March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 1

Fig. 1

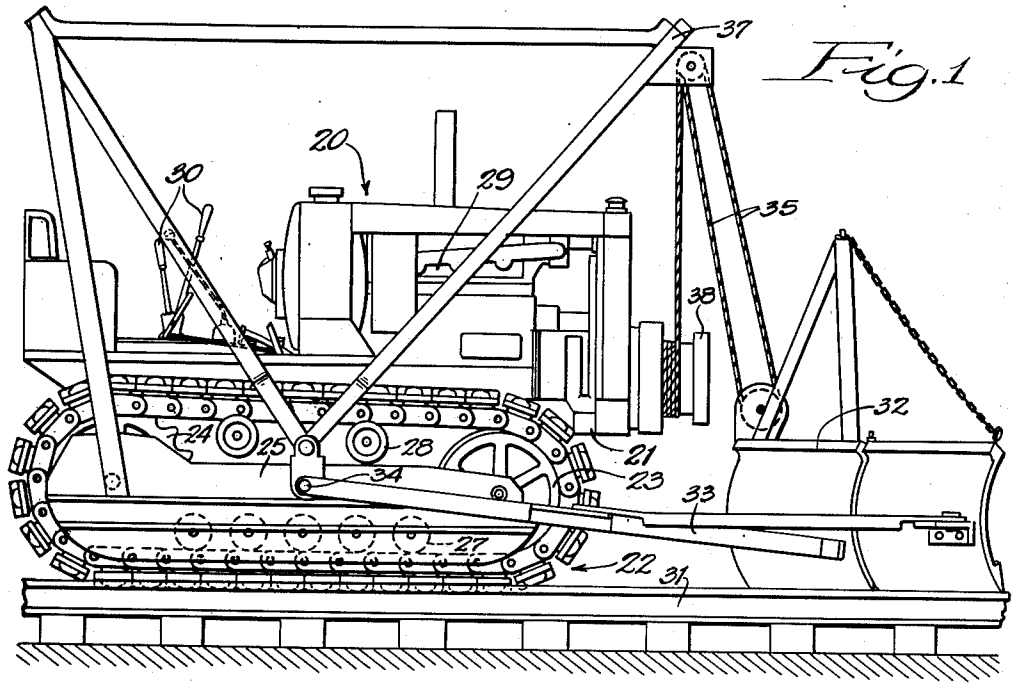
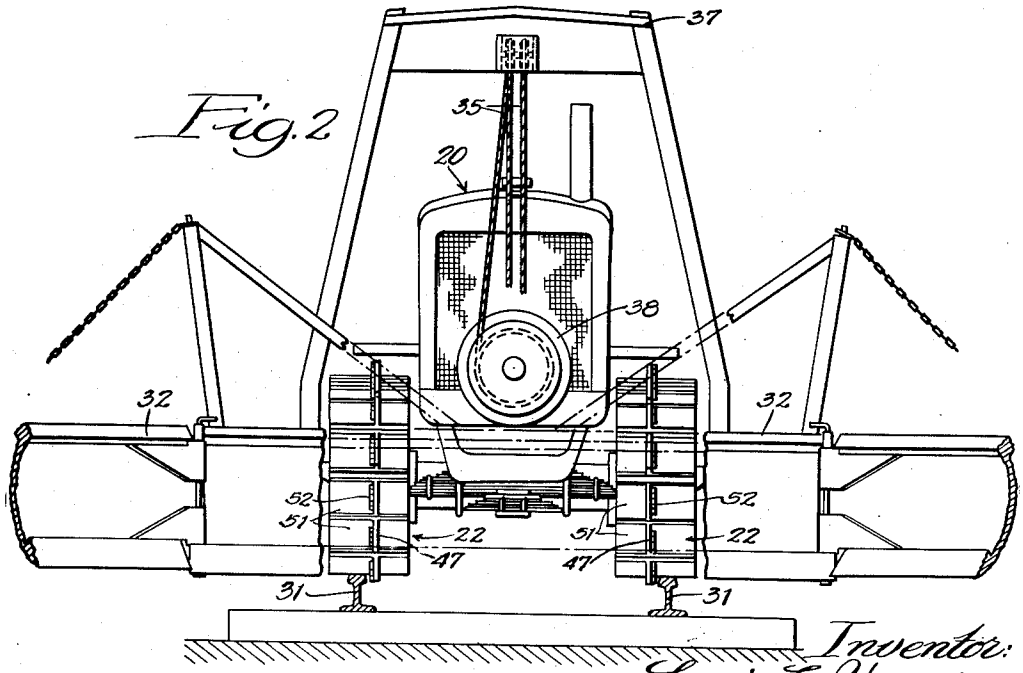


Fig. 2



Inventor:
Lewis E. Younie,
By McCaleb, Hewitt & Dickinson
Attorneys.

March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 2

Fig. 3

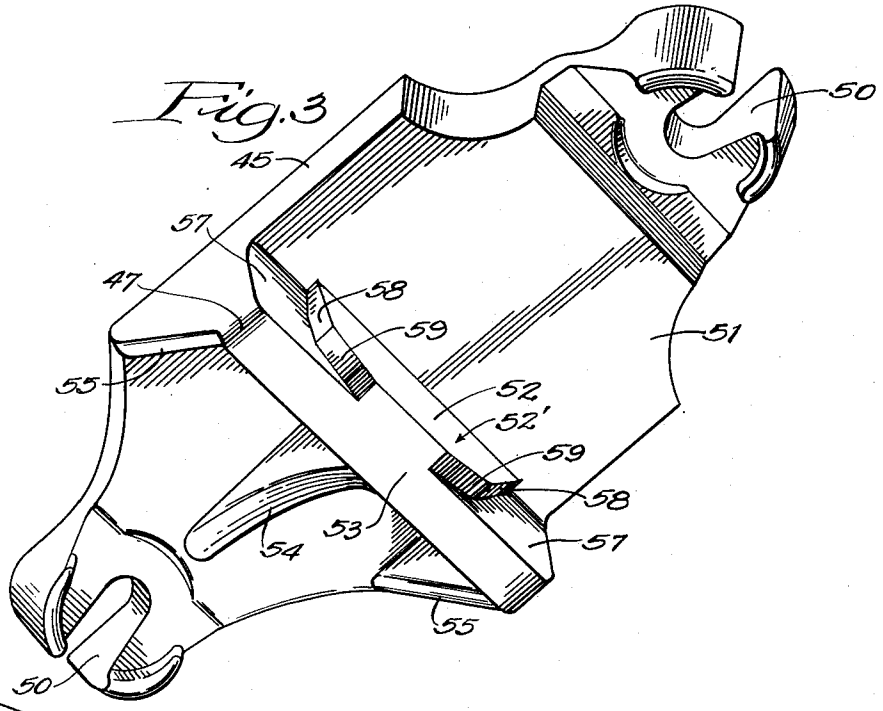
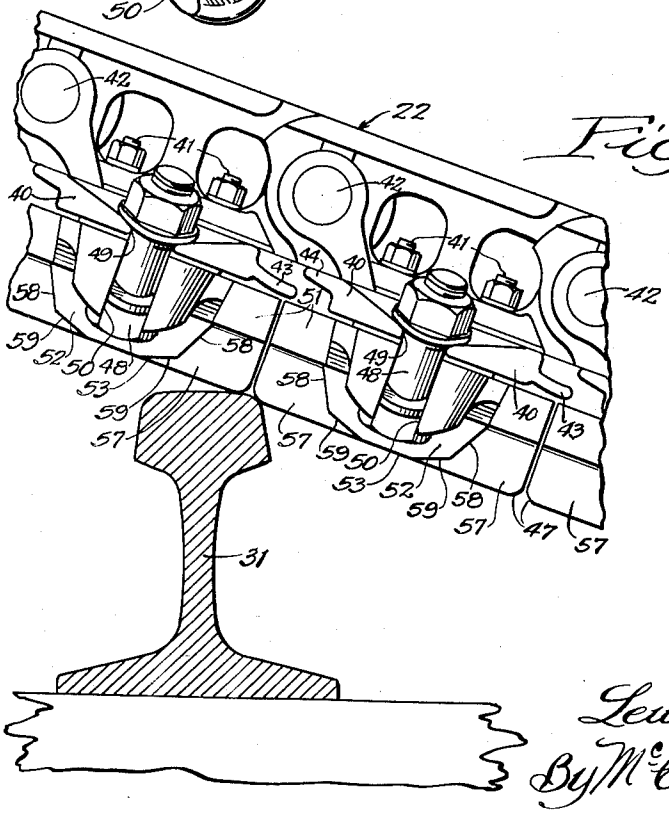


Fig. 4



Inventor:
Lewis E. Younie,
By McCaleb, Hendt & Dickinson
Attorneys.

