Nov. 14, 1939. J. T. LOFTUS 2,180,157

METHOD AND APPARATUS FOR STRAIGHTENING RAILS

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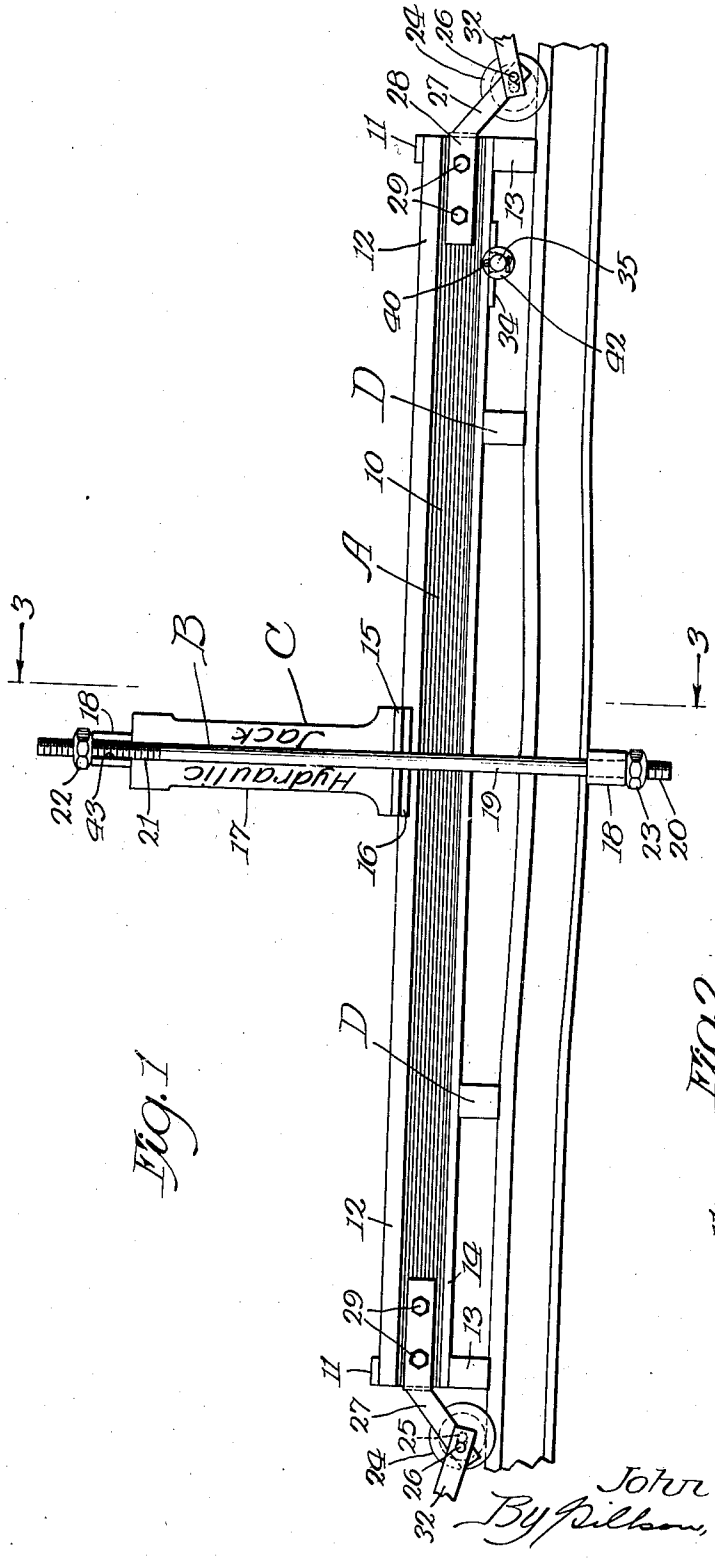

