Sept. 27, 1966 S. I. FEKETE 3,274,952

RAILROAD TRACK GRIPPING APPARATUS

Filed June 10, 1964 4 Sheets-Sheet 1

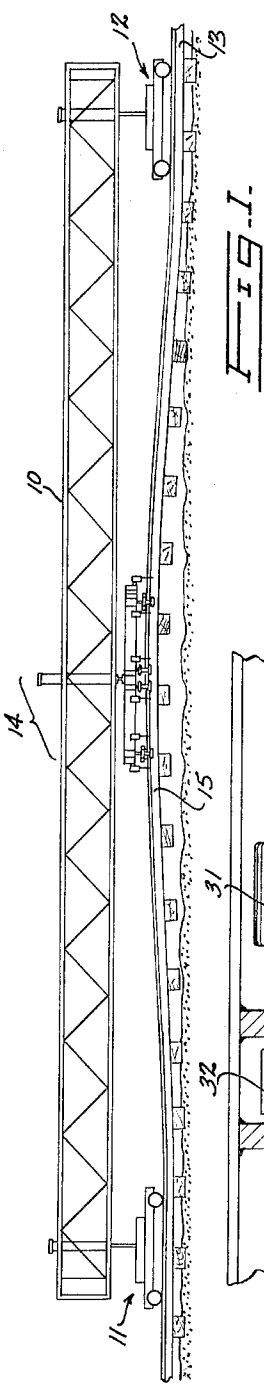


FIG. 1.

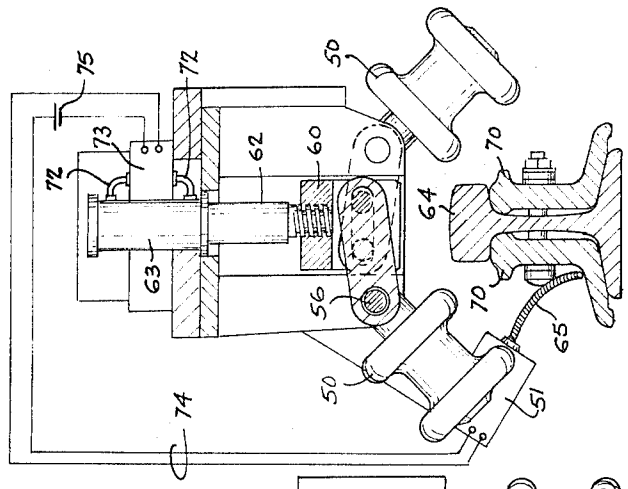


FIG. 7.

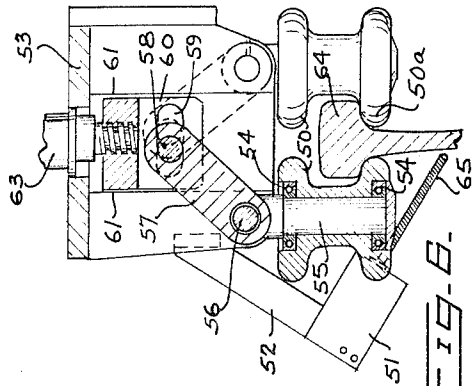


FIG. 6.

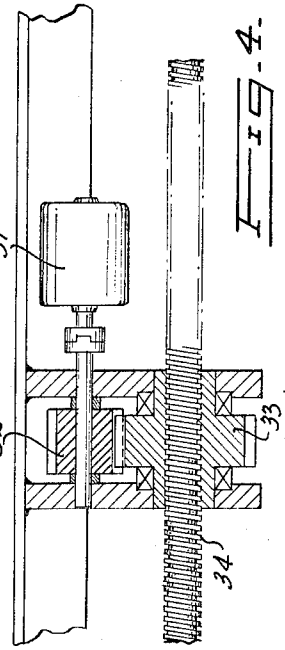


FIG. 4.

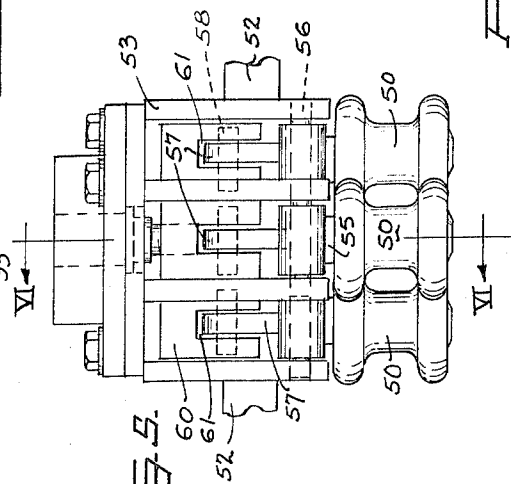


FIG. 5.

