March 20, 1945. P. G. STULTZ 2,371,659

DEVICE FOR STRAIGHTENING FREIGHT CAR ENDS AND THE LIKE

Filed Nov. 5, 1942 5 Sheets-Sheet 1

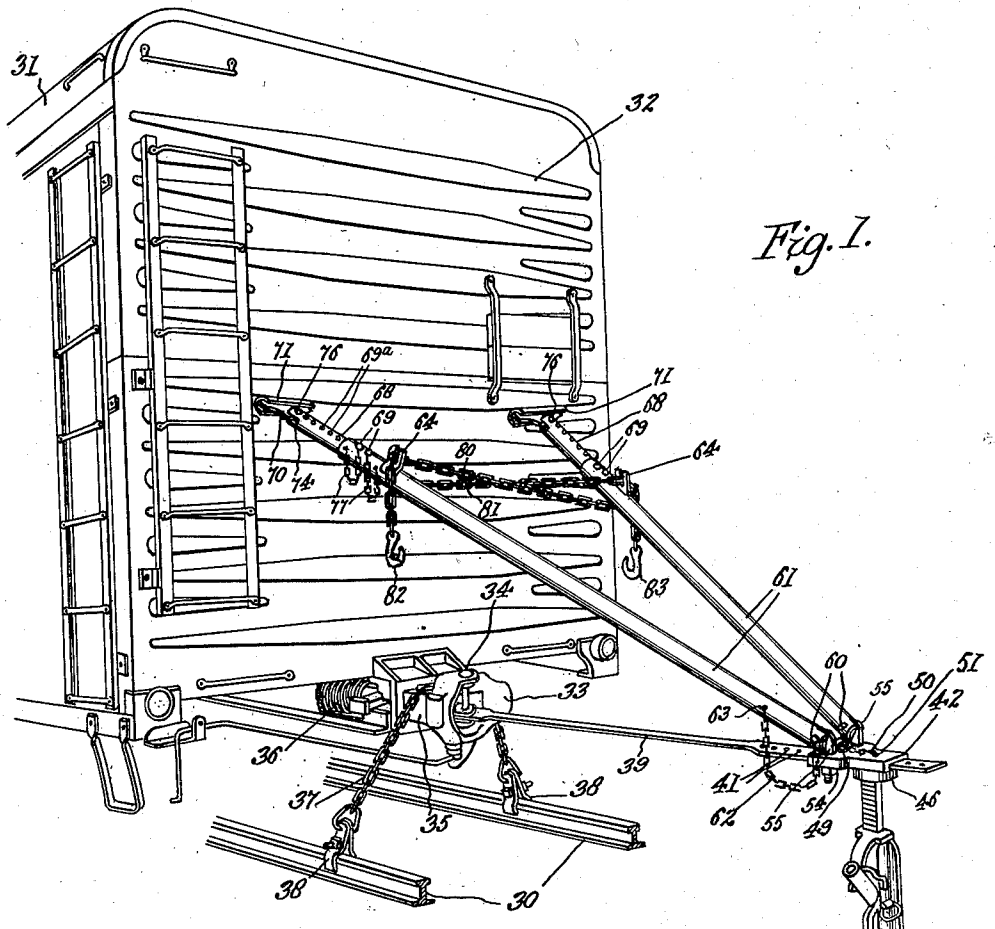

Fig. 1.

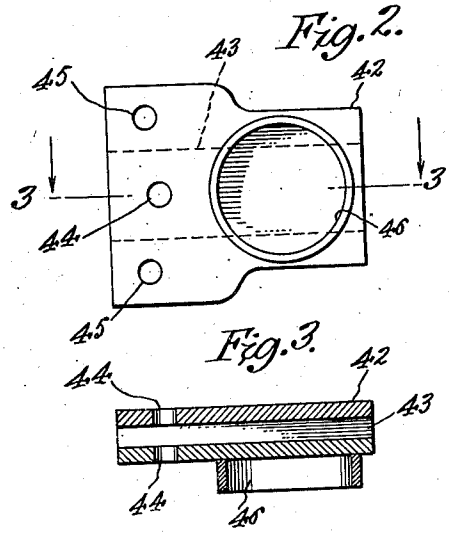

Fig. 2.

Fig. 3.

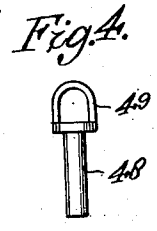

Fig. 4.

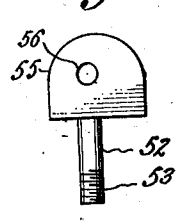

Fig. 5.

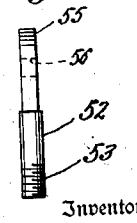

Fig. 6.