Fig. 1

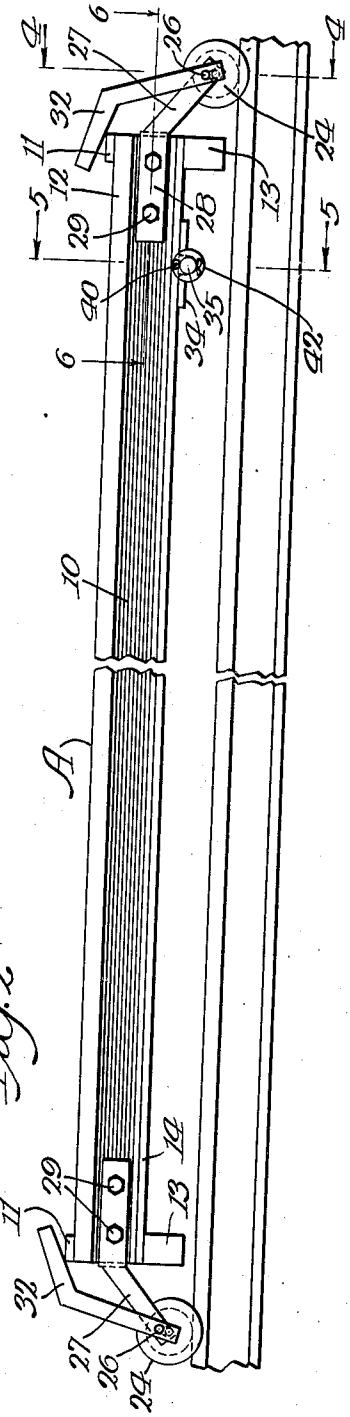

Fig. 2

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Fig. 3

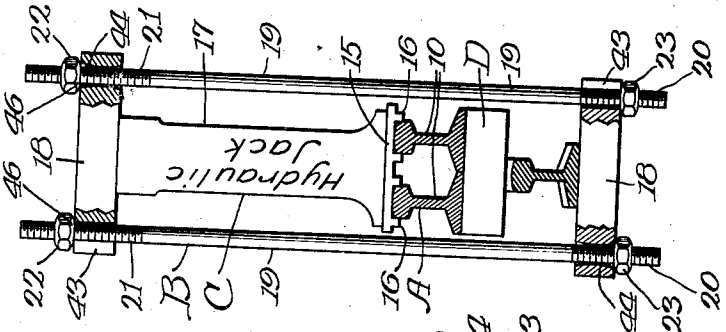


Fig. 4

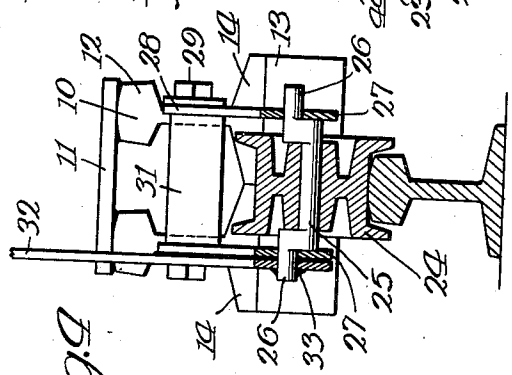