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RAILROAD TRACK GRIPPING APPARATUS

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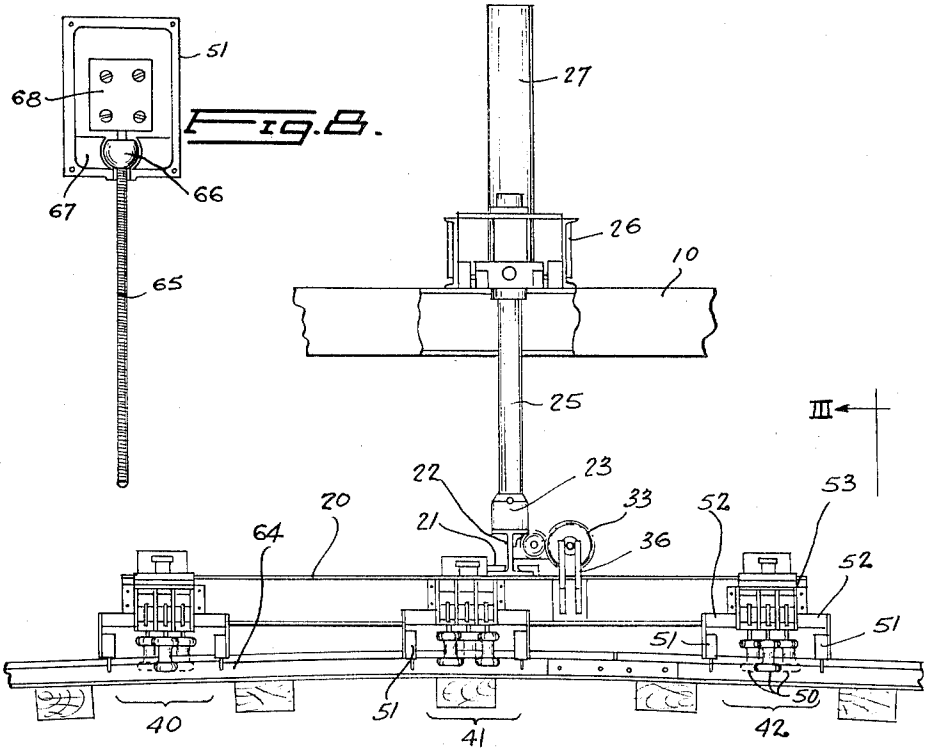


Fig. 8.

Fig. 2.

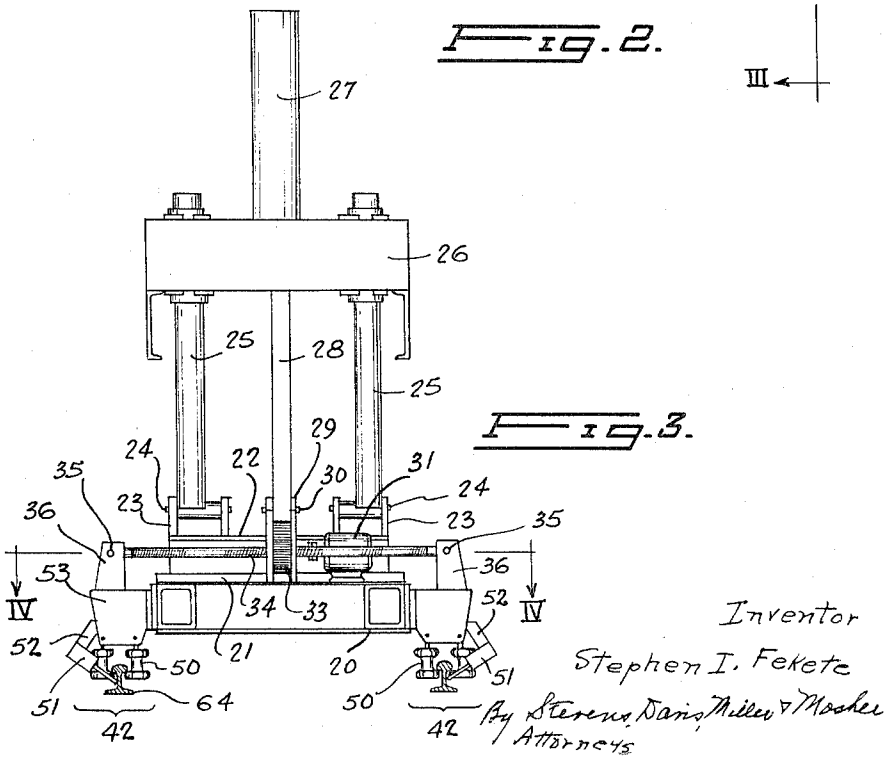


Fig. 3.

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RAILROAD TRACK GRIPPING APPARATUS