March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 3

Fig. 5

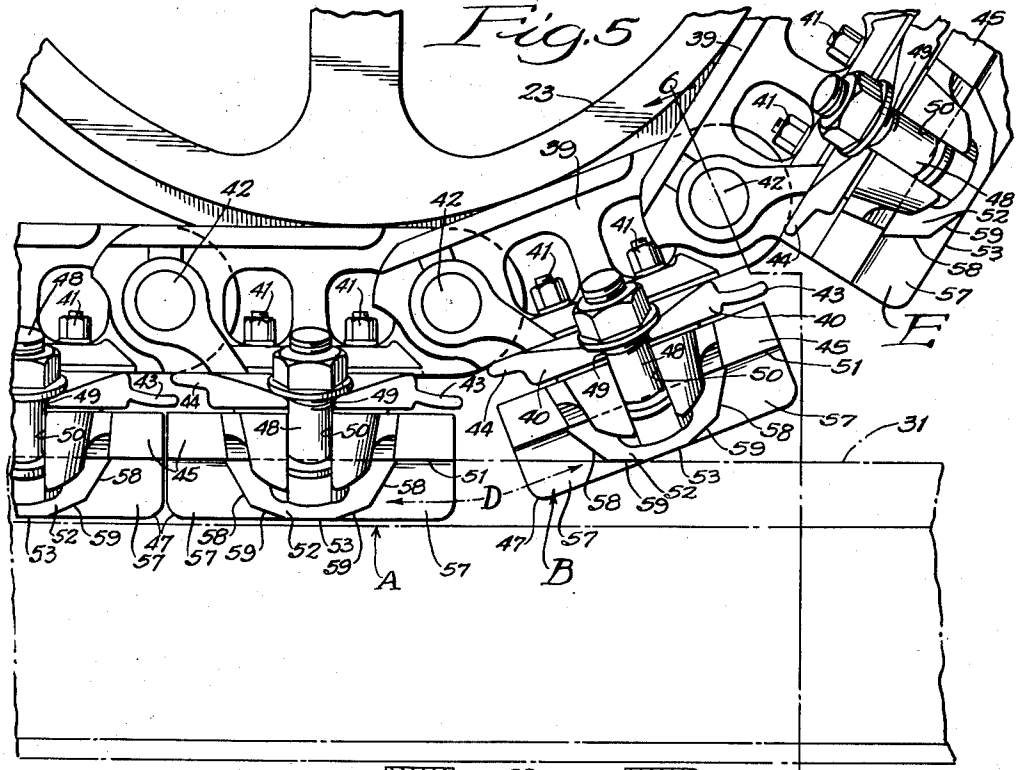
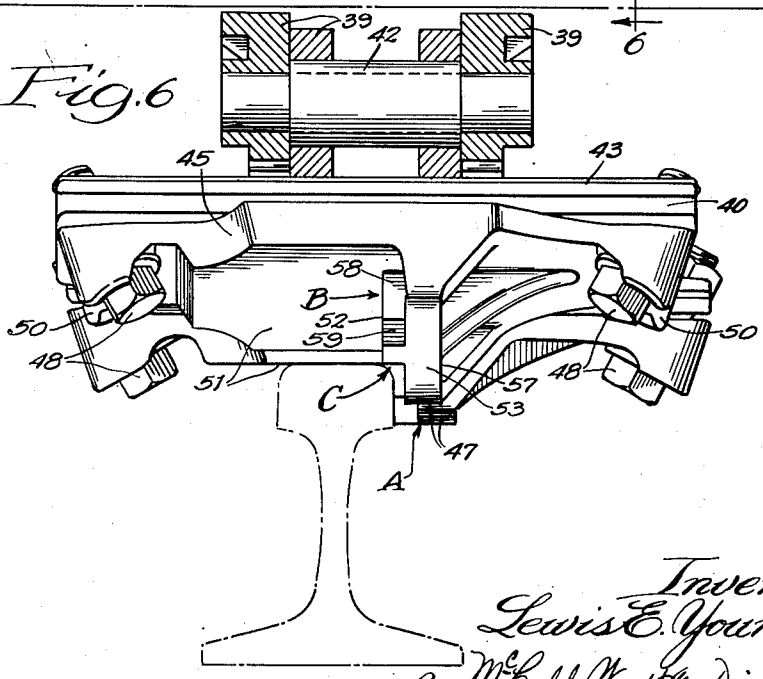


Fig. 6



Inventor:
Lewis E. Younie,
By McCabe, Wendt & Dickinson,
Attorneys.

March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 4

Fig. 7

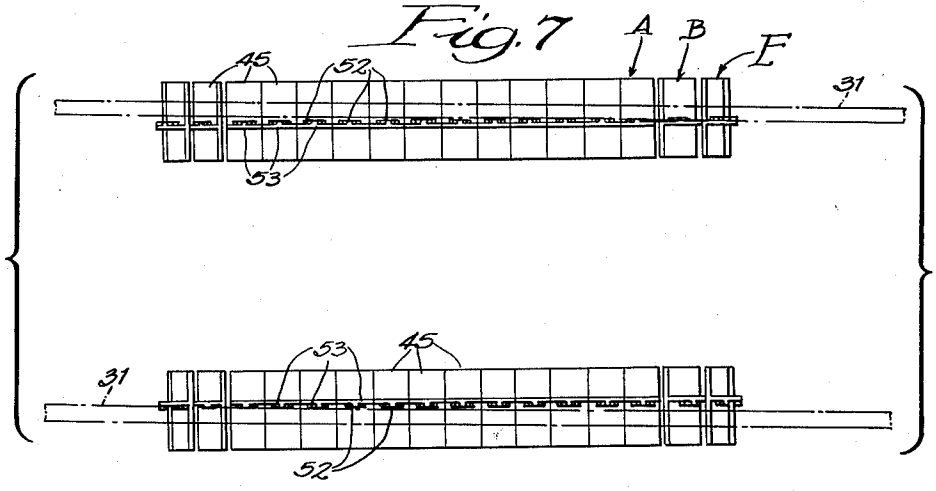
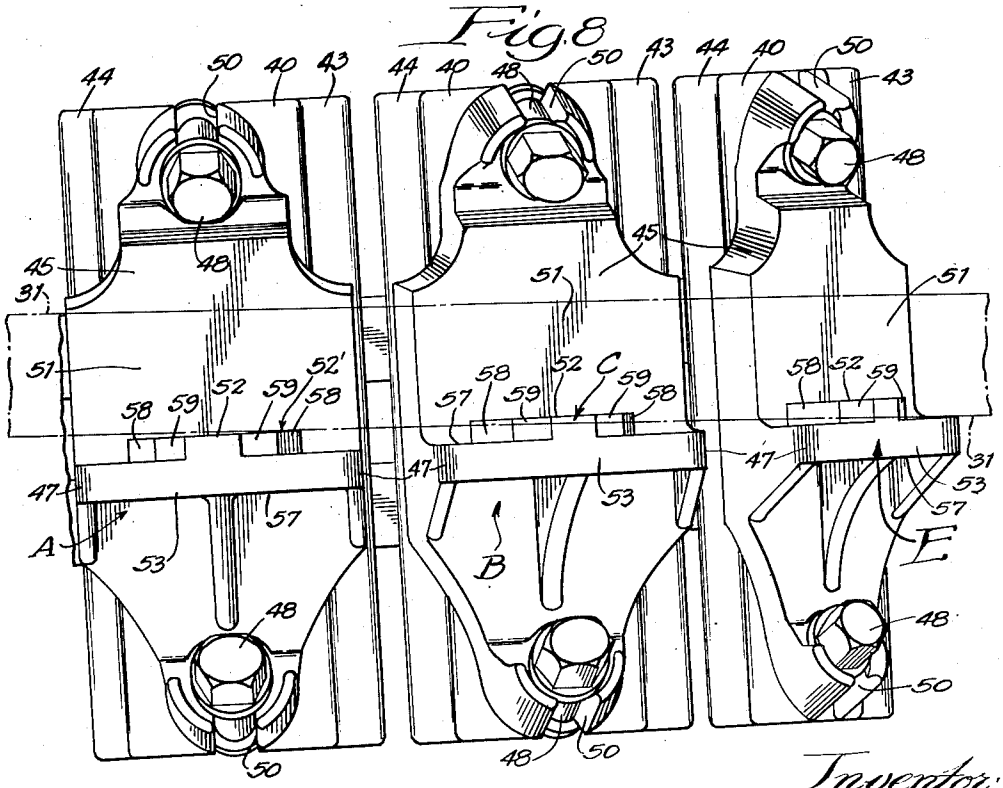


Fig. 8



Inventor:
Lewis E. Younie,
By McCaleb, Reuld & Dickinson
Attorneys.

March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 5

Fig. 9

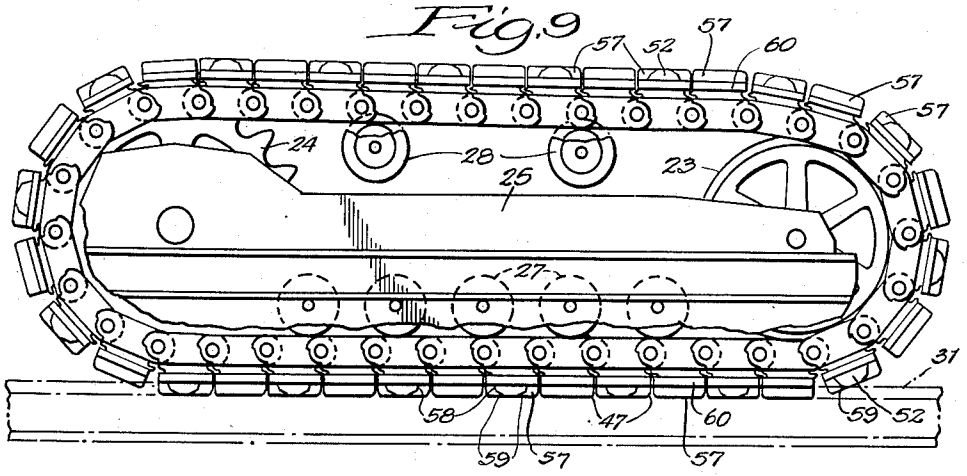


Fig. 10

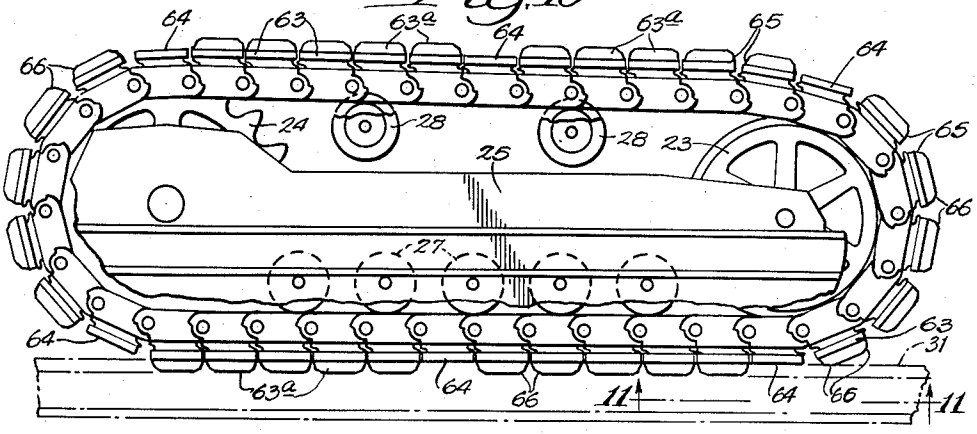


Fig. 10A

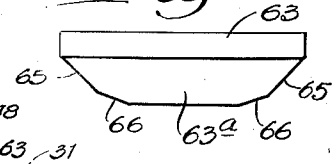
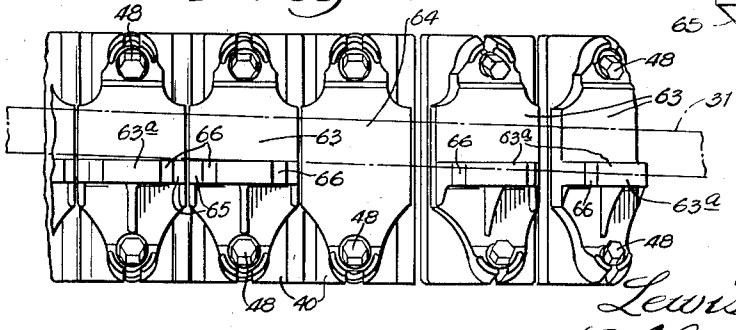


Fig. 11



Inventor.
Lewis E. Younie,
By McCaleb, Wendt & Dickinson
Attorneys.