Fig. 5

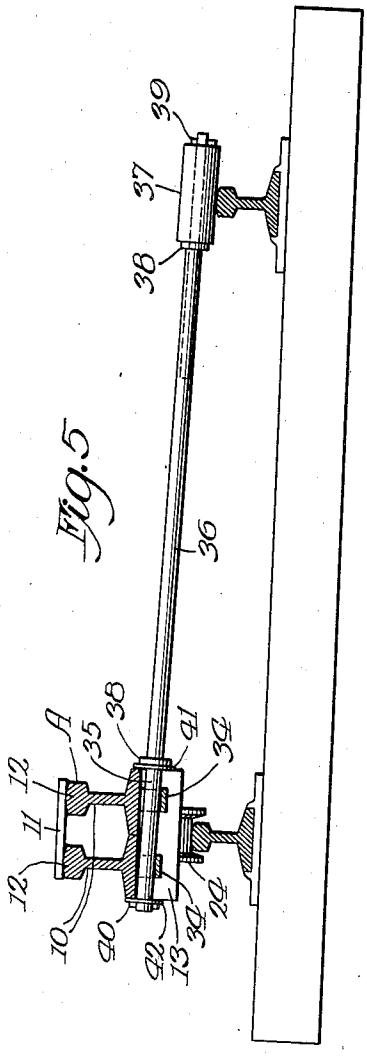
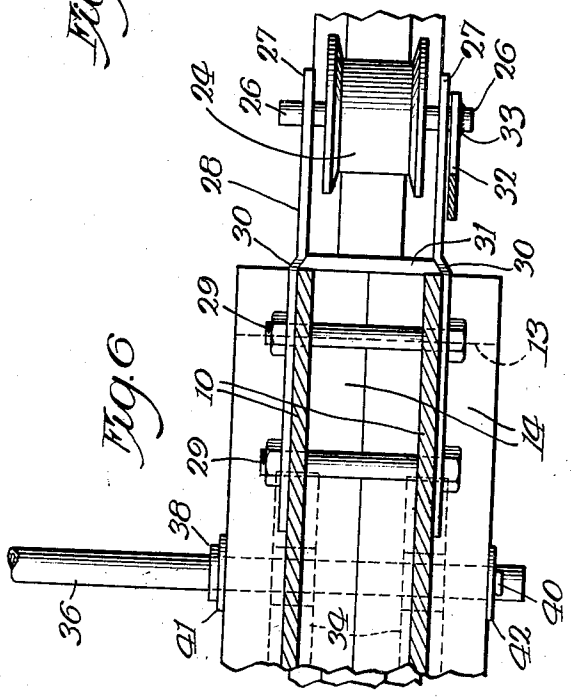


Fig. 6



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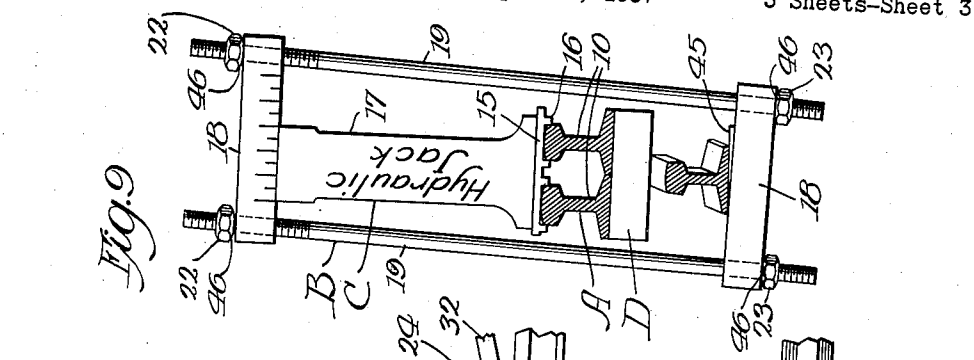