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DEVICE FOR STRAIGHTENING FREIGHT CAR ENDS AND THE LIKE

Filed Nov. 5, 1942 5 Sheets-Sheet 2

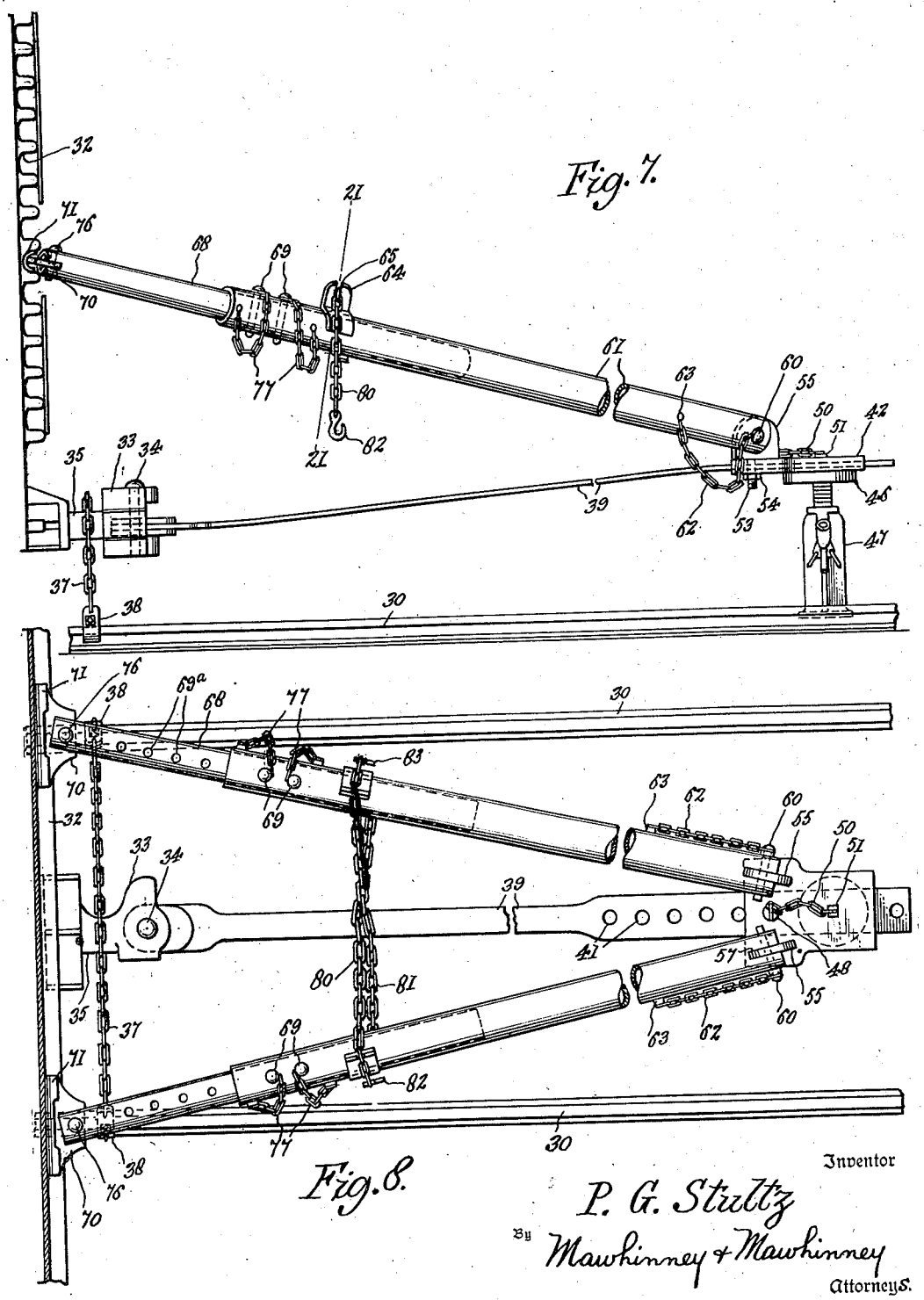

Fig. 7.

Fig. 8.

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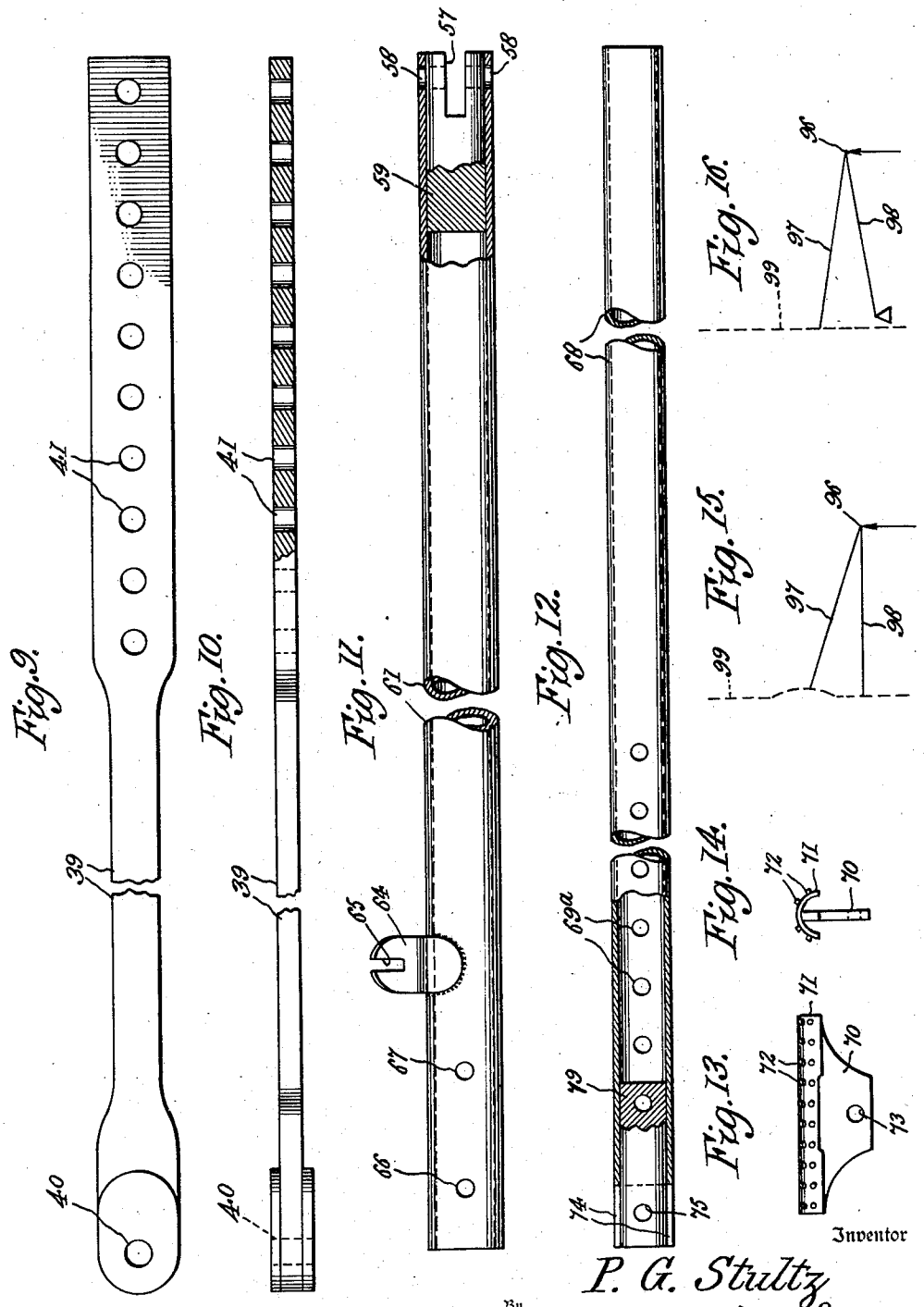
DEVICE FOR STRAIGHTENING FREIGHT CAR ENDS AND THE LIKE

Filed Nov. 5, 1942 5 Sheets-Sheet 3



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DEVICE FOR STRAIGHTENING FREIGHT CAR ENDS AND THE LIKE

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Fig. 17.