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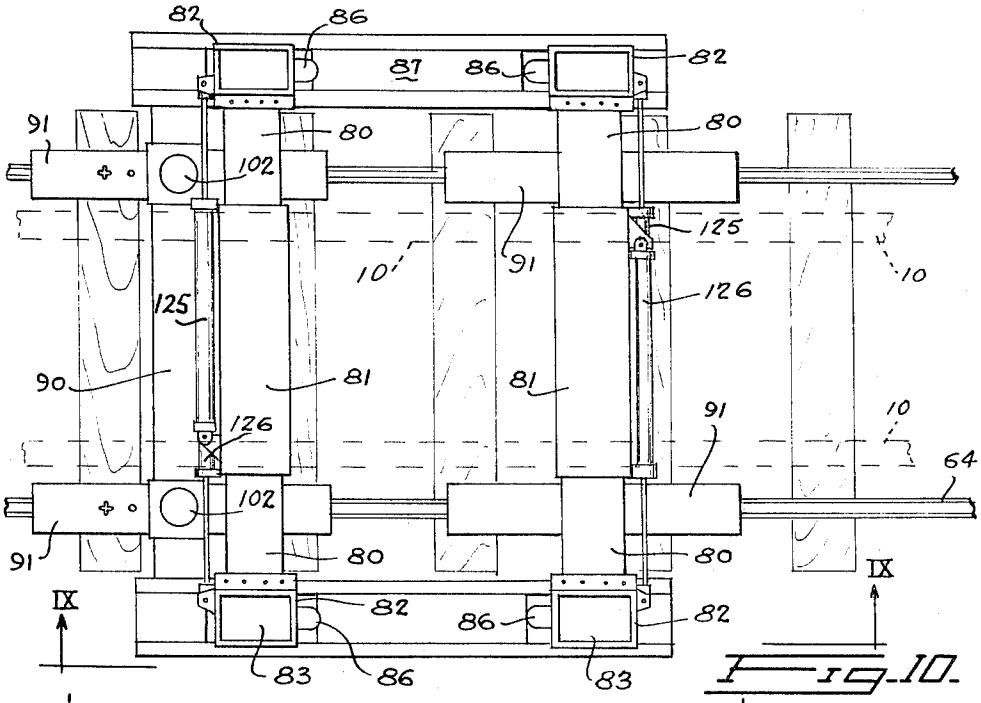


Fig. 10.

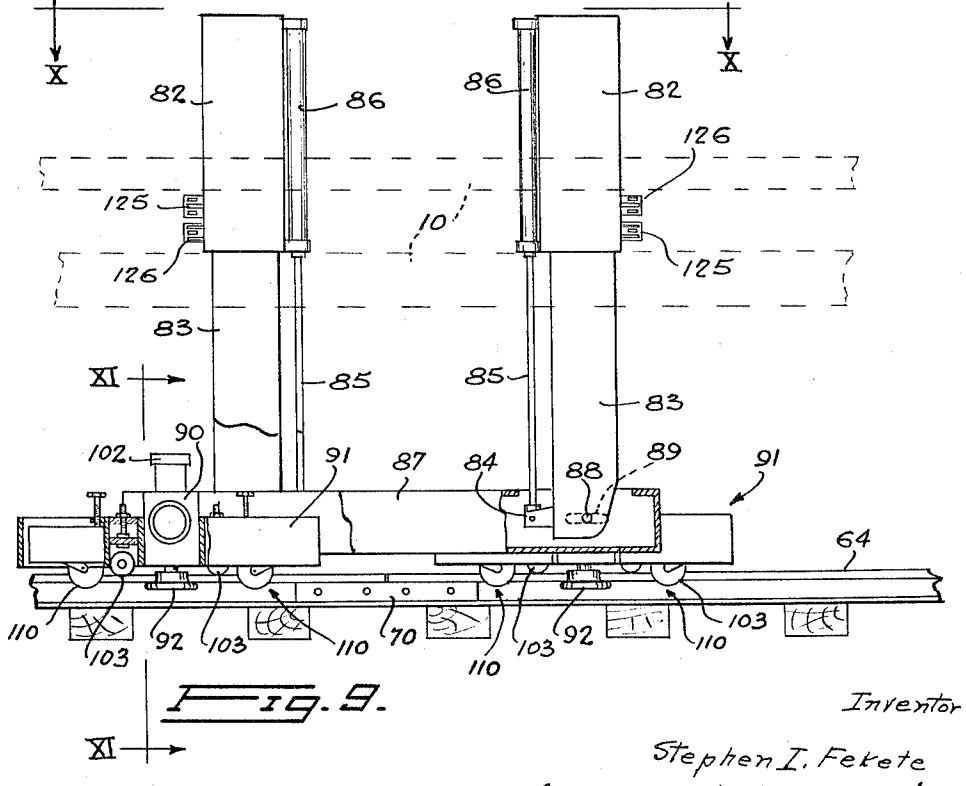


Fig. 9.

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RAILROAD TRACK GRIPPING APPARATUS

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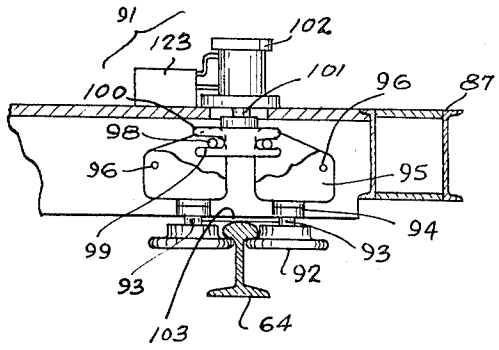


Fig. 11.

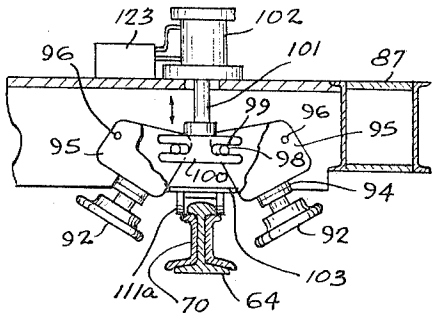


Fig. 12.