Fig. 9

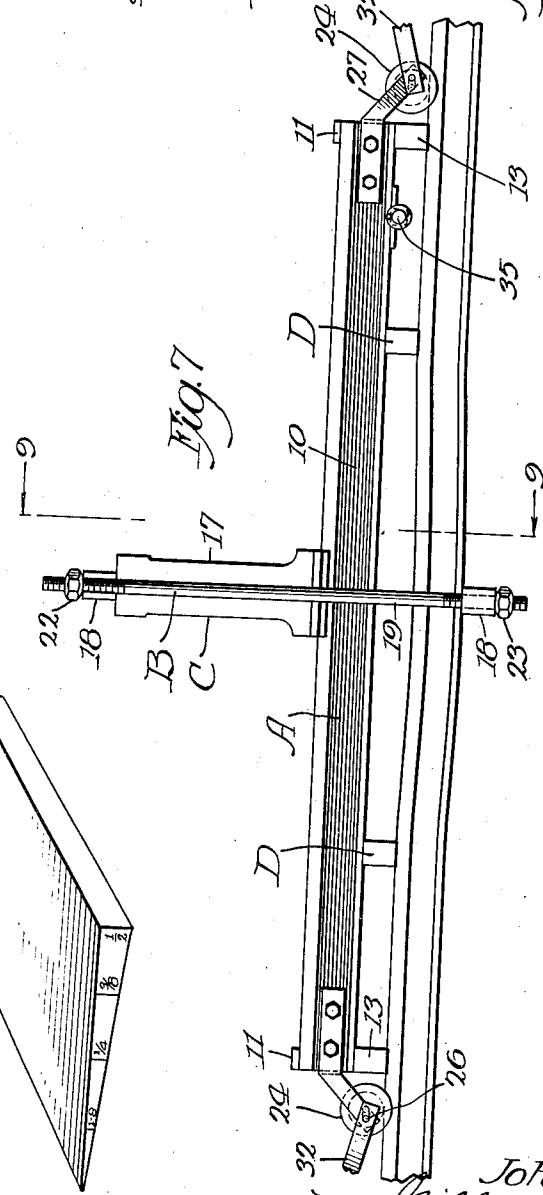

Fig. 7

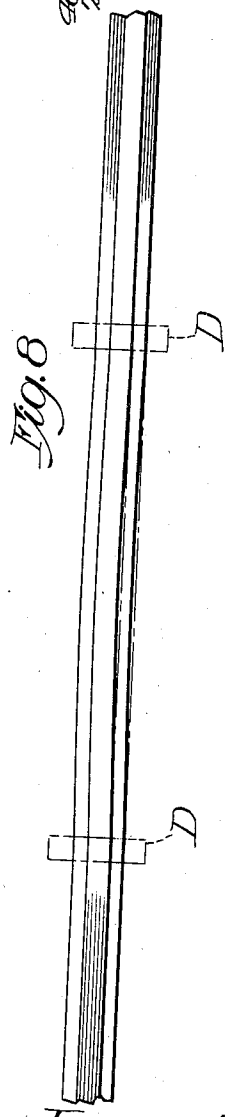

Fig. 8

Fig. 10

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR STRAIGHTENING RAILS

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Application September 18, 1937, Serial No. 164,545

13 Claims. (Cl. 153—38)

Under the peculiar action of locomotives at high speed the track rails develop bends or kinks characterized by downward and sidewise bending as though the rail had been struck a powerful blow at an incline. See "Notes on Track," 1903, by W. M. Camp, pages 983–987.

Heretofore it has been customary to remove such rails and send them to a place equipped with special machinery for straightening the bends. Other rails had to be put in the track in the meantime and obviously the result was very expensive and delays were frequent.

The principal object of the present invention is to provide a simple and inexpensive device and method for straightening bent or kinked rails without removing them from the track.

Generally speaking, this is accomplished by spanning the bend with a strong beam, putting buttresses on the head of the rail under the beam at about the points where the bend begins, mounting the power device on the beam and, with a suitable shackle applied to the power device, simultaneously raising and shifting the bent portion into line.

The same scheme with a slightly different method of application will straighten bends of other character.

A preferred embodiment of the invention for use by ordinary track labor is here described and illustrated in the accompanying drawings, in which

Fig. 1 is a side elevation of the rail straightener on a bent rail just before applying the straightening force;

Fig. 2 is a similar side elevation with the intermediate portion broken away, and illustrating the same straightener in position to travel along the rail between points of use;

Figs. 3, 4, 5 and 6 are sections taken on the lines 3—3, 4—4, 5—5 and 6—6, respectively;

Fig. 7 is a side elevation similar to Fig. 1, showing the device in the position it takes just prior to straightening a downward and sidewise bend or kink;

Fig. 8 is a plan view of a rail illustrating the sidewise bend, and indicating the proper location of the buttresses;

Fig. 9 is a sectional view taken on the line 9—9 of Fig. 7, illustrating a position the parts may take in straightening a downward and sidewise bend or kink;

Fig. 10 is a perspective view of a wedge used in applying the force to the rail.