March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 6

Fig. 12

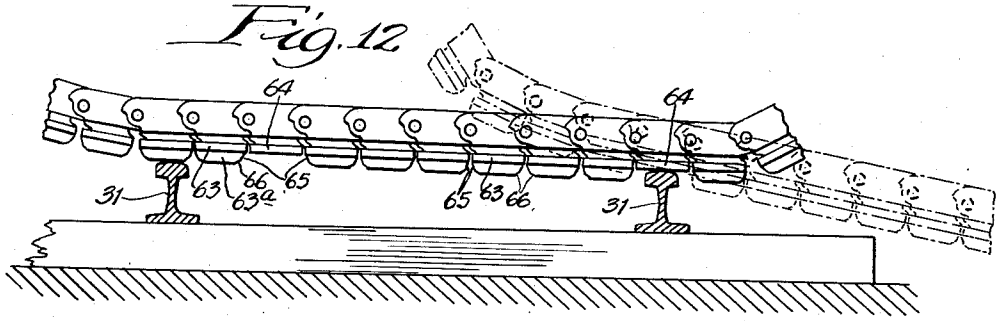


Fig. 13

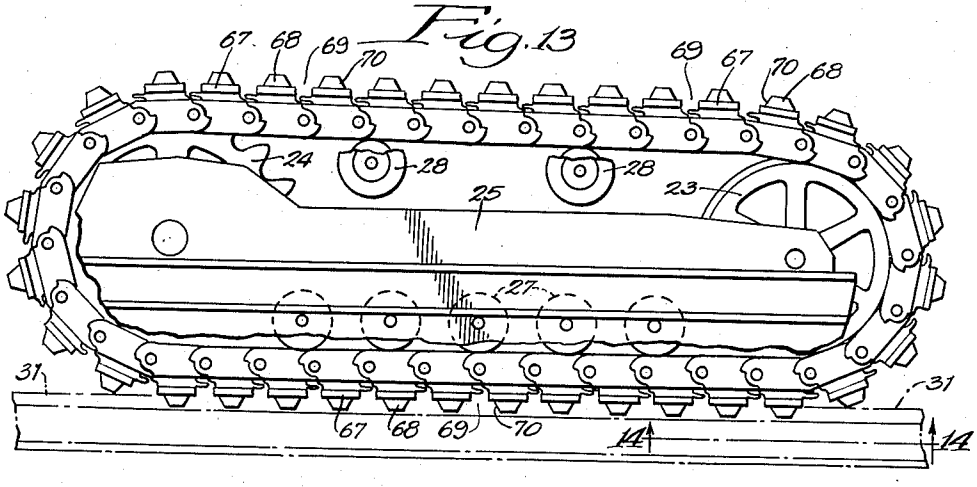


Fig. 14

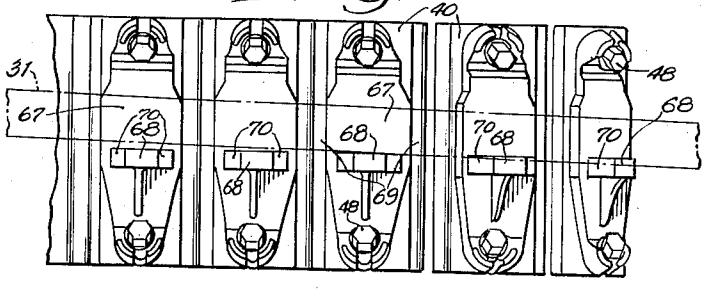
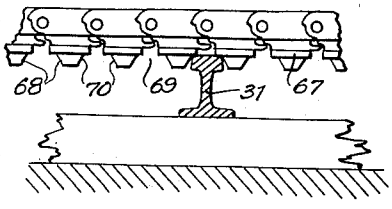


Fig. 15



Inventor:
Lewis E. Younie,
By McCaleb Wendt and Dickinson
Attorneys.

March 21, 1944. L. E. YOUNIE 2,344,764

CRAWLER TRACTOR

Filed May 15, 1941 7 Sheets-Sheet 7

Fig. 16

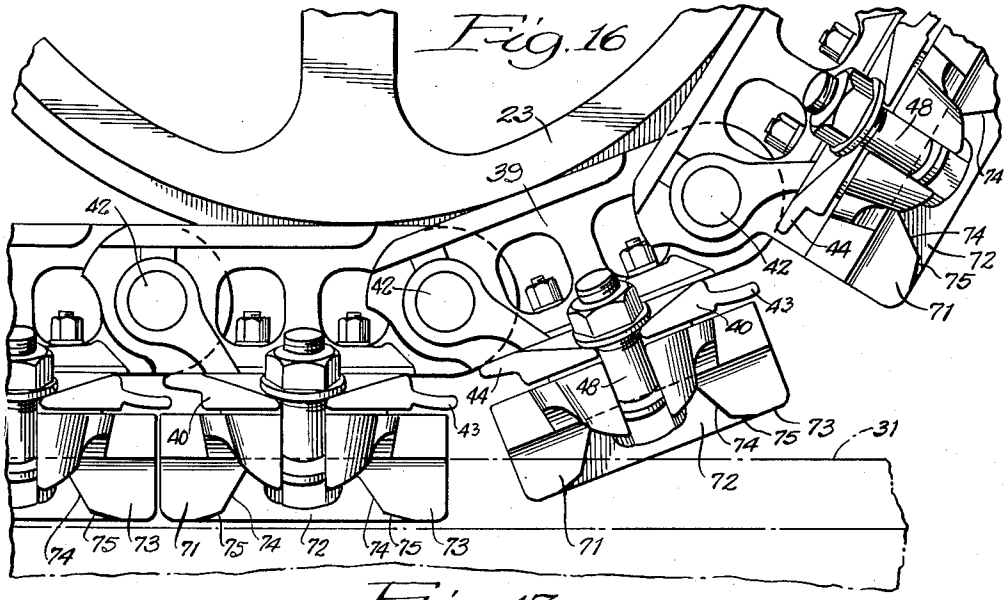
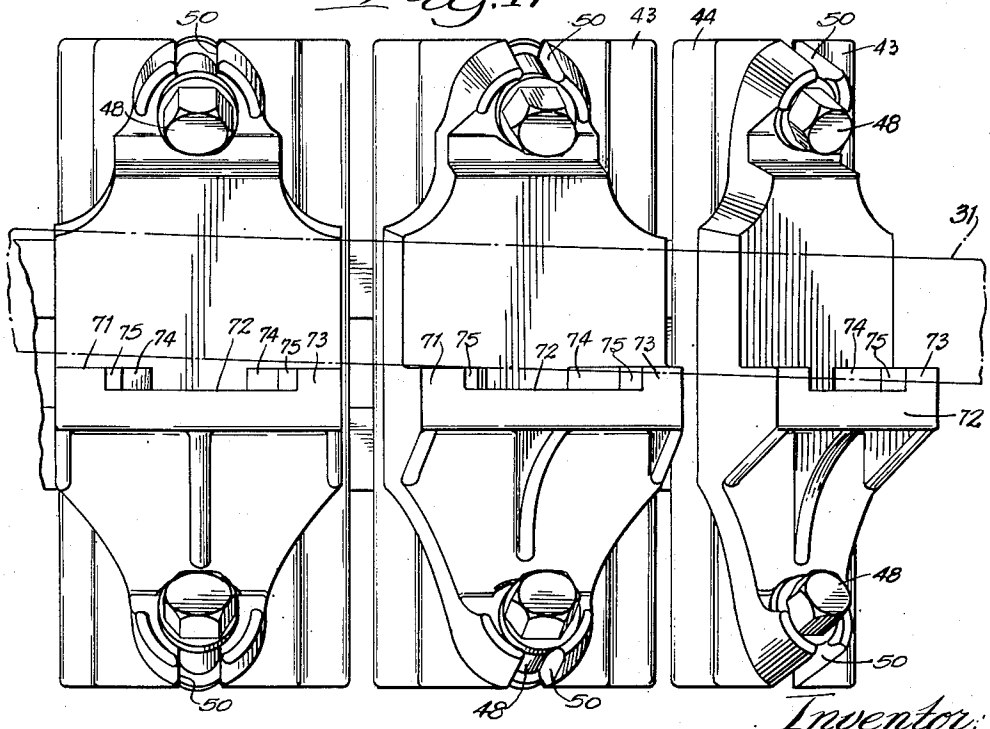


Fig. 17



Inventor:
Lewis E. Younie,
By McCaleb, Hewitt & Dickinson
Attorneys.

Patented Mar. 21, 1944 2,344,764

UNITED STATES PATENT OFFICE

2,344,764

CRAWLER TRACTOR

Lewis E. Younie, Portland, Oreg., assignor to Electric Steel Foundry, Portland, Oreg., a corporation of Oregon

Application May 15, 1941, Serial No. 393,545

29 Claims. (Cl. 105—215)

This invention relates to endless strack- or crawler-type tractors, and is more particularly concerned with improvements in an endless track construction adapting such a tractor to be run, at the driver's will, selectively either as an ordinary free-traveling tractor or as a railway tractor.