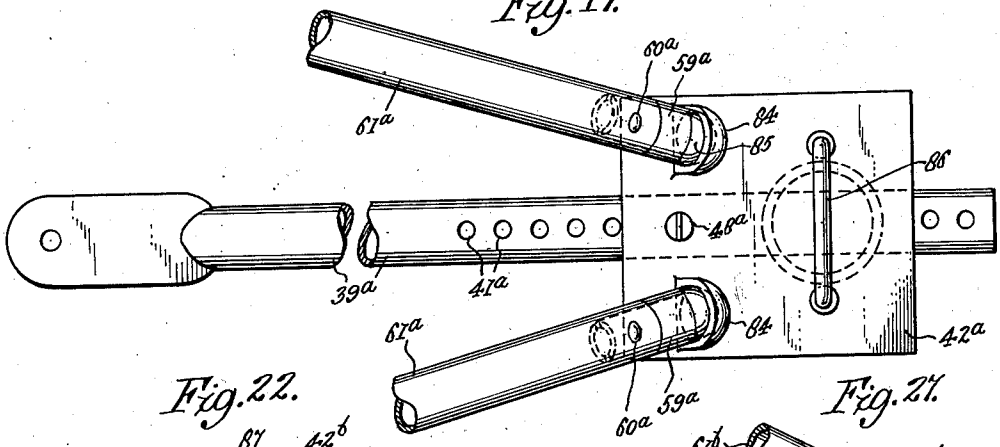


Fig. 22.

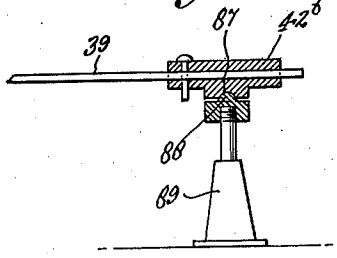


Fig. 24.

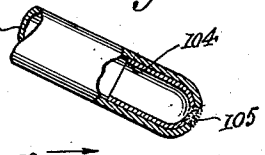
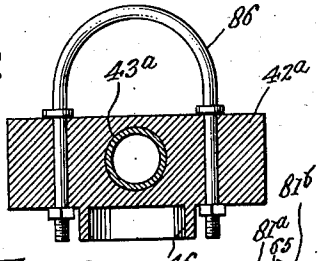


Fig. 18.

Fig. 19.



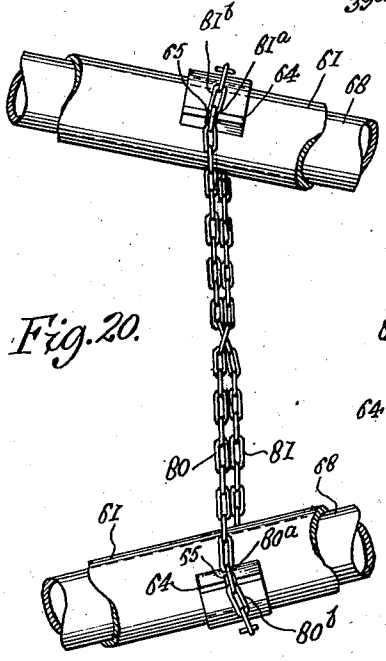
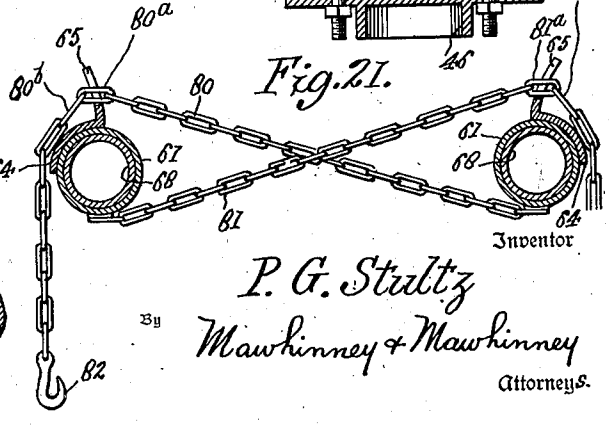


Fig. 20.

Fig. 21.



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DEVICE FOR STRAIGHTENING FREIGHT CAR ENDS AND THE LIKE

Filed Nov. 5, 1942 5 Sheets-Sheet 5

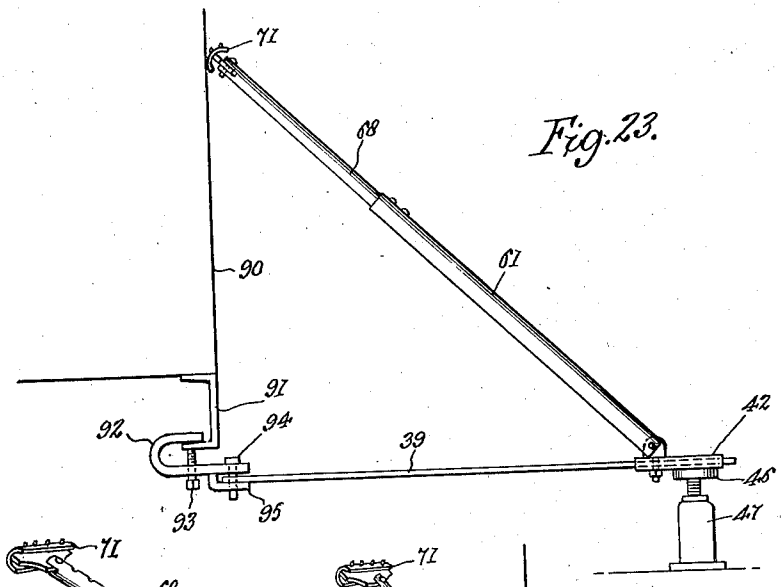

Fig. 23.

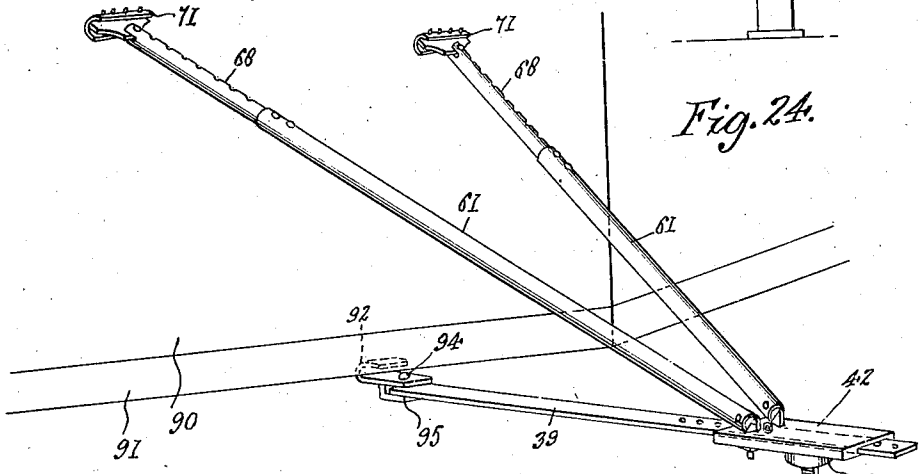

Fig. 24.