But this particular construction is used for the purpose of illustration only and is not intended to impose unnecessary limitations on the appended claims.

Generally speaking, the rail straightener includes a stiff beam A, a shackle B, a powerful jack C, and two buttresses D.

The beam shown is composed of two lengths (about ten feet) of one-hundred-thirty pound rail 10 with steel plates 11, about ¾ x 2½ x 9, welded to the rail heads 12, adjacent to each end of the rail lengths and steel bars 13, 3 x 3¾ x 12 welded to the rail bases 14, adjacent to the ends of the rail lengths.

A movable steel jack plate 15 about ¾ x 10 x 12, having spaced flanges 16 to straddle the rail heads, fits on the intermediate portion of the beam, as best shown in Figs. 3 and 9, and forms the base or seat for a fifty or seventy-five ton hydraulic jack 17.

The shackle shown includes two steel bars 18, 3 x 3¾ x 17, each having a slot 43 at one end and a hole 44 at the other, to receive one and one-half inch steel rods 19, threaded about six inches at their lower ends and about twelve inches at their upper ends to receive nuts 22 and 23.

The buttresses D, here shown, are steel bars 3 x 3¾ x 12, and are adjustable along the rail to positions corresponding with the ends of the bend to be straightened.

In order to facilitate moving, the beam is provided with wheels 24 journaled on axles 25 having eccentric cranks 26, journaled in the arms 27 of forks 28, secured to the ends of the beam by bolts 29. The forks are made of steel bars offset inwardly and bent downwardly at their intermediate portions, generally indicated at 30, at which point they are welded to the beveled end of the plates 31, (Fig. 6).

One of the cranks 26 has a bent lever 32 fixed to it, as by welding at 33, by the aid of which the crank ax'es can be rotated to shift the wheels 24 from the raised position shown in Fig. 1 to the lowered position shown in Fig. 2, for lifting the beam off the rail preparatory to traveling along the track.

On the lower side, adjacent to one end of the beam, two loops 34 are welded to the rail bases to form a socket for receiving one end 35 of an outrigger bar 36, equipped with a roller 37 for giving the device lateral support on the rail opposite to that upon which the wheels 24 travel. The outrigger is really made up of an intermediate section of tubing with a steel bar inserted and welded in one end, fitted with collars 38 welded in place. The extreme ends have holes to receive keys 39 and 40.

When the device is to be stored the key 40 can be removed and the outrigger withdrawn from the loops 34. Washers 41 and 42 are used at each side of the beam to give the outrigger a proper bearing when assembled, as shown in Figs. 5 and 6. It will be noted from Fig 5 that the beam may tilt towards the center of the track while traveling and that makes for stability, particularly in the hands of the ordinary track labor. Upon the application of jack pressure, however, the device will automatically straighten to an upright position with respect to the rail to be straightened.

While the buttresses D might be mounted to slide along the rail base 14, it has been found convenient to have them entirely unattached, in which case they are simply laid on top of the beam in traveling from one place of operation to another. They and other parts could be made of commercial shapes with a saving of weight, but again, it has been found expedient to make the device substantially as shown.

In operation the beam A is placed on the bent rail with the bend somewhere along the intermediate portion of the beam, the jack plate and jack are located approximately at the middle of the bend to be straightened, the shackle is pulled apart at the slotted ends of the bars 18 and slipped into the position shown in Figs. 1 and 3 or 9, as the case may be. The buttresses D and D are inserted and placed at approximately the ends of the bend to be straightened.