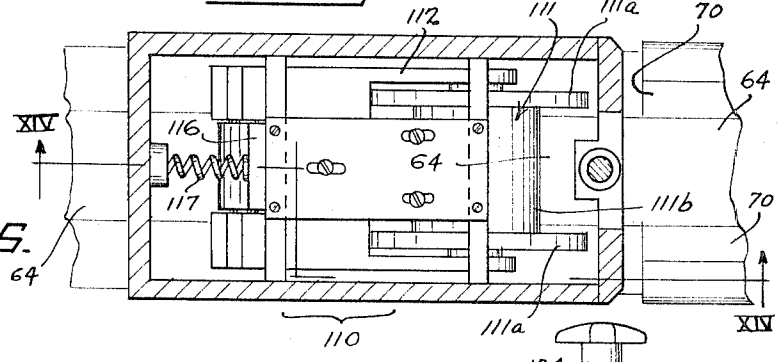


Fig. 15.

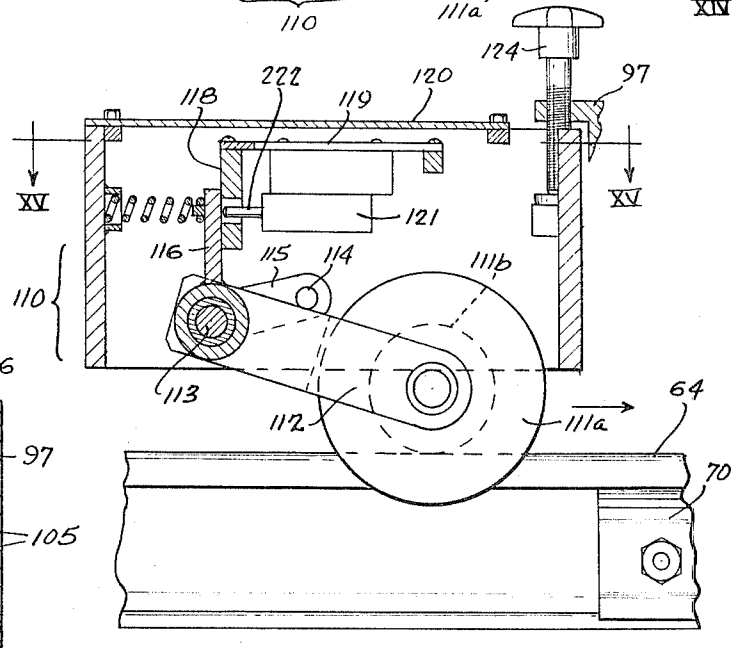


Fig. 14.

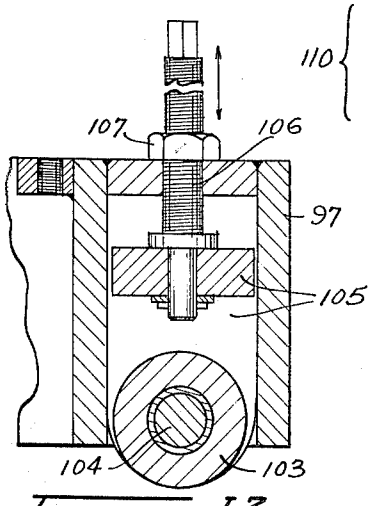


Fig. 13.

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3,274,952

RAILROAD TRACK GRIPPING APPARATUS

Stephen I. Fekete, Minneapolis, Minn., assignor to Mannix International Inc., Minneapolis, Minn.

Filed June 10, 1964, Ser. No. 374,098
10 Claims. (Cl. 104—7)

This application is a continuation-in-part of my earlier filed application Serial No. 285,052, filed June 3, 1963, now abandoned.

This invention relates to apparatus for use with vehicles constructed for travel on railroad tracks, and is concerned with mechanisms for transmitting vertical forces between track and vehicle in the opposite direction to those resulting from the weight of the vehicle. Such forces may take the form of forces exerted upwardly on the track by the vehicle to lift a span of track, or conversely, they take the form of forces exerted downwardly on the vehicle by the track in order to hold the vehicle on the track in the face of some sideways pull or tilting moment, as for example can arise in the case of a track mounted crane.

Track lifting is the main application for which the present invention has been developed, and for this reason it will be described below principally in relation to such use. In this aspect the invention relates to apparatus adapted to elevate successive portions of the track as a continuous operation, that is to say as the vehicle proceeds down the track. Such apparatus may be used with other instrumentalities such as under-track devices for working the roadbed or ballast thereon and which are such as to require temporary elevation of the track. Other uses of the apparatus will be to assist in the slewing or alignment of track.

When employed for track lifting the apparatus is used in conjunction with an elongated boom each end of which rests on a cart. The two carts rest on unelevated sections of track. At an appropriate location intermediate the two carts, the lifting apparatus is secured to the boom. The apparatus includes rollers which grasp the heads of the rails and apply the necessary lifting forces to elevate the span of track between the two carts. Essentially such an arrangement was disclosed in Arbenz et al. U.S. Patent No. 1,100,006, issued June 16, 1914.