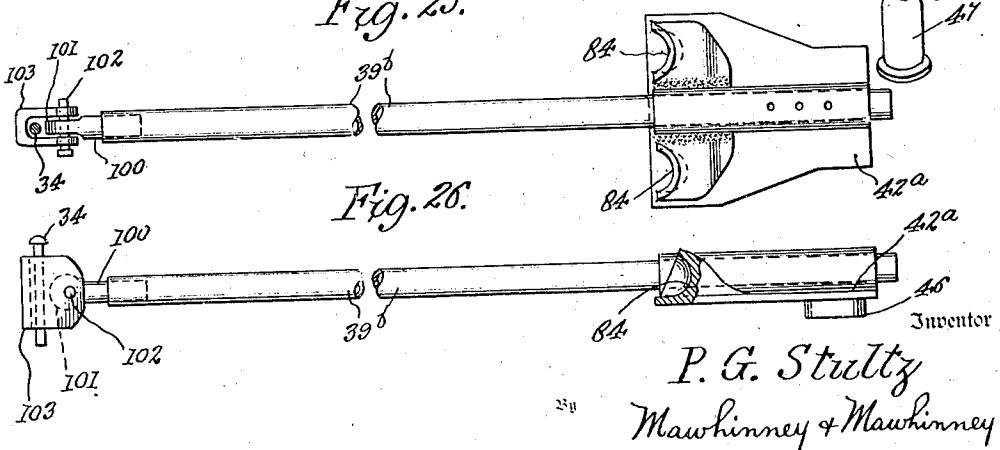

Fig. 25.

Fig. 26.

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Patented Mar. 20, 1945 2,371,659

UNITED STATES PATENT OFFICE

2,371,659

DEVICE FOR STRAIGHTENING FREIGHT CAR ENDS AND THE LIKE

Posy G. Stultz, Roanoke, Va., assignor to Charles M. O'Boyle, Wilmington, Del.

Application November 5, 1942, Serial No. 464,634

12 Claims. (Cl. 153—38)

The present invention relates to improvements in devices for straightening freight car ends and the like.

In railroading practice, in the transportation of lading by freight cars, due to the momentum or inertia of the load, stopping and starting, particularly sudden starting or stopping, of the freight cars has been a cause of the load shifting against the ends of the cars, which are ordinarily made of sheet steel, with the consequent bending or distortion of the ends, generally manifested in an outward bulged condition; and it has become a problem to restore these bulged ends to normal straight original condition.

Cars thus damaged must be cut out of the train for restoration which involves loss of use of the car and its facilities for the duration of the repair period, as well as expense in labor and materials in the repair; and such damaged cars are rejected by shippers at points of loading because it has been found that the outwardly bulged ends prevent tight loading of the car in a manner to prevent shifting of the merchandise, and shifting will ordinarily damage the goods and prevent their sale as first class articles at current market prices.

Machines have been proposed, but with small success, to deal with this condition but such machines are large and cumbersome, require to be manned by a large number of operatives, are not easily transportable from job to job and have numerous other difficulties all of which are known to those skilled in this art.

Then again these bent and distorted steel end plates require enormous pressure to restore the same. Such pressure is not easily obtained at yards where repairs of this kind are ordinarily done, as available tools, such as jacks, cranes and the like, are insufficient to develop such enormous pressure required for the cold bending of steel plates of this heavy gauge.

It is an object of the invention generally to overcome the above difficulties and to provide a straightening device of an exceedingly simple construction with few easily transportable parts, all capable of being set up and operated by not more than two men, which will be inexpensive in its construction, maintenance and operation, and quickly applied to many damaged cars in succession, whereby this type of repair may be so taken care of as to eliminate it as a major trouble in the maintenance of freight car transportation.

Another object of the invention is to provide an improved device by which the cold bending of heavy gauge steel railway freight car end plates may be accomplished in situ, wholly by the application of the bending force externally of the car, and without having to dismantle the car or any of its parts, in which the steps of the method are simply and expeditiously carried out by not more than two operatives, and wherein the tremendous pushing force required to bend the metal, which would otherwise move the car on the rails to the progressive diminishing of this bending force, is converted in a reactionary way to impose upon the same car or work an equal and opposite reacting pulling force which will negative and offset the pushing force, whereby the car may be operated on without the use of the brake.

The invention also contemplates the provision of a simple form of triangulated structure, two sides of which are connected to the work or car, so constructed and arranged that a railroad jack, crane or other lifting device of the capacity ordinarily found in freight and repair yards may be utilized and found sufficient for the purpose in that its power is multiplied many times by the simple arrangement and application of the device.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a perspective view of a device constructed and applied in accordance with the present invention, shown in the position of use as applied to the end of a freight car.

Figure 2 is an enlarged bottom plan view of the jacking head.

Figure 3 is a longitudinal central section taken on the line 3—3 of Figure 2.

Figure 4 is a side elevation of a form of pin for adjustably securing the pull or holding bar in the jacking head.

Figure 5 is a side elevation of a form of swivel member, of which there are preferably two, mounted rotatably in the jacking head and in which the arms are pivoted.

Figure 6 is an edge view of the same.

Figure 7 is an side elevation of the improved device in a position of use and under pressure.

Figure 8 is a top plan view of the same.

Figure 9 is a plan view of a form of pull or holding bar employed.

Figure 10 is a longitudinal edge view of the same with parts broken away and parts shown in section.

Figure 11 is a side elevation of a form of external arm, of which there are preferably two, shown partly broken away and partly in section.

Figure 12 is a similar view of the cooperating internal arm, of which there are preferably two.

Figure 13 is a side elevation of a form of shoe employed.

Figure 14 is an end view of the same.

Figures 15 and 16 are schematic or diagram figures showing the method and principle of operation of the triangulated structure with reference to the bending operations as referred to the power applied.

Figure 17 is a fragmentary top plan view of a modified form of device in which ball and socket universal connections are made between the jacking head and bending arms and in which the device is equipped for use with an overhead crane instead of a jack.

Figure 18 is a side elevation of the device shown in Figure 17, with parts broken away and parts shown in section.

Figure 19 is a vertical transverse section taken on the line 19—19 of Figure 18.

Figure 20 is a top plan view, on an enlarged scale, showing the lugs and anti-spreading chains.

Figure 21 is a cross section taken on the line 21—21 in Figure 7.

Figure 22 is a side elevation, with parts broken away and parts shown in section, of a jack and jacking head with a universal connection therebetween.

Figure 23 is a side view showing a device modified for application to the side of a freight car.