If the bend is merely a "surface" bend, as it is called, that is to say, a downward bend, operation of the jack with the assembly as shown in Fig. 3 will lift the bent portion of the rail between the buttresses and take out the bend. Of course, there is some rebound and for that reason the downward bend should be raised until there is a slight indication of an upward bend. Men readily learn to estimate the amount of upward bend that is required.

It happens, however, that in the great majority of cases the bend is not only downwardly but sidewise, forming what is known as a kink, and straightening such a bend in one operation requires an upward and outward movement or what, in effect, amounts to a diagonally upward and outward movement, in a direction reverse to that in which the bending force took effect. In order to permit this the shackle is made to have a sidewise adjustment and motion, and use also is made of a wedge 45, shown in Fig. 10, tapering from one-half inch to a sharp edge.

In use the wedge is inserted between the lower bar 18 on the shackle and the base of the rail at the side toward which the lateral motion is required. When a straight edge, placed on the rail, as indicated by the dotted line in Fig. 8, shows a sidewise bend amounting to one-quarter inch, the wedge should be inserted to a thickness of one-eighth inch or thereabouts. Then the entire shackle should be slewed over, as indicated in Fig. 9, an amount depending somewhat on the adjustment of the nuts 22 and somewhat on the amount of the sidewise bend.

Operation of the jack with the parts so arranged causes the bent portion of the rail to be raised and to swing sidewise—to the right in Fig. 9. In fact, the bent portion of the rail moves along the resultant of the upward and sidewise movement indicated. That this result must take place will be evident from the following:

Since the shackle is slewed over, the longitudinal axis of the jack, which remains vertical or substantially so, forms an angle with the longitudinal axis of the shackle, and the transverse center line of the jack head lies at one side (the lefthand side in Fig. 9) of the transverse center line of the upper cross bar 18. The initial expansive force of the jack, which may be considered concentrated at the transverse center line of the jack head, thus has a leftward component and therefore tends to elongate the shackle in the direction of the diagonal connecting the upper lefthand and lower righthand corners of the shackle in Fig. 9. While the shackle is jointed and therefore does not of itself resist this elongation, substantial deformation is prevented by the presence of the solid jack and more particularly by the righthand end of the jack head which is exerting thrust against the upper cross bar of the shackle at the right of the center line of the cross bar, so that the upper cross bar cannot move toward the lower cross bar as it would have to do in the attempted deformation of the shackle. The continued expansion of the jack thus concentrates the jack force at the righthand end of the jack head, against a line on the upper cross bar at the right of its transverse center line, and because this line is off-center of the bar it produces greater tension in the righthand side rod 19 than in the lefthand side rod 19. This produces a counterclockwise moment about the center point of the shackle, causing the lower cross bar and the rail portion adjacent to it to swing to the right and upwardly. This movement translates the lower cross bar through a series of planes which are all parallel to each other, and the rail base undergoes the same kind of movement, so that the rail is not appreciably twisted but is translated simultaneously upwardly and laterally.

Of course, the wedge could be inserted between the right end of the lower bar 18 and the nut 23, or between the right end of the upper bar 18 and the nut 22, or the nuts could be adjusted, or a great variety of other expedients could be adopted to apply the force in a way to make the bent portion take the upward and sidewise movement, but in practical use the arrangement shown has proved satisfactory with ordinary track labor.

It will be evident that if the shackle is rectangular and is made or adjusted so that the cross bars are substantially parallel, and if the plane of that portion of the rail base which overlies the lower cross bar is horizontal and hence parallel to the bottoms of the buttresses D, the wedge 45 becomes a convenient means for effecting the necessary canting of the shackle with respect to the jack. However, as has been stated, the required non-parallel relationship of the longitudinal axes of the jack and shackle may be effected in any other appropriate way.

The slot 43 and the relatively large holes 44, together with the round faces 46 on the nuts 22 and 23, permit the shackle to take care of the necessary movement.