In construction and maintenance work on railways, many operations of grading and ballast distribution can be accomplished most advantageously by running the tractor—which carries the grader, scoop, shovel, or the like—in self-steering relation upon the rails. Substantial advantage is also gained in running the tractor on the rails for moving railway cars short distances in construction work or in spotting or switching cars in railway yards. Moreover, it is often of advantage to be able to run a tractor on rails as the quickest route between locations.

To render these operations of the tractor really practicable, however, the tractor must be readily maneuverable off of the rails whenever and wherever the driver wills, without assistance. This is particularly true where work is in progress on main line rails where the tractor must be removed from the rails quickly to permit trains to pass by. In spotting or switching work, the tractor should be able to run off the rails quickly to reach the desired cars.

To adapt the tractor to run on rails and be confined thereon in a self-steering manner, the track shoes have been provided with depending flange lugs which correspond somewhat to the retaining flanges on car wheels. To render the tractor readily maneuverable off the rails at the will of the operator, these depending flange lugs have further been arranged with gaps between them. Some flange lugs, with inter-lugs gaps to facilitate intentional derailing, are the subject-matter of the copending application of Murray E. Burns and George M. Bonnell, Serial No. 380,256, filed February 24, 1941.

In the interest of brevity—but perhaps at the sacrifice of clarity—the climbing out action effected by these inter-lug gaps may be outlined as follows: The driver creates a very definite steering effort to the right, for example, by driving the left track ahead of the right track, by braking on the differential as is usual in crawler tractors. This steering effort produces a slight angular relationship between the two lines of flange lugs depending from the two tracks and the inner faces of the two rail heads, as permitted by the normal clearance spaces between the flange lugs and the rail heads. This slight angular relationship, plus a gap immediately ahead of the foremost flange lug of the bottom reach of the right track, enables the next foremost flange lug, which is descending around the front track wheel, to gain a slight overlapping bite upon the upper surface of the rail head. This slight overlapping bite is maintained by the lateral thrust or crowding due to the turning effort, as against tendency to be cammed down beside the rail head due to rounded corners on the rail head or flange lugs. Continued travel of the tracks will cause the slight overlapping bite to elevate the neighboring shoes and permit the lugs of descending shoes also to ride on top of the rail when they reach the bottom reach of track, whereby the tractor may be run off the rails.

The flange lugs must necessarily be constructed in such a manner as to maintain the tractor on the rails with certainty against the tracks accidentally running off of the rails under the various conditions encountered on a railway road bed. In addition, the flange lugs must be designed to withstand the rough usage to which they are subjected when the tractor is operated separate from the rails, because, due to their projecting structure, the lugs generally receive the brunt of the load and wear as the tractor is driven over hard or rough or rock-covered roadways or terrain. Moreover, the tractor may often have to pass over the rails crosswise or obliquely in moving from one side of the railway to the other or in maneuvering the tractor onto the rails. In such instances, the flange lugs must not only be capable of withstanding the full load of the tractor, but they must also avoid any tendency to grip the rail heads with damaging effect.

The greater the length of the gaps between the flange lugs, the greater will be the above-mentioned overlapping bite, and consequently the better the climbing off or derailing action. For this purpose, it is desirable to have the flange lugs as short as feasible so that the gap between them will be greater. But, on the other hand, shortening the length of the flange lugs is at the expense of their retaining function, their strength, their bottom wear surfaces, and their liability to grip the rail heads between them in passing crosswise or obliquely of a rail.

Thus, the length of the flange lugs has heretofore been subject to conflicting desirability and in practice has been fixed at a compromise balance of feasibility as between the various functions involved. Because this has had to represent a compromise, the climbing out action has not been

as good as desired and the strength, wear, and rail head gripping characteristics have been more or less sacrificed in the interests of a reasonably satisfactory climbing out action.

One of the features of my invention is that the flange lugs are so designed that this conflict of desirable functions and compromise between them is quite eliminated. By my invention the gap which effects the climbing out action may be, within reasonable limits, as great as desired to give the best climbing out action, but yet some—and preferably all—of the functions of retention on the rails, large bottom wear surface, strength, and freedom from gripping rail heads when crossed, may be maintained at their desired maximum without compromise in favor of the climbing out action.

Another object of my invention is a design of flange lug in which the above-mentioned overlapping bite is improved and the tendency of the biting corner of the flange lug to wear away in the course of time is substantially retarded.

Still another object is the provision of flange lugs with gaps to effect the climbing out action, but where the climbing out action, and more specifically the effective overlapping bite, is not diminished by lateral play between adjoining shoes. I achieve this latter object preferably by the structural simple expedient of forming the gaps, which effect the climbing out action, as intra-shoe gaps as distinguished from the inter-shoe gaps heretofore employed.

Other objects and advantages will become apparent from the following description of specific embodiments of my invention and from the accompanying drawings illustrating the same, in which:

Fig. 1 is a side elevational view of a crawler-type tractor equipped with tracks embodying the features of the invention;

Fig. 2 is a front elevational view of the tractor with central and outward portions of the grader attachment carried thereby broken away at the center for clarity of illustration and at the ends by reason of limited space available for this view;

Fig. 3 is an upwardly looking perspective view of one of the auxiliary track shoes of my preferred form, and prominently disclosing the depending flange lug of the shoe;

Fig. 4 is a fragmentary side elevational view of a bottom reach of one of the tracks of the tractor, showing it passing crosswise over a rail;

Fig. 5 is a leftwardly looking fragmentary side elevational view showing the leading shoes of the right side track of the tractor with one of the depending flange lugs in position to effect derailment of the tractor;

Fig. 6 is a fragmentary front elevational view, partially in section, taken substantially along line 6—6 of Fig. 5;

Fig. 7 is a schematic bottom view of the two tracks of the tractor in slight angular relationship to the rails preparatory to the climbing off or derailment action;

Fig. 8 is a bottom view of substantially that portion of the track illustrated in Fig. 5;

Fig. 9 is a fragmentary side elevational view of a tractor track showing a modified arrangement of the derailment structure of the flange lugs;

Fig. 10 is a similar fragmentary side elevational view showing another modified arrangement of the flange lugs;

Fig. 10A is an enlarged diagrammatic detail of a flange lug of one of the shoes of Fig. 10;

Fig. 11 is an enlarged bottom plan view of a section of the bottom reach of the track shown in Fig. 10 substantially in the plane of line 11—11, indicating the approximate relation thereof to a rail to initiate derailment of the associated tractor;

Fig. 12 is a fragmentary side elevational view of the form of track shown in Fig. 10 illustrating certain relationships of the flange lugs to the rail heads when crossing the rails;

Fig. 13 is a fragmentary side elevational view of a tractor track showing a further modified form of traction shoe;

Fig. 14 is an enlarged fragmentary bottom plan view of a section of the bottom reach of the form of track shown in Fig. 13, taken substantially in the plane of line 14—14 illustrating the initiation of derailment;

Fig. 15 is a fragmentary side elevational view showing the relationship of the flange lugs of the modification of Fig. 13 to a rail when crossing the rails;

Fig. 16 is a fragmentary side elevational view of a tractor track showing a still further modification of the flange lug structure; and

Fig. 17 is a bottom plan view of the section of tractor track shown in Fig. 16.

My invention is shown incorporated in the tracks of a crawler-type tractor 20 (Figs. 1 and 2) of a well-known and standard design, that illustrated being, specifically, the construction and design known commercially under the name of "Caterpillar" tractor.

The tractor 20 has a body or chassis 21 mounted to travel upon left and right endless tracks 22. Each track is trained about a front wheel 23 and a rear drive sprocket 24, which are respectively journaled in a track frame 25 pivotally mounted under the chassis 21.

The bottom reach or traction run of each track is held straight by a series of lower rollers 27 journaled in the track frame 25, and the upper reach or return run is supported by idling rollers 28. A motor 29 drives the sprockets 24 through the medium of a differential transmission (not shown). Control over operation of the tractor is effected by means of the usual pedals and levers including steering levers 30, braking on the transmission to cause either selected one of the tracks 22 to slow down or travel ahead relative to the other track to steer the tractor to left or right as may be required.

In grading work on railway beds, for which the tractor is preferably run directly upon rails 31 supported by the bed, a grader attachment 32 may be mounted at the front of the tractor upon the end of a boom 33 pivotally connected as at 34 to the track frame 25. The grader attachment may be supported for vertical adjustment by a cable 35 passing over a suitable pulley arrangement on a super-structure 37 and connected to be wound upon and unwound from a power winch 38 at the front of the chassis 21.

Each of the tracks 22 comprises an endless belt-like series of interpivoted link sections or shoes, each of which inludes an assembly of a spaced parallel pair of side or link rails 39 (Figs. 5 and 6) connected in alignment to an elongated, transversely extending primary shoe plate 40 attached thereto as by means of bolts 41. As best seen in Fig. 6, the end portions of the shoe plate 40 extend substantially equally beyond the

opposite sides of the link rail structure. These shoe assemblies are pivotally interconnected in longitudinal alignment by means of pintles 42 which extend through the overlapping end portions of the link rails 39. The adjacent ends of the shoe plates 40 are provided with overlapping front and rear flanges 43 and 44, respectively.

The shoe plates 40 are equipped with a flange lug structure the primary function of which is to enable running the tractor upon the rails 31 without, under ordinary operating conditions, requiring any steering on the driver's part. This lug structure is further so constructed and arranged that, as its secondary function, it permits the driver to maneuver the tractor easily and quickly off from the rails whenever and wherever desired. Where expedient, the flange lug structure may be integral with, or attached directly to, the primary shoe plates 40; but, as here shown, I prefer to form the flange lugs 47 as integral, transverse, depending parts of elongated auxiliary shoes 45 which are attached to the plain faced primary shoe plates 40. The auxiliary shoes 45 are preferably of substantially the same width and length as the primary shoe plates 40 (Fig. 6) and are detachably connected to the latter as by means of bolts 48.