Figure 24 is a perspective view of the same.

Figure 25 is a top plan view of a further modified form of the device.

Figure 26 is a side elevation of the same.

Figure 27 is a fragmentary end view of one of the external arms showing a method of forming a ball head.

Referring more particularly to the drawings, 30 designates the railway rails on which a box or freight car 31 of any description rolls, and 32 represents one of the corrugated ends of such car. The draw or coupler head 33 has its knuckle removed to receive the improved device which may be attached by the customary knuckle pin 34. The draw bar or coupler shank 35 is mounted on the car in the customary way and is restrained by the influence of the draw bar spring, which is indicated at 36.

In accordance with the invention a chain or other flexible connection 37 may be trained over the coupler shank 35 with its ends brought down and terminating in clamps 38 adapted to be removably secured to the rails 30. This chain will be of suitable selected strength to resist lifting of the car body on its trucks in response to the enormous lifting pressure developed by the improved device. Where the car is heavily loaded such chain 37 will not be required.

A pull or holding bar 39, shown more particularly in Figures 9 and 10, is provided at one of its preferably flattened and reinforced ends with a perforation 40 to receive the knuckle pin 34 by which the bar 39 is anchored to the car or other work. The bar 39 is further provided at its other preferably flattened end with a series of apertures 41 to fit slidingly and adjustably through a slot 43 in an adjustable jacking head 42, shown more particularly in Figures 2 and 3. Such jacking head is provided with holes 44 in both walls at opposite sides of the slot 43 and along a longitudinal center line which causes the coincident axes of the two companion holes 44 to intersect at substantially right angles the longitudinal center line of the slot 43 toward the car end of the jacking head 42. At opposite sides of this center line are the eyes or holes 45 made vertically through the jacking head. Such jacking head is also formed on its lower face with a socket 46 formed by a collar welded or otherwise secured to the lower surface of the jacking head preferably offset from the center thereof away from the freight car. The retaining wall or collar of this socket 46 may be round, square, rectangular or of any desired form which will make it adaptable for cooperation to fit over and about the head of a jack 47 or some other instrument by which the necessary power may be applied to exert a lifting force against the outer end portion of the bar 39.

Referring more particularly to Figure 4, a pin 48 is supplied of a form to fit through the pair of holes 44 on the center line of the jacking head 42 and through an aperture 41 of the pull or holding bar 39 that is presented at the time. By withdrawing pin 48 the jacking head 42 may be slid on the bar 39 toward or from the car to change the ratio of leverage. When the pin 48 is reinserted it will retain the jacking head 42 in the newly adjusted position. The pin head 49 receives the free end of the chain or the like 50 anchored, as at 51, upon the upper part of such jacking head as by welding. This chain 50 is loose so as not to interfere with the insertion and withdrawal of the pin 48, but it retains the pin captive against loss and confusion and assures that the pin 48 is always at hand when needed. One such pin 48 is supplied.

Referring more particularly to Figures 5 and 6, swivel bolts, preferably two in number, are supplied, having plain shanks 52 receivable through and retainable in the holes 45 in the jacking head 42 and of a length to project below the jacking head, where the projecting portions of the shanks are threaded, as shown at 53, to receive nuts 54 by which the bolts are held securely on the jacking head 42 but enabled to freely rotate on the vertical axes of the bolts 52. The bolts have flat heads 55 pierced by horizontal eyes 56. The heads are adapted to be received in slots 57, shown in Figure 11, in the lower ends of the external arms. The slots 57 in the external arms 61 constitute bifurcated portions which straddle the flat swivel heads 55. The bifurcated ends are pierced by perforations 58, two in number, for each external arm 61 used. The two perforations 58 are in line and with their axes substantially at right angles to the axis of the tubular external arm 61 made of metallic pipe or the like. Through these registering perforations 58 and through the included eye 56 of a swivel bolt 52 passes a pin 60. The walls of the spaced perforations 58 engage the shank of the pin 60 at remote axially displaced sections and thus provide a double resistance against shearing stresses which may devolve on such pin 60 incident to the tremendous power developed and transmitted from the pull or holding bar 39 upwardly to the arms 61. Where two arms are provided, two pins 60 will be needed. The heads of these pins are welded to the free ends of chains 62 which chains are anchored, as by welding, at points indicated at 63 on the external arms 61.

Referring again to Figure 11, fillers 59 of metal or other material may be placed in the lower bifurcated ends of the tubular external arms 61 to

reinforce and strengthen the same where weakened by the slot 57 and the perforations 58. Inasmuch as the axes on which the bolts 52 swivel are vertical and the axes of the inserted pins 60 substantially horizontal the external arms 61 have in effect a universal movement about the jacking head 42.

The external arms 61 have secured thereon by welding or otherwise U-shaped lugs 64 having the open slots 65. The upper ends of the external arms are provided with aligning pairs of perforations 66 and 67 formed any desired distance apart along the length of the external arms 61.

Through the upper ends of the external arms are adjustably fitted internal arms 68 of tubular metallic or other desired construction. Such internal arms 68 are traversed at predetermined intervals by pairs of aligning holes 69a, two pairs of which are adapted to register with the two pairs of holes 66 and 67, so that pins 69 may enter such registering or aligning holes and secure the telescoping adjusted position of the arms which determines the overall length of such arms from the apex of the triangle at the jacking head 42 to the upper ends of the internal arms 68 which ends swivelly carry the shoes, as shown in Figures 13 and 14.

The shoes may be of any suitable form one embodiment of which consists of a web 70 welded along the inner portion of the transverse arc of a part cylindrical shoe tread 71 fitted with spaced rows of burrs 72 or other forms of rough surfacing elements to enhance the gripping action of the shoes upon the plain or corrugated face of the car sheets. The webs 70 of the shoes have perforations 73 and such webs are receivable into the slotted or bifurcated upper ends 74 of the external arms 68. These ends are also provided with pairs of perforations 75 in alignment transversely of the length of the arms and in position to register with the perforations 73 of the shoe webs. Pins 76 are adapted to pass through these aligning perforations to pivotally couple the shoes to the arms with the axis of the pivots or pins 76 being substantially vertical so that no matter what the swivel angle of the arms, the entire length of the shoe tread 71 may be made to contact with the face of the car end. The pins 69 may be held captive by chains 77 welded or otherwise connected to the arm sections 61; and similar chains may be welded to the pins 76 and to the internal arm sections 68, if desired, although the vertical position of the pins 76 will tend to hold these pins in place gravitationally.

In Figure 12 a filler or plug 79 is shown mounted in the outer free end of the inner telescoping arm section 68 to reinforce and strengthen the tubular construction against weaknesses which might otherwise occur because of the slotting 74 and the perforating 75.