It will be understood that the sidewise bends are comparatively small; a one-quarter inch inward bend makes a tight gauge. In attempting to illustrate the position of the parts shown in Fig. 9, there is a certain amount of exaggeration.

With the wedge used as indicated, the nuts 22 and 23 need never be changed while the device is being used on a particular size of rail. The relatively longer threading at the upper end of the rods 21 is to permit adjustment for different sizes of rail.

The ability to apply the upward and sidewise

movement to the bent portion of the rail is the key to the situation, and permits the rail to be straightened at one operation instead of a plurality of operations, as would otherwise be necessary.

A device constructed substantially as shown and described has endured a long period of service under actual operating conditions and has made it possible for the first time to straighten downward and sidewise bends in railroad rails while in place in the track.

I claim as my invention—

1. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on the rail, a shackle comprising a pair of side members and a pair of rigid cross bars connected for relative angular movement to provide a quadrilateral frame enclosing the rail and beam at a point between the buttresses, and a jack mounted on the beam at said point having a head narrower than the length of the uppermost cross bar and engaged therewith with the axis of the jack at a side of the transverse center line of said bar.

2. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on the rail, a shackle comprising a pair of side members and a pair of rigid cross bars connected for relative angular movement to provide a quadrilateral frame enclosing the rail and beam at a point between the buttresses, and a jack mounted on the beam at said point having a head occupying less than the whole distance between the side members, whereby the head may be engaged with the upper cross bar and the frame may be canted so that the axis of the jack makes an angle with the frame side members.

3. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on a rail, side members and rigid cross bars loosely coupled at their end portions to form an angularly adjustable upright quadrilateral frame enclosing the rail and beam between the buttresses, and means interposed between the beam and the upper cross bar for exerting expansive force between the beam and a point on said cross bar at a side of its transverse center line.

4. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on a rail, side members and rigid cross bars loosely coupled at their end portions to form an angularly adjustable upright quadrilateral frame enclosing the rail and beam between the buttresses, and means interposed between the beam and the upper cross bar for exerting expansive force between the beam and a point on said cross bar tending to elongate the frame along one diagonal and simultaneously resisting such elongation.

5. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on a rail, side members and rigid cross bars loosely coupled at their end portions to form an angularly adjustable upright quadrilateral frame enclosing the rail and beam between the buttresses, and a power jack device having a base reacting against the beam and a head reacting against the upper cross bar having a surface extended along said cross bar for concentrating the expansive force of the jack at a point on said bar tending to elongate the frame in the direction of a diagonal while another point on said head engages the bar to resist deformation of the frame.

6. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on the rail, a shackle comprising a pair of side members and a pair of rigid cross bars connected for relative angular movement to provide a rectangular frame enclosing the rail and beam at a point between the buttresses, a jack mounted on the beam at said point having a head occupying less than the whole distance between the side members and engaged with the upper cross bar, and means canting the frame so that the axis of the jack makes an angle with the frame side members.

7. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on the rail, a shackle comprising a pair of side members and a pair of rigid cross bars connected for relative angular movement to provide a rectangular frame enclosing the rail and beam at a point between the buttresses, a jack mounted on the beam at said point having a head occupying less than the whole distance between the side members and engaged with the upper cross bar, and a wedge block interposed between the rail base and the lower cross bar to cant the frame so that the axis of the jack makes an angle with the frame side members.

8. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on the rail, a shackle comprising a pair of side members and a pair of rigid cross bars connected for relative angular movement to provide a rectangular frame enclosing the rail and beam at a point between the buttresses, a jack mounted on the beam at said point having a head occupying less than the whole distance between the side members and engaged with the upper cross bar, and a wedge block mounted on the frame for rendering the longitudinal axes of the jack and frame relatively inclined so that the transverse center of the jack head engages the upper cross bar at a side of its transverse center line, whereby the thrust of the jack against said cross bar contains a lateral component.