In order to facilitate detachable connection of the auxiliary shoes 45 to the associated shoe plates 40, the attaching bolts 48 are received in slots 49 and 50 (Fig. 5) located in alignment at the ends of the assembled shoe plates 40 and auxiliary shoes 45, respectively, the slotted ends of the auxiliary shoes being preferably toed in the direction of their traction faces and thickened for greater strength and to assist the bolts in anchoring the shoes. The top or back faces of the auxiliary shoes 45 may be flat so as to present a full bearing surface against the shoe plates 40. On their traction faces, each of the auxiliary shoes 45 is formed with an intermediate flat surfaced thickened portion or pad 51 affording a strengthened tread for engagement with the top surface of the rail 31 upon which the tractor may be riding (Figs. 3 and 6).

The flange lugs 47 depend substantially perpendicularly from the inner ends of the respective tread areas 51 and are preferably dimensioned as to thickness and depth, comparably with the usual wheel flanges on railway rolling stock so as to be accommodated by the ordinary clearances encountered along the rails 31. For clarity and for comparison with the flange lugs shown in the previously mentioned Burns and Bonnell application, Serial No. 380,256, each flange lug 47 may be considered as a composite of two lug bodies—a relatively long major lug body 57 and a shorter minor lug body 52 in the nature of a promontory at the outer side of the major lug body. The outer vertical face of the minor or promontory lug body constitutes a lateral guiding or rail-opposing face 52'. The major and minor lug bodies are preferably coextensive in depth so that they have a common bottom or traction face 53 substantially parallel to the tread 51, which serves as a primary supporting face for the tractor when the tractor is not running on the rails. The minor or promontory lug body 52 is considerably shorter than the main body 57, and its end edges 58, by which the rail-opposing face 52' is set outwardly from the outer face of the main body, are preferably inclined as shown to give the promontory body 52 a wider and therefore stronger base. The corners formed by the bottom or traction face 53 and the end edges 58 of the promontory body 52 are preferably obliquely chamfered as at 59 for a purpose which will later be explained.

All of the rail-opposing faces of the minor lug bodies 52 and the traction faces 53 of the several shoes of the respective tracks 22 extend in aligned planes in the bottom or traction runs of the tracks. Thus, the aligned rail-opposing faces are adapted to co-operate, when the tractor is running upon the rails 31, to retain the tractor upon the rails without much side sway. Also, the aligned traction faces 53 combine to afford a substantial primary supporting area to carry the tractor when it is off of the rails, although in soft ground, gravel, or crushed stone the lugs will sink to permit other surfaces of the auxiliary shoes to share the load. Reinforcement of the flange lugs 47 against lateral thrust in working against the rails, or in use off the rails, is afforded by sets of outwardly extending bracing ribs 54 and 55 placed at the center and ends of the lugs.

In the present instance, a maximum area for the traction surfaces 53 is obtained by making the major bodies 57 of the flange lugs 47 of full length to approach one another closely at their adjacent ends. In the bottom or traction run of the track, therefore, the traction faces 53 present a substantially continuous traction area except for small clearance spaces between the ends of the flange lugs. As shown in Fig. 4, the avoidance of any large gap between the ends of the flange lugs 47 also eliminates gripping of the rail heads 31 when the tractor is run across the rails at either a right angle or an oblique angle thereto. The full length of the major bodies 57 of the flange lugs also gives them more body and hence more strength.

Having described the structure and advantages of my improved flange lug as regards its other functions, I shall now describe its structure and advantages as regards its climbing-off or derailing function.

First, it will be understood that the distance between the rail-opposing faces 52' of the flange lugs 47 of the two tracks 22 of the tractor is preferably substantially the same as the distance between the outer faces of the wheel flanges of railway rolling stock. In practice, this is about one inch less than the gauge dimension (the distance between the inside faces of the rail heads) of the particular rails upon which the tractor is to be run. When the tractor is centered on the rails, therefore, there is approximately a half inch clearance at each side between the flange lugs 47 and the rail heads.

This clearance between the flange lugs and the rail heads and the lateral play thus permitted is important because it is utilized in maneuvering the tractor off from the rails when and where the driver wills. In a crawler tractor, steering mancuvers are usually accomplished by differentially driving the tracks 22, one ahead of the other depending upon the side toward which the tractor is to be turned. When the tractor is running upon the rails 31, the turning effect is, of course, limited by the rather small clearance between the rail heads and the flange lugs. Nevertheless, as indicated in Fig. 7, there is a definite turning of the two tracks with respect to the rails, the degree of the angle assumed being somewhat exaggerated the better to illustrate the derailing action.

As a result of the turning action, the leading flange lugs of the bottom or traction run of the

track on the side toward which the steering effort is directed toward the right as exemplified in Figs. 5 to 8) is crowded laterally against the adjacent rail head. In this action the trailing lug of the opposite track is crowded laterally against its rail head.

In Figs. 5, 6, 7 and 8, the crowded leading flange lug 47 is identified by the reference character A. The slight angular relationship, between the rail and line of rail-opposing faces 52' of the lugs, established by this steering effort causes the minor lug body 52, of the next forward flange lug 47, identified by the reference character B, which is just descending from the front arc of the track toward the plane of the rail top, to overlap the top of the rail head slightly as indicated at C.

In the absence of turning effort of the tractor, engagement of the rounded corner of the rail head by the edge of a descending promontory 52, tends to cam the flange lug down beside the rail head. Thus the tractor is normally confined to running on the rails, without requiring steering by the driver.

In addition to performing the primary function of keeping the tracks on the rails, therefore, my flange lugs 47 are especially constructed to provide derailing means brought into action at the place and the time the operator desires to derail the tractor. This derailing action is accomplished at the time that the lines of tracks are brought into the slight angular relationship to the rail heads, as previously described.

Referring to Fig. 8, the rail-opposing face 52' of the flange lug A, which is on the leading shoe of the bottom reach of track, contacts the near side of the rail head 31. At that position the minor or promontory lug body 52 of the next forward lug B, as shown in Fig. 5, lies wholly above the level of the top of the rail and, as shown in Figs. 6 and 8, slightly overlaps the near margin of the top of the rail at C. The set-back of the outer face of the major body 57 relative to the rail-opposing faces 52', as between the flange lugs A and B, forms a downwardly and outwardly opening gap D (Fig. 5) which receives or accommodates the near portion of the rail head and thus makes the overlap C possible.

The chamfering 59, which is preferably employed at the corner where the end edge 58 of the promontory 52 meets the traction face 53, is at such an angle that it lies parallel with the top face of the rail head when the promontory first contacts the rail head at the overlap C. This gives a greater surface of initial overlapping traction, making the climbing out action more positive as well as retarding the otherwise concentrated wear at the region C of overlap.

In the continued forward movement of the tractor from the position of Fig. 5 to Fig. 8, the steering effort maintains an outward crowding of the promontory 52 of the flange lug B to resist tendency of the traction face 53 of the promontory to cam itself over the somewhat rounded margin of the top of the rail head and down into a position at its side, and by that crowding maintains the bite of the overlap C. At the same time the continued forward movement of the tractor causes the forward track wheel 23 to ride further on to the track shoe carrying the flange lug B. And as the overlap C holds the promontory 52 of that shoe to the level of the top of the rail head, the track wheel 23 together with the front end of the track is elevated until the traction face 53 of the flange lug B lies upon and parallel to the top of the rail head. In this manner, incidentally, the contact of the overlapping bite is rocked from the chamfer facet 59 to the traction face 53 of the promontory.

In the continued forward movement of the tractor, the next forward shoe carrying the flange lug E (Figs. 5 and 6) will descend about the arc of the wheel 23 and the traction surface 53 thereof—or possibly initially the near chamfer 59 thereof—will engage the margin of the top of the rail head with a still greater width of overlapping bite as predicted by Fig. 8. Succeeding descending flange lugs will progressively secure greater width of overlapping bites. By the time that three or four flange lugs have thus descended with increasing overlapping bites, the track has enough traction on the top of the rail head to enable the tractor to be turned through an increasingly greater angle to the track than the relatively slight initial angle before the climbing out started, and then the tractor can be run off the rails, if desired, at the rather abrupt angle.

Thus the climbing out action is accomplished within a very short forward movement of the tractor after the driver makes the initial steering effort to initiate the derailment.

For the purpose of standardization, to permit derailment of the tractor by either forward or reverse movement, and also to permit the auxiliary shoes to be used interchangeably on right and left tracks, the auxiliary shoes, and flange lugs depending therefrom, are symmetrical on either side of their vertical center lines passing between the attaching bolts 48.

It should be remembered, of course, that to effect the turning out or derailing action of the flange lugs 47 as described, a substantial and continued forceful lateral thrust created by the steering or turning effort of the tractor must be maintained in order to hold the relatively slight overlap of the derailing face 59 and the rail head and to overcome the normal tendency of the flange lug 47 to cam the track back to centered relation to the rails 31. This camming effect becomes more pronounced as the edges and surfaces of the flange lugs 47 become rounded from wear. In the absence of steering effort, the tracks 22 are held positively upon the rails in spite of substantial side-sway resulting from such conditions as unevenness in the rails or ordinary twisting forces to which the tractor may be subjected from the nature of the work it is performing; and it requires conscious, forceful steering action on the driver's part to derail the tractor.

(Occasionally unusual conditions may be encountered where the steering effort of the tractor is artificially created, in the absence of steering manipulation by the driver, as where the tractor has a decidedly one-sided drag as by one of the laterally extended spreader wings meeting the resistance of a pile or windrow of earth or crushed stone. The driver can, of course, anticipate such situations and appropriately manipulate the steering levers 30 to counteract the derailment action.)

Thus, by my invention the derailment is accomplished by the simultaneity of (*a*) the gap D between adjacent promontories 52, (*b*) the relationship of the tracks to the rails, as shown in Fig. 7, (*c*) the maintained lateral thrust or crowd, and (*d*) the forward (or reverse) movement of the tractor.

Since the angular relationship (*b*) and the lateral thrust (*c*) are incidents of the steering effort, and they in turn are in practice at least secured only while the tractor is moving along the track,

it can be more simply stated that the derailment is accomplished by providing the gaps and the steering effort.