Chains 80 and 81 have ends welded to the external arm sections 61 adjacent the lugs 64. The free ends of such chains carry hooks 82 and 83 adapted to engage links of the companion chain when in the overlapped position. The slots 65 of the lugs 64 are wide enough to receive the links of the chains when vertically disposed so that an adjacent horizontally disposed link will abut against the lug and prevent the chain from being drawn through the slot 65 such as would enable the arms to spread apart.

Referring more particularly to Figures 15 and 16, 96 designates the apex of a triangle of which 97 is the one side and 98 the other side. 99 represents the line of the car end or the car side or of any metal or other work to which the device is applied. These diagrams Figures 15 and 16 show roughly the action of the device which is mainly triangular in form with the lower side represented by the bar 39, and with the one side 97 represented by the pushing or bending arms. The work 99 to which the free ends of the sides 97 and 98 are applied forms the other third side of the triangle.

The jack or other lifting pressure is applied approximately at the apex 96 as indicated by the arrow and approximately at right angles to the plane of the lower side 98. This causes the triangle to be tilted or rotated slightly from the initial position illustrated in Figure 15 to the position shown in Figure 16, which is possibly exaggerated for the purpose of clearness. This tilting of the triangular device causes the pushing arm or arms to be forced toward the car end 99 or other work and creates a corresponding pull on the lower side 98. Inasmuch as the lower side is connected to the car or other work the pushing and pulling forces applied to the car will be compensating, offsetting or neutralizing in their effect on the car. Thus while one force is tending to move the car in one direction the other force is just as effectively applied to move it in the other direction. This will prevent the car from "walking away" from the applied pressure of the bending arms. In other words it will keep the work up to the bending pressure.

There is possibly an advantage in anchoring the lower side, as in the case of the bar 39, to the coupler head inasmuch as the enormous pressure developed by this triangular leverage device has been found to pull out the draw shank to such an extent as to place the draft spring 36 under compression. As is well known this requires a tremendous force, as for instance the draft of many heavily laden freight cars. The reaction of the compressed spring 36 will add its effect to the pushing arms. The lifting force provided by the jack or other method will be preferably applied at approximately the apex or the angle between the upper and lower sides. The further this force is applied away from the apex will require greater rigidity in the bar 39 to resist the bending strains in the bar 39 created by the lifting or raising movement. These strains are at a minimum at the apex of the triangle. Also the most satisfactory results will be obtained if the jack or other lifting force moves at approximately right angles to the plane of the lower side. Otherwise stated this lifting force should be approximately parallel to the end of the car or the face of the work. For best results the vertical distance between the free ends of the sides 97 and 98 should be less than the length of the lower side 98; or otherwise stated less than the distance between the apex 96 and the anchorage of lower side 98 to the car or work. The angle between the sides 97 and 98 should be acute. The less this angle the more direct the application of the power through the upper side or arm.

The jack or crane simply furnishes the power. These elements are available in all railroad yards and need not be transported with the device which is of minimum weight, can be handled easily and admits of folding so that it can be easily transported on a hand truck.

To cold press end corrugated sheets the same

requires a pressure or force in excess of 200 tons. Jacks and other tools available in railroad yards lack this tremendous force. The triangulated device greatly multiplies the force of the jack so that it is easily able to accomplish the work.

Straightening corrugated sheets of the gondola car, which is composed of a very heavy sheet, requires a pressure to be exerted when the sheet is cold greater than is ordinarily available in a railroad car plant. The leverage exerted by the triangular device of this invention enables a power unit of reasonable size generally found around railroad car plants, namely a jack of 50 tons, to achieve this purpose.

To do this work economically with a car on the rails without the brake applied or other means to prevent the car from moving, it is important that the fulcrum point should be on the car where a pressure of a hundred thousand pounds or more is being exerted on the bent surface, the fulcrum preventing movement of the car away from the arms at the point where the work is being done.

The device can be worked without damage to the anchor points at the side of the car because the side sheets of the car are of much lighter construction and longer distances are involved between the points where the sheets are anchored, so that less power and leverage is required. The fulcrum is where the bar **39** connects at **34** with the coupler. The distance is closer from the fulcrum to the point of application of the force than between the fulcrum and the point of application of the power. It is preferred that where a rigid bar **39** is employed it will have a loose fit on the knuckle pin **34** to allow the outer end of the bar **39** to rise. However, there is approximately 3'' slack in the coupler and the coupler can rise approximately ⅞ of an inch in the carrier.

Furthermore, in connection with the method, the steel plates are pressed cold by both pulling and pushing at the same time to render same substantially immovable during the application of the pressure. The shoes apply the pressure locally at the points where the bends or bulges occur. After the bending a sledge hammer or some other heavy tool is used to strike the sheets heavy blows, preferably along the vertical edges of the sheets in order to set the restored metal and prevent it from buckling out resiliently into the bulge it had assumed.

It will be noted that the construction with reference to the various pins employed provide for double shear resistance and in some cases quadruple shear resistance on the pins where the same are used in pairs.

To affix the device to a bulged or bent end of a car, the coupler knuckle (not shown) is removed. The knuckle pin **34** is then applied to the top lug in the coupler and then through the hole **40** in the holding bar **39** and then through the bottom knuckle pin hole in the coupler. The other end of the pull or holding bar **39** is adjusted in the jacking head and is affixed by the pin **48**. This changes the distance between the fulcrum and the apex where the power is applied. The jack or other instrumentality is now operated to lift the holding bar **39**. This jacking pressure causes a pull on the bar **39** and a pushing moment on the upper arms. The length of the bar **39** may be adjusted by the pin **48** and the lengths of the arms may also be adjusted by the use of the pins **60** and **69**. The arms may be raised or lowered so as to bring the shoes at any desired local area upon the end or side of the car. The roughened shoes and where corrugated, the end walls or plates of the car will tend to hold the shoes and arms against slipping or sliding. Also where two or more of the arms are used, such arms may be moved together or apart a desired distance on the swivel bolts **52**. By hooking the chains **80** and **81** together or by engaging the links of the chains in the slots of the lugs **64** such chains **80**, **81** may act to prevent the arms from spreading under the reaction of the immense force applied.

It will be found more convenient to provide the socket **46** at the bottom of the jacking head as it tends to maintain the jack upright and prevents tilting or slipping out from the device but it is not essential. It makes for a substantial margin of safety.

The device is applicable to any type of freight car and enables the sheets to be straightened and restored to normal or original position without removing any of the damaged parts or car lining as the pressure arms can be moved and applied at any external point where needed.