When it is desired to render such apparatus suitable for continuous operation while traveling along the track, a problem is encountered in the form of the encumbrance to the rollers that is presented by the angle bars or "fish plates" which join the ends of adjacent rails together. Arbenz et al. met this problem (see FIGURE 14 of said patent) by providing comparatively sharp edged rollers and squeezing these edges tightly into the small space shown between the top edge of the angle bar and the underside of the head of the rail. This solution to the problem is not practicable with the type of angle bar now currently in use, because the top of the angle bar fits snugly underneath the head of the rail and leaves insufficient space for any effective purchase to be gained by the roller flanges. When the rails are joined together by welding, a similar problem arises. The weld forms a protuberance that forces the lifting rollers apart and prevents their retaining a proper lifting grip on the rail head.

The principal object of the present invention is to provide an improved structure that will operate satisfactorily on track fitted with modern angle bar or in which the rails are welded together.

Other objects and feature of the invention will appear as the description proceeds.

The accompanying drawings illustrate apparatus for carrying the invention into practice. The description

which follows is provided by way of example only, the scope of the invention being determined by the appended claims.

In the drawings:

FIGURE 1 is a small scale, side view of a complete track lifting assembly;

FIGURE 2 is a fragment of FIGURE 1 showing the rail lifting mechanism in more detail and on a larger scale;

FIGURE 3 is a section on the line III—III in FIGURE 2;

FIGURE 4 is a partial section on the line IV—IV in FIGURE 3;

FIGURE 5 is a side view of one of the roller assemblies;

FIGURE 6 is a section on the line VI—VI in FIGURE 5, but including a rail;

FIGURE 7 is a view similar to FIGURE 6 showing the parts in another position;

FIGURE 8 is a detailed view of a feeler structure;

FIGURE 9 is a side view of a second construction taken on the line IX—IX in FIGURE 10 but with certain parts shown exposed;

FIGURE 10 is a plan view of the mechanism of FIGURE 9 taken on the line X—X in FIGURE 9;

FIGURE 11 is a front fragmentary view taken on the line XI—XI in FIGURE 9;

FIGURE 12 is the same as FIGURE 11 with the parts in a different position;

FIGURE 13 is a detailed view of a hold-down roller structure;

FIGURE 14 is a detailed view of a feeler structure taken on the line XIV—XIV in FIGURE 15; and

FIGURE 15 is a view on line XV—XV in FIGURE 14.

The apparatus shown in FIGURE 1 consists of a boom **10** supported at each end on carts **11** and **12** on unelevated portions of track **13**. The lifting mechanism **14** shown centrally of FIGURE 1 to elevate a span **15** of track is shown in more detail in FIGURES 2, 3 and 4. This mechanism comprises a frame **20** formed on its upper surface with a transversely extending slideway **21** in which can slide the lower flange of an I-beam **22** which is freely pivotally supported by brackets **23** and pivot pins **24** from a pair of columns **25** that are vertically slidably mounted in a frame member **26** of the boom **10**. Vertical movement is controlled by a hydraulic cylinder **27**, the piston **28** of which is also connected to the I-beam **22** through brackets **29** and pivot pin **30**. The pivot pins **24** and **30** are all coaxial so that the lifting frame **20** is free to rotate about a horizontal axis extending transversely of the track. This enables it to take up any necessary position corresponding to the attitude of the track.

Transverse shifting of the frame **20** is obtainable by a motor **31** (FIGURE 4) driving a pinion **32** which meshes with a gear **33** which is internally threaded to receive a screw **34**. The ends of the screw **34** are attached by pivot pins **35** to upstanding plates **36** secured to the lifting frame **20**. Rotation of the motor **31** in the appropriate direction thus produces a bodily shifting of the whole frame **20** to one side, sliding taking place between the slideway **21** and beam **22**. This movement enables the apparatus to be accommodated to curves in the track and also permits an operator to use the apparatus to modify the alignment of the track, over both curved and straight sections.

As seen from FIGURE 2, the rollers **50** which engage the rails are formed into three groups **40**, **41** and **42**, such groups being repeated on the other side of the track (see FIGURE 3). Each group consists of three individual rollers **50**, arranged two on one side of the rail and one on the other side. The side on which

the single roller is arranged is alternated between the groups.

Each roller assembly also includes a pair of feeler mechanisms **51** supported one beyond each end of each roller group. Brackets **52** mount the feeler mechanisms **51** in fixed positions by connecting them to the casings **53** of the roller assemblies.

As shown in FIGURES 5 and 6, each assembly casing **53** supports its three rollers **50** so as each to be freely pivotable on bearings **54** about normally vertical axes defined by stub axles **55**. Roller flanges **50***a* closely engage the undersurfaces of the head of the rail **64**. Each of the axles **55** is mounted in its casing **53** to pivot about a horizontal pin **56**, such pivoting being controlled by an arm **57** which is secured to each axle **55**. At their upper ends the arms **57** converge towards the centre of the casing **53** and each carry a further pin **58** that engages a slot **59** in an elongated actuating bar **60** which is forked at **61** to embrace each of the arms **57**. The bar **60** is vertically slidably mounted in guide surfaces **61'** of the casing **53** and is moved up and down by the pistons **62** (FIGURE 7) of a double-acting hydraulic cylinder **63**. The effect of expanding such cylinder, shown in FIGURE 7, is to rotate the rollers **50** about their pins **56** from their rail-embracing condition to a spread-open or rail-releasing condition in which they are separated from the rail **64**.