One of the outstanding virtues of my present invention may be explained this way: In tracks of the design shown in the previously mentioned Burns and Bonnell application, the same or single flange lugs carried by the respective shoes perform the functions of (*a*) forming the gaps and defining the corners for effecting the climbing out action, and also (*b*) providing the bottom traction surface and preventing the rail heads from being gripped between the flange lugs when crossing over rails. This presents practical and designing problems because the flange lug should be relatively short to yield a wider gap, the more successfully to perform the climbing out function (*a*); while at the same time the flange lug should be relatively long, the better to perform function (*b*). This makes it difficult to determine an optimum length for the flange lugs and in any event it represents a compromise of the functions (*a*) and (*b*). By my invention I have, in a sense, segregated the structures for the respective functions (*a*) and (*b*) so that each may be brought to its maximum or preferably its optimum without compromise with the other function.

Thus, I have created the minor flange lug body or promontory **52** and given it the climbing out function while giving the main body **57** the function (*b*). Accordingly, I can make the promontory as short as I wish to yield the most desirable length of gap. And at the same time I can make the main body **57** as long as the interpintle distance or pitch of the track shoes to yield the maximum bottom traction surface, lug strength and elimination of rail head grab. Even though the minor body or promontory **52** is relatively small, it is not at the sacrifice of its strength, because it is backed up by its integral formation with the sturdier main body.

In determining the desirable length of gap, and consequently the length of the promontory **52**, consideration is to be given to the fact that at the time the gap comes into play, it is somewhat increased because of the arcuate spreading as between the lug A and the lug B about the axis of the intermediate pintle **42**, as will be apparent from Fig. 5.

The modified form shown in Fig. 9 differs from the form above described by the omission of the promontories **52** from the flange lugs of alternate shoes **60**. This leaves the main bodies **57** of the alternate shoes **60** in alignment with the main bodies **57** of the intervening shoes which do carry the promontories **52**. Thus the gap between adjoining promontories **52** is increased by the interpintle distance of one shoe. Referring back to Fig. 8 for comparison, the gap would be enlarged to that between the promontories on flange lugs A and E, with a promontory **52** omitted from the flange lug B. The overlapping bite would thereby be greatly increased and the climbing out action would require less lateral crowding or thrust from the turning effort. Or, alternatively, less gauge clearance is required. This form may better suit rail heads which have excessively rounded edges or where the lateral face of the rail head is pronouncedly inclined from the vertical, although the latter is ordinarily better to be accommodated by correspondingly inclining from the vertical the rail-opposing faces **52'** of the promontories; the substantial continuity of succeeding main lug bodies **57** precludes any grabbing of rail heads in crossing over rails and also preserves large traction surface for the tracks when not running.

In the modification shown in Figs. 10, 11 and 12, the shoes, or auxiliary shoes, **63** carry flange lugs **53***a*, which may be of full width and full length, but the flange lugs are wholly omitted from some shoes **64**—say every fifth, sixth, or seventh shoe.

As will be seen from Fig. 11, the omission of a flange lug from the shoe **64**—or in extreme cases from a pair of adjoining shoes—provides a long gap which yields a climbing out action comparable with Fig. 9.

However, the form of Figs. 10, 11 and 12, as compared with the form of Fig. 9, would ordinarily have the disadvantage of clamping or seizing the rail heads when the tractor passes over them. The gap provided is ample to prevent seizure of a rail head within that gap when passing over rails substantially crosswise. But when the tractor is crossing over a rail at some oblique angle, a rail head would still be subject to seizure in one of the gaps. Also, in passing over rails either crosswise or obliquely, there is a possibility that two rails—the two main rails, or a rail and a guard rail, or diverging rails at switches—might be so spaced that one rail would lie against the forward end of one gap and the other rail lie against the rearward end of another gap, and a somewhat similar seizure result.

To avoid any such complications, I prefer, as shown in the form of Figs. 10, 11 and 12, to slant off the ends of the flange lugs at an angle of about forty-five degrees, as indicated at **65** and shown more accurately in the enlarged detail diagram of Fig. 10A. This may be supplemented by corner chamfers **66** corresponding to the corner chamfers **59** of Fig. 3 and for the same purpose. The slanting off the ends of **65** will permit the flange lugs to free themselves from any rail head entering a gap between lugs at lugless shoes **64**. In a track of the form of Fig. 10, the slanted off ends **65** function chiefly when they adjoin lugless shoes **64**, but for the sake of uniformity and interchangeability, I prefer to use the slanting off **65** at both ends of all lugs.

The form of Figs. 10, 11 and 12, like the form of Fig. 9, because it provides such long gaps and such facile climbing out action, may be subject to the disadvantage of a tendency toward too ready a climbing out and derailment if not carefully designed.

In the form of Figs. 13, 14 and 15, the depending shoes **67** carry flange lugs **68** of full width throughout but considerably shorter than the width of their auxiliary shoes. In the interest of a better climbing out action, the inter-lug gaps **69** are made relatively long, and as a result they are large enough to receive a rail head in crossing over a rail, as shown in Fig. 15. To prevent their rail head seizure, the ends of the flange lugs **68** are slanted off at **70**, corresponding to the slanted off ends **65** shown in Fig. 10A. It will be understood that the flange lugs **68** may also be provided with chamfers like that shown at **66** in connection with the form of Figs. 10, 11 and 12.

As will be seen from Fig. 15, the slanting off of the ends as at **70** will permit the lugs to cam themselves out of engagement with the rail head rather than lock thereto.

I might explain, in connection with this rail head seizing problem in general, that where inter-lug gaps are normally large enough, or almost large enough, to receive a rail head, there is even

greater danger of seizure when a track is climbing crosswise on to a rail and the rail head comes between the lug of a shoe descending around the front track wheel and an adjoining lug. This is because the gap between the two lugs at that time is somewhat enlarged by the spreading of the lugs due to the track curving around the track wheel. As the gap, with the rail head received therebetween, passes into the bottom reach of track, the gap is ensmalled, which may exert a powerful grip upon the rail head.

In the forms of Figs. 3 and 9, and also in the form of Figs. 16 and 17, presently to be described, the rail seizure problem is eliminated by eliminating any gaps into which the rail might be received. In the forms of Figs. 10 to 15, the problem of rail head seizure is met by slanting off the ends.

It will be understood that in all of the forms thus far described, the climbing out action is fundamentally the same as has been described in detail. When the ends of the flange lugs are slanted off, the gap is somewhat wider at the bottom of the flange lugs than at the top of the flange lugs, and it is the gap at the former which more or less determines the overlapping bite for the climbing out action. Thus the slanting off of the ends has the incidental advantage of preserving a larger and stronger base for the flange lugs while increasing the effective length of the gap for the climbing out action.

The characteristic of the form shown in Figs. 16 and 17 is that the gap employed for the climbing out action is an intra-lug gap rather than an inter-lug gap as it is in the previously described forms. This form can best be understood by initially describing it in terms of its comparison with the preferred form of Fig. 3. Thus the main body 72 of the flange lug corresponds to the main body 57 of Fig. 3. There are twin promontories 71 and 73, one at each end of the main body 72. These twin promontories may be considered as formed by medially halving the promontory 52 of Fig. 3, putting the forward half at the trailing end of the flange lug as the promontory 71 and putting the trailing half at the forward end of the flange lug as the promontory 73. This places the gap between the end edges 74 of the twin promontories 71 and 73. A vertical section taken in the plane of the twin promontories 71 and 73 would thus be characteristically an inverted U, the twin promontories forming the legs of the U.

Fig. 17 shows how this intra-lug gap functions to afford the characteristic overlapping bite for the leading promontory 43 as it descends to the plane of the top of the rail head. Chamfered corners 75, corresponding to the chamfered corners 59 of Fig. 3, may likewise be employed and for the same purpose.

Here, as in the preferred form of Fig. 3, the outer faces of the promontories 71 and 73 are rail-opposing surfaces which normally confine the tracks to the rails. The lug body 72 affords a relatively large traction surface for the tracks when they are not running on the rails and also keeps any rail head from entering the gap between the promontories when crossing the rails. The main body 72 also acts as a reinforcing web between the promontories 71 and 73 to keep them from being spread apart. For these reasons, I prefer not to eliminate the main body 72 between the promontories 71 and 73 for most purposes, although that might safely be done where a lighter and less sturdier structure can safely be employed as with lightweight tractors.

The form of Figs. 16 and 17 has the objection that for ordinary pitch lengths of shoes, the length of the gap for climbing out action may in practice be somewhat more restricted, and also they do not have the advantage of the enlargement of the climbing out gap by the spreading apart of the flange lugs in passing around the track shoe.

But the form of Figs. 16 and 17 does have an advantage which may be very important in certain types of track construction. In the forms previously discussed, where the gaps are inter-lug gaps, if any lateral play develops as between shoes, so that the flange lug B (Figs. 5 and 8) may shift laterally in reference to the flange lug A when the latter is crowded against the rail head, the overlap of the bite may correspondingly be decreased, and the climbing out action consequently impaired. In the form of Figs. 16 and 17, where the climbing out gap is an intra-lug gap, there can be no such off-setting of the overlapping promontory 73 relative to the crowded promontory 71, no matter how much offsetting there may be as between one flange lug and adjoining flange lugs due to lateral play. Lateral play such as I mentioned may be at the pintle bearings of the shoes, or as between the track rails 39 and the guide flanges of the track wheels 23 or track rollers, or elsewhere. This lateral play may result from less accurate designing and workmanship or from wear.

Another advantage of the form of Figs. 16 and 17 is that the important climbing out corners—at the region of the facet 75 specifically—of the climbing out gaps are better protected against traction wear when not running on rails because those corners are set between and protected by the enlarged ends of the flange lugs. In the form first described, as can be seen from Fig. 5, the climbing out corners at the facets 59 are more exposed to wear.

In describing the double bodied or promontoried forms of flange lugs, I have, for the sake of a clearer analysis to, and differences from, the form of flange lug disclosed in the previously mentioned Burns and Bonnell application, described my flange lug as consisting of a major body and a minor or promontory body. It will be appreciated, however, that these forms may alternatively be described as flange lugs having outer rail-opposing faces with adjoining offsets to form climbing out gaps and define the climbing out corners or shoulders.

