June 7, 1960 F. B. MILLER 2,939,507

FREIGHT CAR WALL STRAIGHTENER

Filed Oct. 12, 1956 3 Sheets-Sheet 1

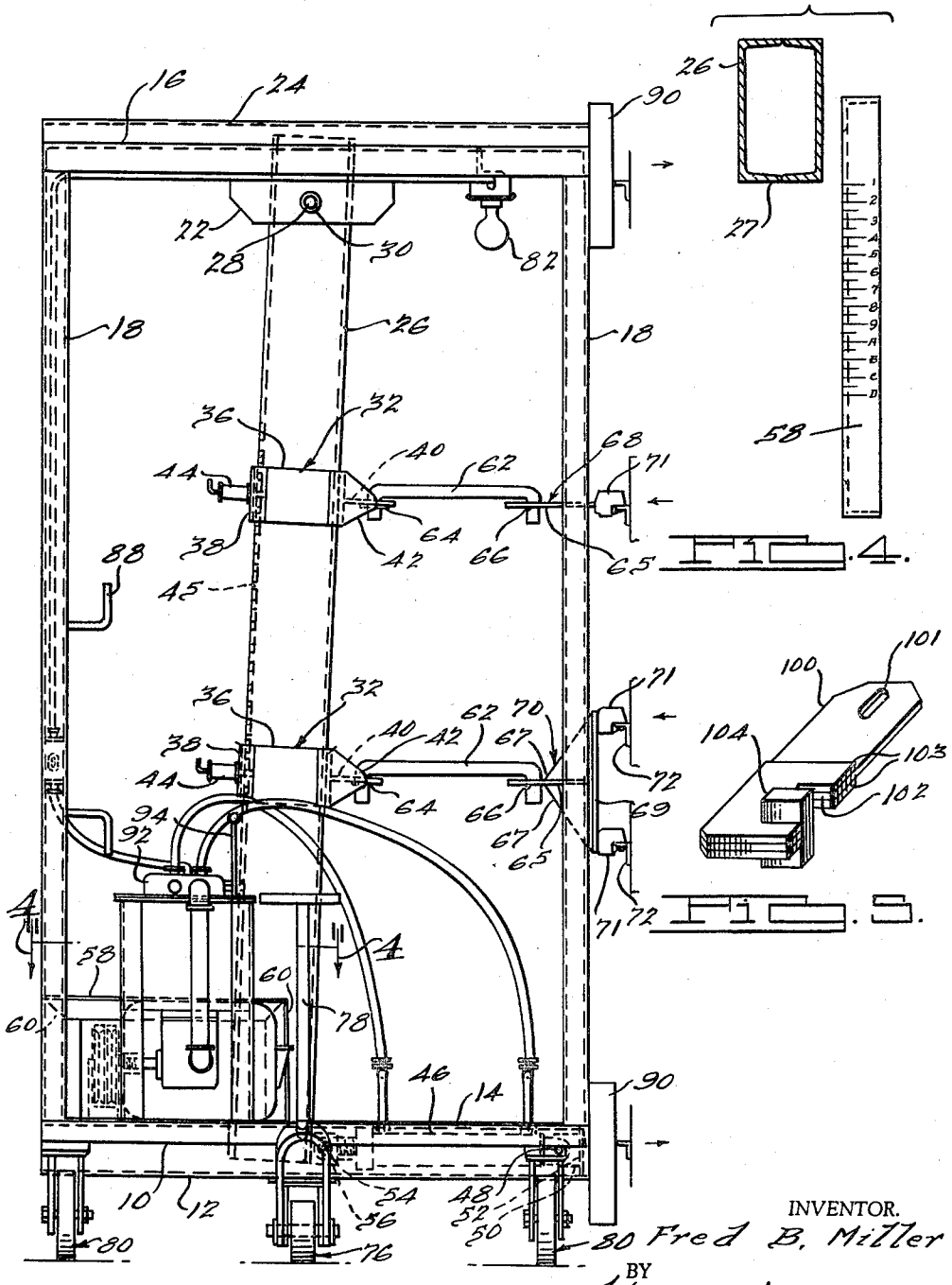


FIG. 1.

FIG. 5.

FIG. 4.