Each feeler mechanism **51** comprises a flexible probe **65** mounted on a ball **66** (FIGURE 8) supported in a socket **67** and acting on the actuating pin of a microswitch **68**. This mechanism is conventional and no claim is made to any novelty therein. For each of the six groups of rollers, the two associated feeler mechanisms **51** are connected in parallel by electric cables **74** to a power source **75** and to a solenoid and hydraulic valve assembly **73** (FIGURE 7) which passes hydraulic fluid to the hydraulic cylinder **63** through lines **72**. As soon as either one of the probes **65** of a given roller assembly is deflected from its normal position in which it just clears the web **69** of the rail **64** (FIGURE 6) by striking an angle bar **70** (FIGURE 7), the cylinder **63** is energized to move the rollers to their rail-releasing condition. Release of both probes causes positive reversal to move the rollers to rail-embracing condition.

Thus, assuming the parts to start in the position shown in FIGURE 2, if the apparatus were to move along the track to the right the probe of the leading feeler mechanism **51** of the central roller group **41** would soon encounter the angle bar **70** with the result that the rollers of this group will be spread open to the FIGURE 7 position. Before this leading probe is released by the angle bar **70** the probe of the trailing feeler mechanism **51** of the same roller group will be deflected by the same angle bar. The rollers will thus be maintained in the open position until the trailing feeler probe of the roller group **41** has passed beyond the end of the angle bar **70**.

In order to achieve this operation, the spacing of the parts is important. The spacing between the probes of each pair of feeler mechanisms, that is to say the feeler mechanisms located at each end of a given roller group, must not exceed the length of the shortest angle bar to be encountered in practice. In this way the trailing feeler mechanism must be actuated before the leading feeler mechanism is released and rollers are held open.

To avoid two groups of rollers being open simultaneously, the spacing between adjacent probes of adjacent roller groups, that is to say the spacing between the probe of the trailing feeler mechanism of roller group **42**, for example, and the probe of the leading feeler mechanism of roller group **41** must be greater than the longest angle bar to be encountered in practice. A typical bar length is 36 inches.

As will best be appreciated from FIGURE 1, an elevated span of track will have a significant upward curvature. The sharpness of this curvature will tend to be increased when the ends of the elevated span are artificially held down on the roadbed by downward thrust at the carts **11** and **12**. To provide ideal lifting conditions with a track so curved, the central roller group **41** on each side is secured to the frame **20** at a slightly higher elevation than that of the front and rear roller groups **40** and **42**. If desired, the magnitude of this vertical differential between roller groups can be made adjustable by mounting one or other of the assemblies to be vertically movable on the frame **20**. Although the track will not normally be elevated and hence not upwardly curved when the lifting mechanism is in the fully down position shown in FIGURE 2, this view shows a typical curvature of elevated track to facilitate appreciation of this aspect of the invention.

Whenever a roller group approaches an angle bar, the rollers are automatically spread out to their rail-releasing condition to pass freely by the angle bar and no two groups of rollers (on any one rail) will be open simultaneously. It follows that each rail will always be supported by at least two groups of rollers. If support by only one group can be accepted as it normally can, then only two groups need be provided to engage each rail. Such an arrangement is illustrated in the alternative construction of FIGURES 9 to 15.

This mechanism is supported by a pair of horizontal, transverse beams **80** that are slidingly mounted in tubular supports **81** secured to the boom **10**. Each beam **80** has secured to each of its ends a vertically oriented, tubular support **82** in which a vertically extending beam **83** is slidingly mounted. The lower end of each beam **83** carries a bracket **84** to which is connected the piston rod **85** of a hydraulic cylinder **86** secured to the associated support **82**. On each side of the track the lower ends of the beams **83** support a horizontal, longitudinally extending beam **87**. The connection of each horizontal beam **87** to each vertical beam **83** is pivotally, being about a pin **88**, and, at one end, some freedom to slide is provided by a slot **89** in the beam **87** which cooperates with the pin **88**.

Between the forward ends of the two beams **87** there extends an interconnecting horizontal beam **90**, and a similar beam joins the rear ends of the two beams **87**. At each end, somewhat inwardly of the beams **87**, the interconnecting beams **90** support four rollers assemblies shown generally at **91**.

Each roller assembly **91** includes a pair of rail-gripping rollers **92** each freely pivotable on bearing **94** about a normally vertical axis (FIGURE 11) defined by a stub axle **93**. Each bearing **94** is mounted on a frame **95** which is pivotally mounted on a pin **96** in the fixed structure **97** of the assembly **91**. Frame **95** carries a pin **98** that slidingly engages a slot **99** in plate **100** secured to the lower end of a piston rod **101** of a double-acting hydraulic cylinder **102**. It will be evident that vertical movement of the rod **101** will cause rotation of the pair of rollers **92** between the rail-embracing condition of FIGURE 11 and the rail-releasing condition of FIGURE 12.

It will be observed that, in this embodiment of the invention, the rollers are swung about axes (defined by pins **96**) that are offset from the axes of the stub axles **93** in the direction away from the rail **64**. As a result, when the rollers are swung inwardly to their rail-embracing condition they also perform a lifting motion which serves to pick up the rail which may have sagges slightly at this location while being supported only by the other roller group. The lifting action of the rollers also serves to force the rail head tightly up against a pair of hold-down rollers **103** and thus ensure an accurate location of the rail in relation to the roller assembly.