In conclusion, it will be seen that in all of the forms I have disclosed, danger of seizing the rail heads in crossing over them has been eliminated without sacrifice of, or compromise with, that length of climbing out gap which yields a more desirable climbing out action. And also, in most of the forms here disclosed, I have further retained a desirable strength and large traction surface for the flange lugs. Additionally, in all of the forms here disclosed, the climbing out shoulder or corner is preferably strengthened by a broadened base by the expedient of the body, which carries the climbing out shoulder, being slanted upwardly and inwardly to the base of the auxiliary shoe.

While my invention is susceptible of various modifications and alternative constructions, and while I have illustrated and described certain

preferred embodiments, it is to be understood that I do not thereby intend to limit my invention to the specific forms disclosed but contemplate that many modifications and substitutions may be made without departing from the scope and spirit of my invention.

I claim:

1. The combination with an endless track-type tractor having right and left parallel tracks for supporting and driving the tractor and having provision for steering the tractor by differentially driving the tracks, each track comprising an endless chain of shoes trained over longitudinally spaced wheels and having tread surfaces for contacting the tops of the rail heads of a railway track, of means for confining the tractor to the rails when normally running thereon and for enabling the tractor, at the will of the driver, to be maneuvered off the rails, said means comprising a longitudinally aligned series of flange lugs carried by each track and projecting beyond said tread surfaces at the inner sides of the associated rail head in a relation thereto similar to that of car wheel flanges, and presenting outwardly facing lateral guide surfaces adapted from time to time to contact the inner face of the associated rail head to effect the confinement, the flange lugs including inwardly extending surfaces disposed adjoining, but transversely inwardly from, the plane of the guide surfaces and at a considerably slanted angle to the vertical, and adapted, when descending from the front arc of the track to the plane of the rail top at a time when the tracks are disposed at the maximum angle to the rails which the confinement by the lugs will permit and at a time when steering effort of the tractor applied to the other track maintains a transverse outward crowd upon the foremost lug of the bottom reach of the associated track, to gain a slight outward overlap upon the near edge of the associated rail head, whereby further descent of the descending lug about the front arc and into the bottom reach of its track will lift the leading edge of the track up to the top of the rail head to permit other lugs of that track subsequently to run on top of the rail head.

2. A crawler-type tractor having tracks including shoes provided with treads and longitudinally elongated flange lugs projecting from said treads and formed with lateral rail-opposing faces co-operating in the bottom runs of the tracks to steer the tractor when running on railroad rails, traction surfaces on the edges of said flange lugs adapted to support the tractor when not running on the rails, and auxiliary surfaces on at least certain of said lugs extending transversely from adjunction with the plane of the rail-opposing faces at considerable angle to the vertical, said auxiliary surfaces being arranged to assist in derailing the tractor at the driver's option by enabling overlapping approach to and engagement of the rail head by the traction surface of the lug of a shoe in advance of the foremost shoe of the bottom run of the tractor on the side of the tractor toward which the driver steers the tractor to run it off of the rails.

3. In combination, in an endless track adapting a vehicle supported thereby to be run upon railroad rails, track shoes each including a relatively broad tread area, flange lugs projecting from the tread areas with their major dimension disposed longitudinally of the track and including longitudinally aligned rail-opposing lateral faces, the edges of said lugs providing traction faces adapted to support the associated vehicle when not running on the rails, each of at least certain of said flange lugs including a transverse auxiliary surface facing longitudinally of the track and extending down from the tread level of the associated shoe to the traction face of the flange lug in a generally longitudinal direction and disposed adjoiningly inwardly of the plane of the rail-opposing faces, whereby to assist in derailing the track when the foremost lug of the bottom run of the track has the rail-opposing face thereof forcefully crowded against the rail as by the strong and continuous steering effort applied by the driver, and the auxiliary surface on the next succeeding flange lug is caused to extend into overlapping relation to the top of the rail so that as said succeeding lug comes toward the bottom run position its traction face is brought into engagement with the top of the rail to lift the track onto and over the rail.

4. An endless track construction for crawler-type tractors adapted to run selectively on open terrain or upon railroad rails comprising, in combination, an articulated series of shoe assemblies including treads and flange lugs depending below said treads, having lateral faces arranged to oppose the adjacent lateral surfaces of an associated rail in the bottom run of the track normally to maintain the tractor upon the rail and relieve the driver of the tractor from the necessity of attending to the steering, each of said flange lugs having, arranged in longitudinal succession, a plurality of transverse surfaces disposed in angular relation to each other and inwardly adjoining the plane of the rail-opposing face, one of the surfaces facing downwardly and another longitudinally and downwardly, the said plurality of surfaces on the flange lug of the shoe in advance of the foremost shoe of the bottom run of the track being adapted to come into successive overlapping engagement with the near margin of the top of the adjoining rail head when said foremost shoe is subjected to a definite lateral outward thrust as by a forceful steering effort initiated by the driver to crowd the lateral face of the foremost flange lug hard and continuously against the opposing surface of the rail head.

5. In combination in an endless track for crawler-type tractors, an articulated series of track shoes including relatively broad tread areas, and flange lugs depending from the tread areas, rendering the tractor self-steering while running on railroad rails, the flange lugs including laterally facing rail-opposing guide faces and, longitudinally adjoining the latter, transversely inwardly offset outwardly opening regions to define climbing off shoulders and intervening gaps to receive the adjacent top margin of an associated rail head when the track is turned thereagainst, the lugs presenting bottom traction surfaces of length greater than the spacing of their climbing off shoulders.

6. In combination in a shoe structure for an endless track of the crawler-type, a relatively flat tread surface, a flange lug projecting below said tread surface, said flange lug having a lateral rail-opposing guide face to maintain the shoe on a railroad rail when its track is running thereon, a bottom traction surface, and a railwardly facing portion transversely offset inwardly from the plane of the guide surface and longitudinally adjoining the guide face and de-

fining a derailment shoulder adjoining said traction surface adapted to gain a derailing purchase upon the head of the rail when the flange lug is skewed against the rail head during continued travel of the track.

7. A shoe construction for an endless track in a crawler-type tractor comprising, in combination, a tread surface, a steering flange lug projecting below said tread surface and having a lateral rail-opposing guide face for engagement with the inside surface of an associated rail head when the shoe is traveling upon a railroad rail, a traction face on the bottom edge of said flange lug, a laterally rialwardly facing wall transversely offset inwardly from the plane of the guide face and longitudinally adjoining the guide face, and a transverse shoulder forming the forward wall of the offset for gaining a slight overlapping bite upon the near top margin of the rail head when the track is turned against the rail head.

8. In combination in a track shoe for crawler-type track, a generally flat body including a tread surface, a flange lug projecting below said surface and adapting the shoe to be run in self-steering relation upon a railroad rail, said flange lug having a rail-opposing lateral face for track guiding engagement by the rail head, a traction face along its bottom edge, and a transverse shoulder adjoining said rail-opposing face and directed generally downwardly and in slanting relation to the traction face, for easing the traction face onto the top of the rail for derailment of the associated track when the flange lug is skewed relative to the rail while the track is traveling so that the shoulder can gain a purchase on the rail head.

9. In combination in a track shoe for crawler-type tracks, a generally flat body including a tread surface, a flange lug projecting below said surface and adapting the shoe to be run in self-steering relation upon a railroad rail, said flange lug having a rail-opposing lateral face and a traction face along its bottom edge, the outward side of the flange lug having a substantial portion of its intermediate area inwardly offset from the face to form a gap longitudinally dividing the rail-opposing face to receive the upper adjacent corner of the associated rail in derailment of the track, and a shoulder at one end of the offset for gaining an overlapping bite on the top margin of the rail head to ease said traction face onto the rail head when the track is turned thereagainst.

10. An endless track structure for tractors comprising, in combination, an endless series of linked track shoes having rail-top engaging tread areas, each of said shoes having a flange lug projecting below the tread areas and extending substantially entirely across the shoe longitudinally of the track, the flange lugs of the shoes co-operating in alignment in the bottom run of the track to maintain the track upon a railroad rail, and means for assisting in maneuvering the track off of the rail including transverse shoulders formed in the lateral rail opposing sides of said flange lugs and short of the ends thereof and arranged to oppose the rail top in the down-traveling reach of the return run of the track when the track is maneuvered to carry the flange lug of the down-traveling reach over the rail, so that the shoulder of the flange lug which succeeds the foremost lug of the bottom run of the track may in such maneuver engage the top of the rail and ease the edge of the associated lug onto the rail for derailing the track.

11. An endless track structure for tractors comprising, in combination, an endless series of connected track shoes having rail engaging tread areas, the majority, but not all, of the shoes having depending flange lugs projecting below the tread areas and extending across the shoes longitudinally of the track, said flange lugs co-operating in a row in the bottom run of the track to maintain the track upon a railroad rail, those of said shoes which do not have the lugs being interspersed at intervals between the shoes which do have the flange lugs, to provide gaps in the row of flange lugs to enable maneuvering of the flange lug of one of the adjacent shoes into overlapping relation to the top of the rail to derail the track when the track is turned thereagainst.

12. A track structure for crawler-type tractors comprising, in combination, an endless series of pivotally connected track shoes having rail engaging tread surfaces, the majority but not all of said shoes having flange lugs projecting beyond the tread surfaces and extending across the shoes longitudinally of the track, the flange lugs co-operating in alignment in the bottom run of the track to maintain the track upon a railroad rail, the lugless shoes leaving gaps in the flange lug structure to enable passing of the flange lug of one of the adjacent shoes into overlapping contact with the top of the rail to derail the track when the track is turned against the rail, the overlappingly contacting end of the derailing lug adjacent the gap being chamfered into substantial parallelism with the rail top at the initiation of the overlapping contact.

