional support for itself.

The tie-ejector mechanism will be called upon to eject either a tie which has become disengaged from both rails and has been propelled by the next attached tie up from the track and along the top of the under-track device 27 to be discharged from the rear of the upper runners of such device onto the tie-ejector rollers, or a tie which has been judged to need replacement and has been knocked down from its engagement with the rails onto the rollers by the tie hammers 56a and 56b.

FIGURE 3 shows a tie 55' at the moment of being knocked down from the rails 22 onto the tie-propelling rollers 46a, 46b. These rollers will both be driven at high speed, in the same direction (clockwise in the example) so as to drive the tie to the same side of the track as soon as their teeth bite into the tie. FIGURE 4 shows the position of the tie 55' a moment later (a fraction of a second, since the operation is very rapid and the entire ejection process takes only about one second at the most). The gap 53 between the rollers, the trailing end of the tie being ejected trends to drop down onto the roadbed after it leaves the upstream roller 46a. Instead of being a disadvantage, as might have been expected, this tilting of the tie has been found to be useful in that it elevates the leading end of the tie. The downstream roller 46b which is still in contact with the tie then tends to propel the tie along an upwardly inclined path, and experience has shown that ties are usually given a better trajectory and are thrown further away from the track by this arrangement than by prior forms of tie-ejector mechanisms in which sufficient rollers were employed to ensure that the tie remained substantially horizontal all the time. It has been found necessary, however, to allow the rollers (or at least one on the side to which the ties are to be propelled) to project substantially above their supporting structures, and preferably to have sloping planes within as has already been explained, so that the inclined tie will never be prevented from properly engaging the rollers. Since it will be desirable in practice to be able to eject ties to either side, both rollers will be so constructed.

The criterion for spacing the rollers to obtain the dropping down effect of the trailing end of the tie is that the rollers should be at least as far apart as half the length of a tie, and preferably rather further to allow for the fact that the tie travels quite rapidly to one side of the track. Dropping will theoretically occur if the center of gravity of the tie has not passed the downstream roller when its trailing end loses the support of the upstream roller.

Movement of the movable support assemblies to inoperative position is demonstrated by FIGURE 5 which shows assembly 38b hoisted by withdrawal of the piston of cylinder 42. The assembly turns through slightly more than a right angle to the normal roadbed side and can slide under gravity (or can easily be manually moved) within the shell of the tube 45 to prevent the tube 45 and the parts it supports projecting undesirably far outwardly to the side of the vehicle 20. The tube 44 can be retained in this in-board position by a pin 64. The other assembly 38a will be similarly brought up and inwardly to an inoperative position, when not in use, and for travel along the track as part
of the vehicle 20, at least one of the carts of which will preferably be provided with a hydraulic motor for self-propulsion of the vehicle. Fluid for all the hydraulic operating parts will be supplied from a power plant and control station shown diagrammatically at 65 in FIGURE 1.

One half of an alternative form of tie-ejector mechanism is illustrated in FIGURE 8. This mechanism has four tie-pulling rollers, two female and two male, which are assembled, and the assemblies each project almost half way under the track. FIGURE 8 shows movable assembly 68b consisting of a vertical circular tube 74 slidable and rotatable in a sleeve 70 which is pivotally mounted in essentially the same way as before on the beam 21. Vertical tube 74 supports horizontal tube 75 and 76 and 77. Another tie-ejector device 75 will house a hydraulic motor for driving rollers 76, 77. Clamp 78 will limit downward sliding of tube 74 in sleeve 70, and rotation of tube 74 can be arrested in two parts of means of a pair of pins 79 connected together by bar 80, the pins 79 passing through holes in sleeve 70 to enter holes in the base plate 81, and clamping the rollers under the track; the other position is with the tube 74 turned anti-clockwise (looking down on the tube) to bring the rollers out from under the track. After being locked in this second position by the pins 79, the assembly 68b is hoisted into its inoperative position, tube 74 sliding upward along sleeve 70 as before. The assembly 68a on the other side will be similar, and the operation of the mechanism will be basically the same as for FIGURES 1 to 7, except that the tie will not be tilted as it is ejected from under the track.