As best seen in FIGURE 13, each roller **103** is mounted to rotate freely about a pin **104** which is secured at its ends in a forked frame **105** that is slidably mounted in the fixed structure **97** and adjustable in position by screw **106** secured by lock nut **107**.

Detection of angle bars **70** is effected by feeler mechanisms **110** of which there are eight, one located immediately ahead and one immediately behind each pair of rail-gripping rollers **92**. Each mechanism **110** (FIGURES 14 and 15) comprises a feeler roller **111** having a pair of flanges **111***a* straddling a rail **64**, and a central portion **111***b* riding on such rail. The roller **111** is mounted on a forked arm **112** that is free to turn on pin **113**. Arm **112** bears on a pin **114** projecting from one arm **115** of a bell-crank lever, the other arm **116** of which is acted on by a spring **117** that urges the arm **116** against a stop **118** secured to support **119** and hence of casing **120**. Support **119** also supports a micro-switch **121** having an actuating plunger **122** engaging the arm **116**.

Normally the roller portion **111***b* will ride on the rail head as shown in FIGURE 14. When the angle bar **70** is encountered, the flanges **111***a* will ride up on the same, slightly elevating the arm **112** and hence turning the arm **116** sufficiently to actuate the micro-switch **121** to energize a solenoid **123** to move the rollers **92** to open position. Initial setting up adjustment of each feeler mechanism **91** is effected by screw **124** which controls the relative positions of casing **120** and fixed structure **97**.

In FIGURE 9 the second embodiment of the invention is shown engaging unelevated rail. It will be employed in the manner of FIGURE 1 to elevate a span of track by the lifting action of cylinders **86**. Any variation from horizontal of the rails can be followed by the rollers by virtue of the freedom of horizontal beams **87** to pivot at each end at their connections to vertical beams **83**. In addition to this lifting action the whole assembly can perform a track aligning operation by lateral shifting of the beams **80** relative to the boom **10**. Shifting in one direction is powered by a pair of cylinders **125** and in the other direction by a pair of cylinders **126**.

As an alternative, automatic operation by feelers can be dispensed with, the various hydraulic cylinders **63** and **102** being individually controlled by an operator. There will normally be an operator travelling on the boom **10** to take care of other apparatus mounted thereon and suspended therefrom beneath the track. It will be necessary for the operator to control the lateral shifting of the frame **20** by motor **31** or of beams **80** by cylinders **125**, **126**, to take into account transverse curvature of the track as the apparatus proceeds, and the same operator can actuate the hydraulic cylinder **63** or **102** of each roller group at the appropriate time to cause the rollers to spread and allow an angle bar to pass. With the feeler mechanisms **51** or **110** thus dispensed with, the critical spacing, that is the spacing which must be at least as great as the length of the longest angle bar to be encountered, will now theoretically be determined as between adjacent rollers of adjacent roller groups, rather than between adjacent feeler mechanisms of adjacent roller groups. However, as a practical matter, it will be convenient to make the spacing between roller groups rather larger than this theoretical minimum in order to allow the operator some latitude of judgment in the timing he adopts for closing the roller group which has just passed beyond an angle bar and then opening the next roller group which is just approaching the same angle bar.

As above mentioned, the invention may be applied to vehicles such as cranes or excavators that travel on rails and require holding down against tilting. In this case no lifting mechanism is required, the rollers and their associated mechanisms (hydraulic cylinder, mechanical linkages, and preferably the feelers for automatic operation) being provided in addition to the normal wheels that support the vehicle on the track. All the features described above are applicable to such a construction, with the exception of the mounting of the roller groups at different levels to accommodate an upwardly curving track. Since the track would not be lifted, it would become curved in this way.

Although it will be much preferred that the rollers of each group grip the head of the same rail, it would be possible to space the rollers of a group by the width of the track so that the rollers are moved in to embrace the outside edges of the heads of the two rails or conversely are moved out to embrace the inside edges of the heads of the two rails, it being assumed that in such cases the gauge of the rails is rigidly maintained by the ties, or the flanges of the wheels of the vehicle if the invention is applied say to a vehicle mounted crane, the rollers being located near such wheels. With these alternatives in mind, reference in the claims which follow to the rollers of a group gripping a "rail structure" is intended to include such rollers gripping oppositely facing surfaces of a single rail or a pair of rails.

I claim:

1. Apparatus for gripping a section of railroad track, the rails of which are joined together by angle bars, comprising:

(a) a plurality of groups of rail gripping rollers,

(b) each group comprising a plurality of rollers with at least one said roller positioned on each side of a rail structure,

(c) each roller including a flange portion for grippingly engaging the underside of a rail head of said rail structure,

(d) each group including means for moving said rollers between a closed, rail-embracing condition and an open, rail-releasing condition,

(e) said moving means for each group being operable independently of the moving means for each other group,

(f) and detection means associated with each group positioned immediately forwardly and rearwardly of each group for detecting an angle bar on said rail structure,

(g) the detection means for each group being connected to the roller moving means of the same group to actuate the latter on detention of an angle bar to move the rollers to open condition.