13. A track structure for crawler-type tractors comprising, in combination, an endless series of connected track shoes having tread surfaces co-operating in the bottom run of the track to support the track upon a rail, flange lugs on the shoes projecting below the tread surfaces thereof and disposed crosswise of the shoes and longitudinally of the track, the flange lugs co-operating in alignment in the bottom run of the track to maintain the track upon a railroad rail, the flange lugs being omitted from certain of said shoes to provide gaps in the flange lug structure to enable directing of the flange lug of one of the immediately adjacent shoes into overlapping contact with the top of the rail when the track is turned thereagainst to derail the track, the ends of the flange lugs being convergingly and generously slanted downwardly throughout substantially their heights to cam an adjoining lug from the rail head entering a gap when the track crosses over a rail.

14. In combination in an endless track for vehicles, a series of connected track shoes, flange lugs projecting downwardly from said shoes and adapting the track for self-maintenance upon a railroad rail, and track-carried structure, enabling derailment of the track, so positioned and arranged that when the foremost lug of the bottom run of the track is forced laterally against the rail during continuing forward movement of the associated track, the structure downwardly engages the rail for climbing the lugs onto the rail, said flange lugs being dimensioned longitudinally of the track to approach one another relatively closely in the bottom run of the track whereby to enable running of the track across railroad rails without danger of gripping the rail heads.

15. In combination in an endless track struc-

ture for tractors, a series of connected track shoes providing treads, flange lugs extending longitudinally of the track and depending from said treads to maintain the track upon a railroad rail, at least certain of said lugs having the ends thereof spaced apart sufficiently to offer gaps to receive a rail head therebetween with ample clearance to avoid gripping the rail head when driving the tractor transversely across the rails, the spaced ends of said lugs being slanted off downwardly and longitudinally of the track to reduce gripping of the rail head by the ends of the gaps when the track crosses obliquely over a rail.

16. An endless-type track for vehicles including, in combination, a linked series of track shoes, flange lugs projecting from said shoes to adapt the track for self-maintenance along the top of a railroad rail, the ends of said flange lugs being slanted off downwardly and longitudinally of the track to provide substantial inter-lug gaps to permit derailment of the track by forcing the next succeeding flange lug ahead of the foremost flange lug of the bottom run of the track into overlapping relation to the top margin of the associated rail, and to permit reception of a rail head between the lugs with ample clearance and without gripping the rail head when the track is driven across the rails.

17. An endless link-belt type track for tractors comprising, in combination, a series of shoes having co-operative treads and retaining flange lugs projecting below said treads to adapt the track to run on rails, said flange lugs presenting an aggregate lateral face for opposing a rail upon which the track may be traveling to guide the track therealong, said face having gaps at intervals along the track within which the edge of the rail may be received ahead of the foremost flange lug of the bottom run of the track when the latter is turned against the rail for effecting derailment of the track, and chamfered shoulders defining the forward limits of the gaps and adapted for overlapping engagement with the top margin of the rail when the edge of the rail is within the associated gap as aforesaid.

18. And endless track for crawler tractors comprising, in combination, a series of track shoes connected together in link-belt fashion, the shoes having tread areas adapted, in the bottom run of the track, to ride upon the head of one of the rails along which the tractor is being driven, flange lugs depending below said tread areas and co-operating, in said bottom run, to guide the track upon the rail, the flange lugs presenting pairs of opposed lower salient corners with intervening gaps whereby, when the track is turned against its associated rail, the adjacent top margin of the rail head may lie within the gap to permit the leading shoulder of the gap to gain an overlapping purchase upon the top margin of the rail head, the lugs having longitudinally facing edge surfaces which extend from the salient corners upwardly and longitudinally.

19. An auxiliary shoe to be attached, along with similar shoes, to respective shoes of the tracks of a crawler-type vehicle, the auxiliary shoe comprising a base plate provided with means for attaching it to the bottom of a primary shoe of the track, a bottom tread surface for riding on the top of a rail head, and a flange lug extending across the base at the inner end of the tread surface and depending below the tread surface, the flange lug comprising a long major body of substantial thickness presenting a bottom traction surface and a minor body in the nature of a promontory on the outer side of the main body and shorter than the main body, and presenting a lateral rail-opposing guide surface for retaining the track in running relation upon the rail, the minor body also having laterally extending end surfaces co-operating with the bottom traction surface of the minor body to form climbing out shoulders adapted to gain a purchase upon the rail head when maneuvered into overlying relation to the rail head while the track is in motion.

20. An auxiliary shoe to be attached, along with similar shoes, to respective shoes of the tracks of a crawler-type tractor, the auxiliary shoe comprising a base plate provided with means for attaching it to the bottom of a primary shoe of the track, a bottom tread surface for riding on the top of a rail head, and a flange lug extending across the base at the inner end of the tread surface and depending below the tread surface, the flange lug comprising a long major body of substantial thickness presenting a bottom traction surface and a pair of short minor bodies in the nature of promontories on the outer side of the main body and disposed adjoining its ends to leave an inwardly offset downwardly and outwardly opening gap between the promontories, the promontories presenting outwardly facing rail-opposing guide surfaces, the opposed ends of the promontories co-operating with their bottom surfaces at the traction surface to define climbing out shoulders through a major portion of the dependency of the lugs whereby to broaden the bases for the shoulders, said shoulders being respectively adapted for gaining a derailing purchase upon the rail head when maneuvered to receive the proximate corner of the rail head between the shoulders in the continued onward travel of the associated track along the rail.

21. A track for a crawler-type tractor comprising an endless series of interconnected shoes formed to adapt the track to run on railroad rails and comprising depending flange lug structure presenting opposed longitudinally spaced lower shoulders with outwardly and downwardly opening gaps therebetween whereby, when the track is turned outwardly against its associated rail, the top margin of the rail head is received in the gap to permit the leading shoulder of the lug to gain a slight overlapping contact upon the top margin of the rail head, each pair of shoulders defining an intervening gap being carried by a single shoe.

22. A track shoe to be pivotally connected with similar track shoes to form the endless track of a crawler-type vehicle to be operated on the rails of a railroad track, the shoe having a downwardly facing tread area to ride on the top of the rail and a flange lug structure depending below the tread area presenting a rail-opposing guide surface to maintain the track aaginst outward lateral displacement relative to the rail, the flange lug structure forming therewithin an outwardly and downwardly opening gap presenting opposed lower shoulders whereby, when the track is turned against its rail, the top margin of the rail may be received within the gap to permit the leading shoulder, when the flange lug structure is descending into the bottom reach of the track, to gain an overlapping purchase upon the top margin of the rail to enable the track to climb onto the rail.

23. In combination in a track shoe for crawler-type tractors, a body including a tread surface, an elongated guiding flange lug projecting be-

low said surface and having a rail-opposing longitudinal face adapting the shoe to be run in self-steering relation upon a railroad rail, a salient corner on said lug adapted to gain an overlapping purchase upon the top of a rail head when the track with which the shoe may be associated is driven against the rail for derailing the track, said lug having a broadened base for strengthening said salient corner, and a surface which faces longitudinally of the lug and extends from said salient corner to said broadened base and defines one end of a gap to receive a longitudinal edge of the rail head whereby to enable the salient corner to gain said derailing purchase on the rail head.

24. A track structure of the character described, comprising, in combination, an endless series of flexibly connected track shoes having rail-engaging tread surfaces, the majority, but not all, of said shoes having flange lugs projecting beyond the tread surfaces and extending across the shoes longitudinally of the track, the flange lugs cooperating in a row in the bottom run of the track to maintain the track upon a railroad rail, with a lugless one of said shoes leaving a gap in the flange lug row to enable maneuvering of the flange lug of one of the adjacent shoes at one side of the gap into overlapping contact with the top of the rail to derail the track when the lug of the adjacent shoe on the opposite side of the gap is forcibly directed against the rail for that purpose.

25. In combination in a shoe for a crawler type endless track, a body including a tread surface adapted to ride upon a railroad rail, a guiding flange lug projecting below said tread surface adapting the associated track to be run in self-steering relation along the rail, and a surface on said lug sloping toward the plane of said tread surface adapted to overlie the rail head for gaining a derailing purchase thereon when, for the purpose of derailing the track, the shoe, and thereby the flange lug, is crowded outwardly relative to the rail while in the down-traveling reach of the return run of the track, the flange lug having its base of increased cross-sectional area whereby said sloping surface is strengthened to withstand the extraordinary strains resulting from the derailing action.

26. In combination in an endless track for vehicles, a series of connected track shoes, flange lugs depending from said shoes and adapting the track for self-maintenance upon a railroad rail, and track-carried structure normally out of effective engagement with the rail but constructed and arranged to be brought into downward engagement with the rail by a deliberate derailing maneuver initiated by the operator of the associated vehicle during movement of the track along the rail, for climbing the lugs onto the rail to derail the track, said flange lugs, in the bottom run of the track, being of longitudinal length to approach one another relatively closely, whereby to enable the track to be run across railroad rails without gripping the rail heads.

27. A track structure comprising a series of interlinked units with depending flange lugs, arranged in a longitudinal row, and presenting lateral faces opposing a rail head upon which the track runs, whereby to confine the track to the rail, the units including transverse shoulders so positioned on the unit that when the track is turned laterally against a rail head the shoulder on the descending forward end of the bottom reach of the track will downwardly engage the rail head to effect the climbing of the associated flange lug onto the rail head to derail the tractor, the climbing out shoulder of a given unit being intermediate the ends of the rail opposing face.

28. A shoe to be interlinked with like shoes to form a crawler type track, which includes a depending flange lug having a lateral face to oppose the rail head upon which the track runs, to confine it to the rail, a shoulder extending transversely and inwardly from the rail-opposing face and downwardly presented for gaining a climbing out purchase upon the rail head when the track is turned relative to the rail head, and a traction face along the bottom of the flange lug to contact the ground when the track is traveling over the terrain, the climbing out shoulder being intermediate the ends of the traction face.

29. A shoe to be interlinked with like shoes to form a crawler type track, which includes a depending flange lug having a lateral face to oppose the rail head upon which the track runs, to confine it to the rail, a shoulder extending transversely and inwardly from the rail-opposing face and downwardly presented for gaining a climbing out purchase upon the rail head when the track is turned relative to the rail head, and a traction face along the bottom of the flange lug to contact the ground when the track is traveling over the terrain, the rail-opposing face being longitudinally shorter than the traction face.

LEWIS E. YOUNIE.