The device is so powerful that it is not necessary to unload a car as the applied pressure will develop sufficiently to move in the lading along with the bulged sheets. It saves time to be able to repair damage without unloading the car and without having to gain access to the interior of the car. Moreover the load in the car serves to prevent the car from rising off its trucks when the pressure is applied. The device can be used in adjusting lading that has shifted over ends of the car such as lumber, stone, poles, etc.

Figure 16 shows the lower side **98** of the triangle at its left end pulled slightly away from the surface of the work **99** which indicates that this fulcrum point is a shifting one due to the outward movement of the coupler head incident to the compressing of the coupler spring. However in those instances in which the lower side of the triangle is connected to a non-shifting anchor, as to the car bolster, angle iron or the like, the lower side member **98** will not be permitted to shift outward, or in the direction to the right viewed in Figure 16, but this lower side **98** will lift or pivot upwardly while the motion of translation will all devolve upon the other side member **97**, forcing it toward the left into the work **99**.

Referring more particularly to Figures 17, 18 and 19, a modified form of jacking head **42ª** is shown on which sockets **84** are provided; such sockets upstanding from the jacking head and being formed integral therewith or separately and united to the jacking head in any convenient manner. These sockets cooperate with ball heads **85** on the lower ends of the external arms **61ª** in order that the pressure or straightening or bending arms will have a substantially universal movement on the jacking head **42ª**. For convenience the ball heads **85** may be cast or otherwise produced upon plugs or fillers **59ª** removably secured in the ends of the arms **61ª** as by the use of pins **60ª**.

Where the jacking heads are made from castings, these universal joints of the ball and socket type are of more economical construction than the swivel bolts **52** of Figures 5 and 6.

The jacking head **42ª** carries a U-bolt **86** or other form of eye by which the jacking head **42ª** may be lifted from above, as by the use of a crane hooking into the eye **86**. In other words the lifting force may be developed by a jack below or a crane above the jacking head.

In the form of jacking head 42a the through slot 43a will be of circular cross section, for which see Figure 19, in order to mate with the round bar cross section of the holding or tension bar 39a which is of a pipe construction having the pairs of spaced perforations 41a through its upper and lower walls to receive the pin 48a which also passes through openings in the jacking head similar to the openings 44 shown in Figure 3.

Referring more particularly to Figures 20 and 21, these figures show the chains 80 and 81 which are anchored to the external arms 61 by welding or otherwise preferably at the lower portions of such external arms. These chains are crossed and extended over the upper sides of the companion external arms 61 where links 80a and 81a, vertically disposed, are slipped down through the slots 65 of the lugs 64, the adjacent links 80b and 81b, horizontally arranged, are wider than the slots 65 and therefore abut against the outer sides of the lugs 64 and prevent the chain pulling through the slots 65. In this instance the doubled chain ties the two compression or straightening arms together and results in double strength of chain against spreading of the arms 61.

Referring more particularly to Figure 22, the jacking head 42b is formed with a rounded socket 87 to receive a ball head 88 on the upper end of the jack 89. This will give a universal movement between the jack and the jacking head, will enable these two parts to fit adequately together throughout all contacting face areas and will thus enable the jacking head to oppose any tilting movement of the jack 89 and to prevent the jack from falling over.

Referring more particularly to Figures 23 and 24, these figures show a device for operating upon the side of car indicated at 90, and for this purpose the side sill or channel 91 is used for forming the anchorage for the adjustable spacing bar 39. A clamp 92 is constructed and arranged to grab the side sill channel along its lower flange, this clamp having one or more set screws 93 to engage beneath such lower flange. A pin 94 functioning as the knuckle pin of Figure 1 passes through the eye 40 of the holding or spacing bar 39 and through the shank of the clamp 92 to loosely hold the bar 39 at a fulcrum point on the car. This method of application to the work applies also to cross members or to center sills or to body bolsters or any other part of the car or trucks. The pin 94 also passes through an offset portion or ledge 95 forged or cast with the clamp 92 or carried therebeneath in spaced relation to the shank of the clamp to accommodate the end of the spacing bar 39 between such shank and the offset part 95; the offset part 95 serving to support the end of the spacing bar 39.

A chain or chains may be substituted for the bar 39, in which case one end may be welded to the jacking head and the other end wrapped around the coupler shank or hooked on to the side or center sill of the car or to other desired anchorage points.

The hooks 82 and 83 may be hooked in links of the chains 81 and 80 where the pressure arms are spread far apart.

The device is applicable to plain, corrugated, embossed, wooden or other ends of cars, to ships' plates and other uses.

Referring more particularly to Figures 25 and 26, 39b illustrates the tension or holding bar, also referred to as the spacing bar which is of tubular construction having at one end a filling or plug, 100, having a shank projecting therefrom with a flat perforated end 101 through which removably engages a substantially horizontal pin 102. This pin 102 also passes through both legs of a U-shaped yoke 103 having a vertical height which will correspond substantially to the vertical height of the knuckle pin 34 lying between the upper and lower lugs of the coupler head 33. To apply this modification to the coupler, the pin 34 would be lifted out, the knuckle set aside, the yoke 103 slipped into place and the coupler pin 34 dropped so that it engages within the bight of the U-shaped yoke 103 in the manner indicated in Figures 25 and 26. This yoke 103 will prevent shifting of the inner end of the spacing bar 39b vertically up and down on the coupler pin 34 and will prevent any sudden or quick movements of the spacing bar up on the coupler pin incident to the upward or jacking movement of the outer end of such spacing or holding bar 39b. At the same time this yoke arrangement provides for a pivoting movement in a vertical direction of the spacing arm about the pin 102 so that the spacing bar 39b may swing up about its fulcrum on the coupler head in obedience to the jacking movement applied at the outer end of such spacing bar.

Referring to Figure 27, the lower end of the external arms 61b may be reinforced by plugs, fillers, or the like, either solid or tubular, as indicated at 104 and the composite ends of the arm and filler are peened over and welded as indicated at 105 into a substantially globular form or part spherical form to constitute the ball head for cooperating with the sockets 84 as shown in Figures 17 and 18. This is a cheap and strong form of ball head construction.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of this invention without departing from the spirit thereof, such changes and modifications being restricted only by the scope of the following claims:

What is claimed is:

1. A device of the character described comprising a jacking head having means whereby the same may be forcibly lifted and also having a slot and upstanding sockets, a spacing bar slidable through said slot, means to adjustably fix said bar in the head, means to fulcrum the bar to the work, and straightening arms having ends engaged against the work and ends with balls to universally engage in said sockets.