2. Apparatus according to claim **1** including means mounting said roller groups spaced from each other along the rail structure in the direction of extent of the track with a clear space between the nearest pair of detection means of each pair of adjacent groups greater than the longest angle bar in use on said track.

3. Apparatus according to claim **1**, wherein each said group comprises at least three rollers with at least two rollers positioned on one side of the rail structure and at least one roller positioned on the other side of the rail structure.

4. Apparatus according to claim **1** including means pivotally mounting the rollers of each group for movement between said open and closed positions, the axes about which the rollers pivot between said open and closed positions being so displaced outwardly of the rail structure that the flange portions of the rollers that engage the rail structure exert a lifting action on said structure on movement of said rollers to the closed position.

5. Apparatus for gripping a section of railroad track, the rails of which are joined together by angle bars, comprising:

(a) at least four groups of rail gripping rollers,

(b) each group comprising a plurality of rollers with at least one said roller positioned on each side of a rail of said track,

(c) each roller including a flange portion for grippingly engaging the underside of the head of its associated rail,

(d) each group including means for moving said rollers between a closed, rail-embracing condition and an open rail-releasing condition,

(e) said moving means for each group being operable independently of the moving means for each other group,

(f) means mounting a respective pair of said groups to engage each rail of the track,

(g) and a pair of detection means associated with each group positioned respectively forwardly and rearwardly of each group for detecting an angle bar on the rail engaged by said group, said detection means being spaced from each other by a distance less than the shortest angle bar in use on said track,

(h) the detection means for each group being connected to the roller moving means of the same group to actuate the latter to move its rollers to open condition on detection of an angle bar,

(i) said mounting means mounting said roller groups spaced from each other along the respective rail in the direction of extent of the track with a clear space between the nearest pair of detection means of each pair of groups on each rail greater than the longest angle bar in use on said track.

6. Apparatus for lifting a span of railroad track, the rails of which are joined together by angle bars, comprising:

(a) a vehicle comprising a pair of carts spaced apart along the track and a boom interconnecting said carts,

(b) a lifting frame vertically movably mounted on said boom intermediate said carts,

(c) at least four groups of rail-lifting rollers,

(d) means mounting a respective pair of said roller groups on said frame to engage each rail of the track,

(e) each group comprising a plurality of rollers with at least one said roller positioned on each side of a rail of said track,

(f) each roller including a flange portion for supportingly engaging the underside of a rail head,

(g) each group including means for moving the rollers thereof between a closed, rail-embracing condition and an open, rail-releasing condition,

(h) said moving means for each group being operable independently of the moving means for each other group,

(i) and a pair of detection means associated with each group mounted on said frame respectively forwardly and rearwardly of each group for detecting an angle bar on the rail engaged by said group, said detection means being spaced from each other by a distance less than the shortest angle bar in use on said track,

(j) the detection means for each group being connected to the roller moving means of the same group to actuate the latter to move its rollers to open condition on detection of an angle bar,

(k) said mounting means mounting said roller groups spaced from each other along the respective rail in the direction of extent of the track with a clear space between the nearest pair of detection means of each pair of adjacent groups on each rail greater than the longest angle bar in use on said track.

7. Apparatus according to claim **6**, including means pivotally mounting the rollers of each group on said frame for movement between said open and closed positions, the pivotal axes of the rollers being displaced outwardly from the rail engaged by said group beyond the rotational

axes of said rollers whereby the flange portions of the rollers that engage the rail heads exert a lifting action on said rail heads on movement of said rollers to the closed position.

8. Apparatus according to claim **6**, wherein there are six said groups of rail-lifting rollers with three such groups mounted on said frame to engage each rail of the track, and wherein said mounting means mounts said roller groups with the centrally located group for each rail at a higher elevation than other groups for such rail to conform the levels of the flanges of the rollers of the respective groups to a curved span of track elevated by said apparatus and extending downwardly to the roadbed beyond each extremity thereof.

9. Apparatus according to claim **4**, wherein the axes about which the rollers pivot between their open and closed positions are disposed outwardly of the longitudinal axes about which the rollers rotate.

10. Apparatus for travelling along a railroad track while simultaneously lifting a span of said track, the rails of which track are joined together by angle bars, comprising:

(a) a vehicle comprising a pair of carts spaced apart along the track and a boom interconnecting said carts,

(b) a lifting frame vertically movably mounted on said boom intermediate said carts,

(c) six groups of rail lifting rollers,

(d) each group comprising a plurality of rollers with at least one roller of the group positioned on each side of a rail of said track,

(e) each roller including a flange portion for supportingly engaging the underside of a rail head,

(f) each group including means for moving the rollers thereof between a closed, rail-embracing condition and an open-rail-releasing condition, said moving means for each group being operable independently of the moving means for each other said group,

(g) and means mounting all said roller groups on said frame with three of said roller groups engaging each rail of the track with the groups spaced from each other in the longitudinal direction of the vehicle with a clear space between the two nearest rollers of each pair of adjacent groups on each side of the vehicle greater than the longest angle bar in use on said track,

(h) said roller groups being mounted on said frame with the centrally located group for each rail at a higher elevation than the other groups for such rail to conform the levels of the flanges of the rollers of the respective groups generally to the curvature of a span of track elevated by said roller groups and extending downwardly to the road bed on each side of said roller groups to said carts.

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