It should now be clear that the feature of dividing an under-track device into two parts and mounting these parts on opposite sides of an on-track vehicle, yields substantial advantages of practical operation. It will, however, also be evident that it is not inherently essential to the invention that the under-track device be thus divided. The whole device could be inserted and supported solely from one side of the track. Alternatively it could be inserted from one side, and supported, once in position, from both sides. Needless to say, the divided construction is preferred, as tending towards lighter supports and greater ease of operation, although the broad principle of an on-track vehicle that is capable of transporting an ancillary under-track device (tie-ejector mechanism to the site of operations, there inserting it under the track and then moving it along in synchronism with a primary under-track device (plow or sled) is believed to be novel, independently of the specific manner of inserting and supporting the transported under-track device.

Down to this stage in the description, the feature of mounting a device on an on-track vehicle to transport it to the site and there inserting it under the track, has been described and illustrated only in respect of an ancillary under-track device of the tie-ejector type. The principle is equally applicable to other under-track devices, and in particular to a primary under-track device (plow or sled type. This aspect of the invention is illustrated in FIGURES 9 and 10, and again, for many practical reasons, the under-track device has been divided into two parts and one such part has been mounted on each side of the on-track vehicle.

The under-track device chosen to illustrate this aspect of the invention is a so-called undercut or self-pulled plow, a detailed description of which is contained in James W. Christoff's United States patent application Serial No. 91,186, filed simultaneously herewith. In FIGURES 9 and 10 of the present specification, such under-track device has been shown only generally, as the device 90, and no description of its detailed construction has been attempted, since the purpose of the present description is to demonstrate its method of support by the on-track vehicle 20 which is basically the same as has already been described, although it may be expedient to lengthen the beam 21 somewhat for the function now to be described.

Forward cart 92 supports a sleeve 93 on vertically adjustable cylinder-guide combinations 91. Sleeve 93 carries an inner rod 94 which can move transversely of the track direction. Portions of rod 94 are threaded and engage threaded collars 95 which are mounted at each end of sleeve 93 to rotate but not to move otherwise relatively to sleeve 93. Rotation of the collars thus permits transverse adjustment of the ends of rod 94 relative to the sleeve 93, hence relative to the cart 92, and hence relative to the beam 21 of the vehicle 20 which is pivotally connected to sleeve 93 about a vertical axis and is thus fixed in relation to the cart 92 for transverse movement although adjustable relatively thereto in the vertical direction with the sleeve 93.

The ends of rod 94 serve as pivotal supports for movable assemblies 97a and 97b, each of which consists of a horizontal portion 98 extending outwardly to a junction with a pair of downwardly extending divergent leg portions 99. To the junction of portions 98, 99, there is connected the piston of a double-acting hydraulic cylinder 100 pivotally mounted on standard 101 projecting upwardly from rod 94 through a slot in sleeve 93. The lower ends of leg portions 99 are firmly secured to the upper outside edges of the under-track device 90 which is here shown as divided into two parts 98a and 98b connected together when in operation to form a unitary device. If preferred the two parts may be operated separately, bolts 96 then being omitted.

To remove the under-track device 90 from beneath the track, rail dogs 32a, 32b are engaged and the track is elevated by jacks 33a, 33b. Cylinders 100 are then operated to swing movable assemblies 97a, 97b upwardly and withdraw the two parts 98a and 98b (embolished by this time, of course) from respective sides of the track and bring them up each to an inoperative position. Such a position for the part 98a is shown in broken lines in FIGURE 10, and pin 102 is shown to retain it. If preferred, the part 98a could be turned through a greater angle to lie more inboard to the vehicle 20 than the drawings, which are essentially diagrammatic, show. Also, additional means for securing the part 98a in such inoperative position may be provided, especially when the on-track vehicle is to travel along the track with heavy under-track device parts thus supported at its sides. The operation of placing an under-track device beneath the track is the reverse of the removal operation just described.

Although it has not been illustrated, the vehicle 20 shown in FIGURES 9 and 10 may also support a tie-ejector mechanism in the manner of FIGURES 1 to 8 for co-operation with the under-track device 90. Thus the on-track vehicle may simultaneously support more than one under-track device.

As will be evident, numerous variations of structure will be possible within the scope of the various aspects of the invention.