9. A device for straightening a downward and sidewise deformation in a rail by a single bending operation comprising a stiff beam adapted to overlie a rail, spaced buttresses to support the beam on the rail, a jack on the beam between the buttresses, a shackle comprising a pair of side members and a pair of rigid cross bars, and means connecting said members and bars together for relative angular movement to provide a quadrilateral frame enclosing the jack, beam and rail between the buttresses, said connecting means comprising nuts adjustably threaded on the end portions of the side members for limiting the separation of the cross bars.

10. In a straightener for downward bends in a rail of a track, a rigid base for engaging the head of a rail, a shackle for embracing said base

and the rail, a device cooperating with the shackle and the base for bending the rail toward the base, means supporting the base on the track including brackets extending from the base, axles having crank end portions journaled in the brackets, wheels loose on said axles, and means for turning said cranks to project said wheels into engagement with the rail to support the base clear of the rail for movement thereon and to retract said wheels to lower the base into operative engagement with the rail.

11. In a straightener for downward bends in a rail of a track, a rigid base adapted to be engaged with the head of a rail, a shackle for embracing said base and the rail, a device cooperating with the shackle and the base for bending the rail toward the base, means mounting the base on the track including brackets extending from the base, axles having crank end portions journaled in the brackets, wheels loose on said axles and in substantially the median vertical plane of the rail, and means for turning said cranks to project said wheels into engagement with the rail to support the base clear of the rail for movement thereon and to retract said wheels to lower the base into operative engagement with the rail with the median vertical planes of the base and rail aligned.

12. The method of straightening a downward and sidewise bend in a rail while in the track which includes enclosing the bend in a generally uprightly disposed quadrilateral frame having opposite sides of substantially equal length and having stiff upper and lower cross bars tied together at their respective ends so as to be capable of endwise shifting substantially horizontally relative to each other while remaining in substantially the same general vertical plane, disposing the cross bars transversely of the rail with the upper cross bar displaced horizontally with respect to the lower cross bar in the direction of the concave side of the sidewise bend so that the frame is substantially rhomboidal in shape, maintaining the lower cross bar fast with relation to the base of the rail in the bent portion thereof, and applying an expansive force to the frame by means of a member loosely engaged with the upper cross bar and maintained substantially vertical, said member having a portion engaged with said bar of less length than the bar and arranged to span the center of the bar and located closer to the upper obtuse angle of the rhomboidal frame than to the upper acute angle thereof, whereby greater tension is set up in the side of the frame at the concave side of the sidewise bend than in the opposite side of the frame with the result that the lower cross bar and the adjacent bent portion of the rail move upwardly toward the upper cross bar and shift horizontally with respect to the upper cross bar and the bent portion is straightened by moving upwardly and to one side.

13. The method of straightening a downward and sidewise bend in a rail while in the track which includes enclosing the bend in a jointed, normally oblong rectangular frame having stiff upper and lower cross bars, deforming the frame to substantially rhomboidal shape with the plane of the frame normal to the plane of the rail web and with the cross bars substantially horizontal above and below the middle of the bend and the lower cross bar maintained fast with relation to the rail base and the upper cross bar displaced horizontally with respect to the lower cross bar in the direction of the concave side of the sidewise bend, arranging an expansible member to expand, along a line substantially normal to the straight line of the rail, between the upper and lower cross bars, maintaining said member in said position, said member having a portion loosely engaged with the upper cross bar of less length than the bar and arranged to span the center of the bar and located closer to the upper obtuse angle of the rhomboidal frame than to the acute angle thereof, and thereupon expanding the member, whereby greater tension is set up in the side of the frame at the concave side of the sidewise bend than in the opposite side of the frame with the result that the lower cross bar and the adjacent bent portion of the rail move upwardly toward the upper cross bar and shift horizontally with respect to the upper cross bar so that the frame becomes substantially rectangular and the bent portion is straightened by moving upwardly and to one side.

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