2. A device for straightening the bulged sheets of railroad cars comprising elongated upper and lower members meeting in an acute angle with the apex spaced from the sheet with the free end of the upper member engaging said sheet, means flexibly anchoring the free end of the lower member to the car with said lower elongated member extending out at substantially right angles to the plane of the sheet, a jacking head located at said apex for connecting said members together, said jacking head having slidable movement on said lower member, means to secure the jacking head fixedly in adjusted position on said lower member, a socket on said jacking head, said upper member having a ball end portion fitting for universal movement in said socket, said jacking head having means to receive movable power means applied to move said jacking head in a direction substantially parallel to the plane of the work to cause a tilting movement of said jacking head and connected mem-

bers whereby to cause free end of the upper member to move against the work.

3. A device for straightening the bulged sheets of railroad cars and the like comprising upper and lower elongated members meeting in an acute angle with the apex spaced from the sheet and with the free end of the upper member engaging the sheet, means flexibly anchoring the free end of said lower member to the car, and a jacking head located approximately at said apex for connecting said members together, means between said jacking head and upper member for connecting these two parts for substantial universal movement, said jacking head slidable on said lower member and carrying with it said upper member to change the degree of the angle between the members for application of the free end of the upper member to selected zones on the sheet, means to secure the jacking head fixedly in adjusted position on said lower member, said jacking head constructed and arranged to receive power means whereby said jacking head is raised to cause said members and jacking head as a unit to turn angularly about the connection with the car to force the free end of said upper member against the sheet.

4. A device for straightening the bulged sheets of railroad cars and the like comprising elongated upper and lower members meeting in an acute angle with the apex spaced from the sheet and with the free end of the upper member adapted to engage against the sheet, means flexibly anchoring the free end of the lower member to the car, a jacking head located approximately at said apex for connecting said members together, means between said jacking head and upper member for enabling vertical and lateral angular adjustment of said upper member with respect to said jacking head, said jacking head having slidable movement on said lower member to move in and out with respect to the sheet whereby to bring the free end of said upper member against the sheet irrespective of its vertical or lateral angular adjustment in said jacking head, means to secure said jacking head fixedly in adjusted position on said member, said jacking head adapted to receive power means to lift the jacking head and cause said members to execute a turning movement about the connection of the lower member with the car resulting in the forcing of the free ends of said upper member against the sheet.

5. A device for straightening the bulged sheets of railroad cars and the like comprising elongated upper and lower members meeting in an acute angle with the apex spaced from the sheet and with the free end of the upper member engaging said sheet, means flexibly anchoring the free end of the lower member to the car, a jacking head located approximately at said apex for connecting said members together, means connecting said upper member to said jacking head for relatively adjustable angular movement, said jacking head adapted to receive power means for raising the jacking head and simultaneously imposing on said upper and lower members a turning movement about the connection of the lower member with the car to drive the free end of said upper member forcibly against the sheet.

6. A device for straightening the bulged sheets of railroad cars and the like comprising an elongated tension member adapted to be movably connected to the car and to extend outwardly from the sheet, a jacking head slidably mounted upon the outer portion of said tension member and having means to secure same in adjusted position on said tension member, a plurality of elongated compression arms having outer ends individually pivoted in said jacking head for independent angular movement with respect to said jacking head and to one another, the free ends of said elongated compression members adapted to engage against said sheet, said jacking head adapted to receive power means to raise said jacking head and to consequently rotate all of said members and jacking head about the connection of the tension member with the car resulting in the forcing of the free ends of the compression members against the sheet.

7. A device for straightening the bulged sheets of railroad cars and the like comprising an elongated tension member having means to movably connect an end portion thereof with the car and with the member projecting outwardly from the sheet, a jacking head on the outer portion of said tension member, and a plurality of compression members mounted at their outer end portions in said jacking head for pivotal and independent vertical and lateral angular movement, the inner free ends of said compression members adapted to engage against the outwardly bulged sheet, said jacking head adapted to receive power means for lifting the same to cause rotary movement in all said members about the connection of the tension member with the car resulting in the thrust of the free ends of the compression members against the sheet.

8. A device for straightening the bulged sheets of railroad cars and the like comprising an elongated tension member having means to movably connect an end portion thereof with the car and with the member projecting outwardly from the sheet, a jacking head on the outer portion of said tension member, and a plurality of compression members mounted at their outer end portions in said jacking head for pivotal and independent vertical and lateral angular movement, the inner free ends of said compression members adapted to engage against the outwardly bulged sheet, said jacking head adapted to receive power means for lifting the same to cause rotary movement in all said members about the connection of the tension member with the car resulting in the thrust of the free ends of the compression members against the sheet, and adjustable flexible means coupled between said compression members at their inner free portions to prevent spreading of said members from the relative angular position at which they are set.

9. A device for straightening the bulged sheets of railroad cars and the like comprising an elongated tension member having means to movably connect an end portion thereof with the car and with the member projecting outwardly from the sheet, a jacking head on the outer portion of said tension member, a plurality of compression members mounted at their outer end portions in said jacking head for pivotal and independent vertical and lateral angular movement, the inner free ends of said compression members adapted to engage against the outwardly bulged sheet, said jacking head adapted to receive power means for lifting the same to cause rotary movement in all said members about the connection of the tension member with the car resulting in the thrust of the free ends of the compression members against the sheet, said compression members each comprising extensible members for varying the overall length of said compression member,

and means to fix said extensible members in a selected position of relative adjustment.

10. A device for straightening the bulged sheets of railroad cars and the like comprising elongated tension means having at its inner end portion a flexible connection with the car, elongated compression means having its free inner end adapted to engage the bulged sheet and with its outer end portion inclining outwardly toward the tension means, and jacking means for uniting said tension and compression means in acutely angled relationship at their outer end portions for permitting angular adjustment of said compression with respect to said tension means, said jacking means adapted to receive power means for raising the jacking means to rotate the tension and compression means about the connection with the car to cause said compression means to exert thrust against the bulged sheet.

11. A device for straightening the bulged sheets of railroad cars and the like comprising a jacking head, tension and compression members meeting at an acute angle at the jacking head with their opposite ends having a tri-point contact with the car to hold the jacking head in vertical alignment, said jacking head constructed and arranged to receive power means for exerting an upward movement on the jacking head to apply pressure against the sheet to straighten the bulged portions of the same.

12. A device for straightening the bulged sheets of railroad cars and the like comprising a jacking head, tension and compression means meeting at an acute angle at said jacking head with their opposite ends forming a three-point contact with the car for holding the car against movement and contacting the bulged portion of the sheet, said three-point contact acting to hold the jacking head in vertical alignment and preventing lateral movement of the jacking head when the power is applied, said jacking head constructed and arranged to receive power means for lifting the jacking head to apply pressure against the sheet to straighten the bulged portion of the same.

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