We claim:

1. A tie-ejector mechanism for use in association with means for elevating a section of railroad track, comprising
   (a) a pair of tie supporting and propelling means,
   (b) means for mounting said tie supporting and propelling means on said track elevating means beneath a section of railroad track elevated by said track elevating means,
   (c) said mounting means mounting said tie supporting and propelling means spaced apart from each other transversely of the track in position to receive, support and propel towards one side of the track respective ends of a tie displaced downwardly from the track,
   (d) the spacing between said tie supporting and propelling means being at least as great as half the
length of a tie whereby the trailing end of a tie prop-
pelled by said means to one side of the rack will
drop after moving beyond the upstream supporting
and propelling means for continued propulsion of
the tie by the downstream propelling means along
an upwardly inclined path.

2. A tie-ejector mechanism according to claim 3, where-
in each said tie supporting and propelling means com-
prises a roller having a plurality of individual, tie-pro-
pelling teeth arranged around its periphery with an axi-
ally extending space between each pair of teeth.

3. The combination of
(a) an under-track device of the tie-ejector mechanism
type,
(b) and an on-track vehicle for supporting said mech-
anism beneath an elevated section of railroad track,
(c) said mechanism comprising a pair of tie supporting
and propelling means spaced apart from each other
transversely of the track,
(d) and said vehicle comprising a pair of support
assemblies each supporting a respective said tie sup-
porting and propelling means and each movably
mounted on a respective side of the vehicle to move
its associated tie supporting and propelling means
between an operative position beneath the track
and an inoperative position remote from such under-
track position,
(e) the spacing between said tie supporting and prop-
pelling means in said operative position being at
least as great as half the length of a tie whereby
the trailing end of a tie propelled by said means to
one side of the track will drop after moving beyond
the upstream supporting and propelling means for
continued propulsion of the tie by the downstream
propelling means along an upwardly inclined path.

4. The combination of
(a) an under-track device formed in two parts,
(b) an on-track vehicle for inserting said device be-
neath an elevated section of railroad track,
(c) a pair of support assemblies each supporting a
respective part of the under-track device and each
mounted on a respective side of the vehicle,
(d) each said support assembly being pivotally mount-
ed on the vehicle to swing its associated under-track
part between an operative position directly under-
neath the ties of the track and an elevated, inoperative
position removed from beneath the track,
(e) each said support assembly being mounted so that
movement between said operative and inoperative
positions consists of a single swinging motion about
a horizontal axis extending parallel with the direction
of extent of the track.

5. The combination of
(a) an under-track device of the tie-ejector mechanism
type formed in two parts,
(b) each part of said mechanism comprising tie sup-
porting and propelling means,
(c) an on-track vehicle for supporting said mechanism
beneath an elevated section of railroad track,
(d) a pair of support assemblies each supporting a
respective said part of the tie-ejector mechanism and
each mounted on a respective side of said vehicle,
(e) each support assembly being pivotally mounted
on the vehicle to swing its associated mechanism part
between an operative position directly under-
neath the ties of the track and an elevated, inoperative
position removed from beneath the track,
(f) each said support assembly being mounted so that
movement between said operative and inoperative
positions consists of a single swinging motion about
a horizontal axis extending parallel with the direction
of extent of the track,
(g) the spacing between the tie supporting and prop-
pelling means of the respective mechanism parts
in said operative position being at least as great as
half the length of a tie whereby the trailing end of
a tie propelled by said means to one side of the track
will drop after moving beyond the upstream
supporting and propelling means for continued pro-
pulsion of the tie by the downstream propelling
means along an upwardly inclined path.

6. The combination of
(a) means for elevating a section of railroad track,
(b) a pair of tie supporting and propelling means,
(c) means mounting said tie supporting and propelling
means on said track elevating means beneath a
section of railroad track elevated thereby,
(d) said mounting means mounting said tie support-
ing and propelling means spaced apart from each
other transversely of the track in position to receive,
support and propel towards one side of the track
respective ends of a tie displaced downwardly from
the track,
(e) the spacing between said tie supporting and prop-
pelling means being at least as great as half the length
of a tie whereby the trailing end of a tie propelled
by said means to one side of the track will drop
after moving beyond the upstream supporting and
propelling means for continued propulsion of the tie
by the downstream propelling means along an up-
wardly inclined path.

References Cited in the file of this patent

UNITED STATES PATENTS
1,929,617 Walbridge .................. Oct. 10, 1933
2,664,652 Talboys ....................... Jan. 5, 1954
2,828,699 Fox .......................... Apr. 1, 1958