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FREIGHT CAR WALL STRAIGHTENER

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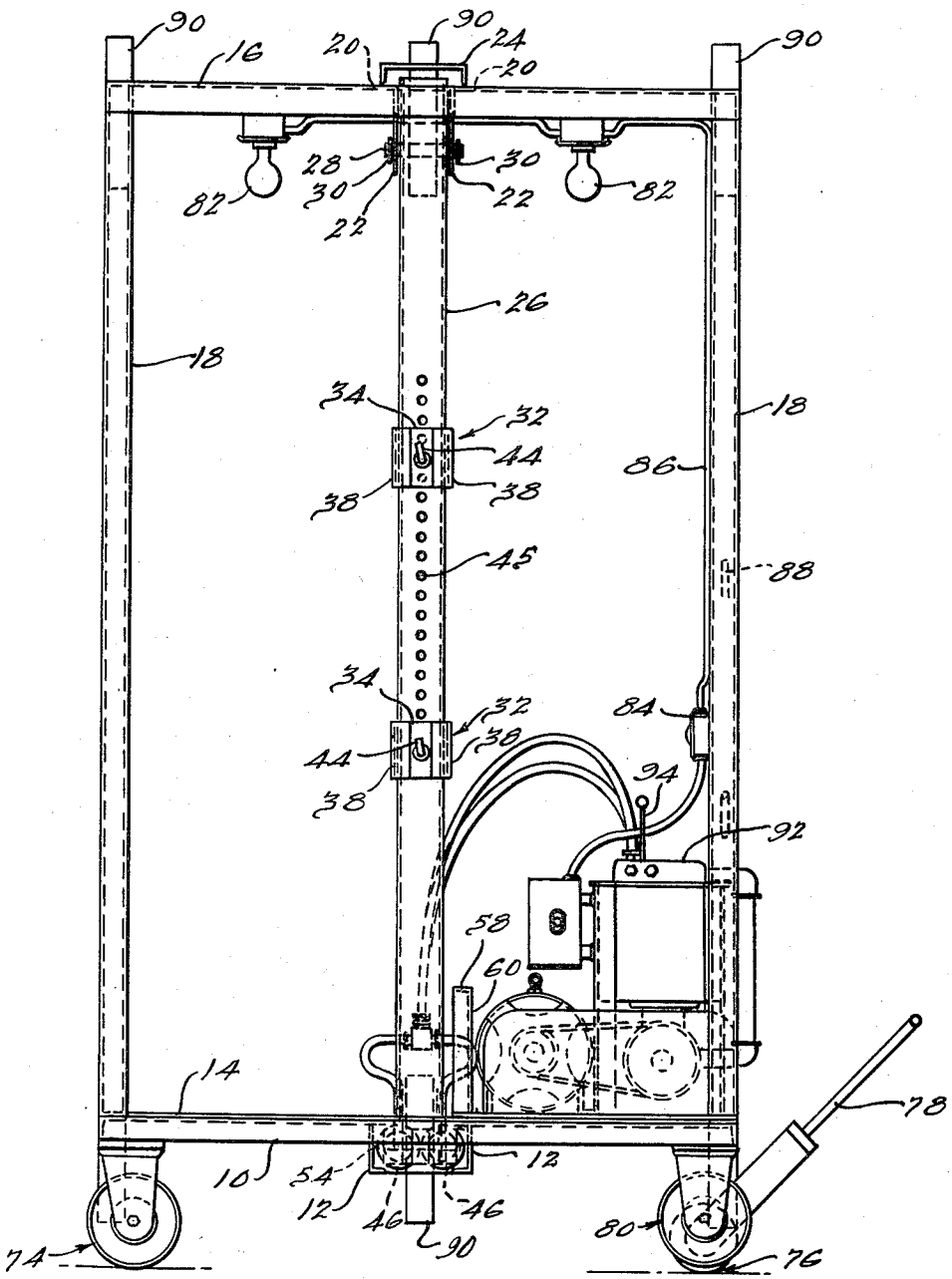


FIG. 2.

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FREIGHT CAR WALL STRAIGHTENER

Filed Oct. 12, 1956 3 Sheets-Sheet 3

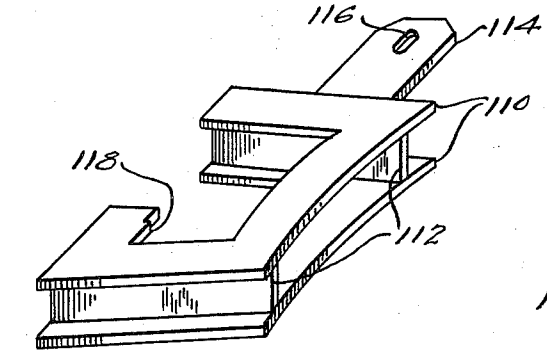


FIG. 6.

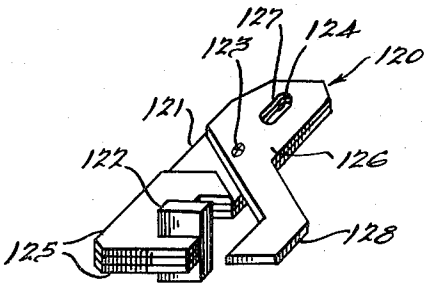


FIG. 7.

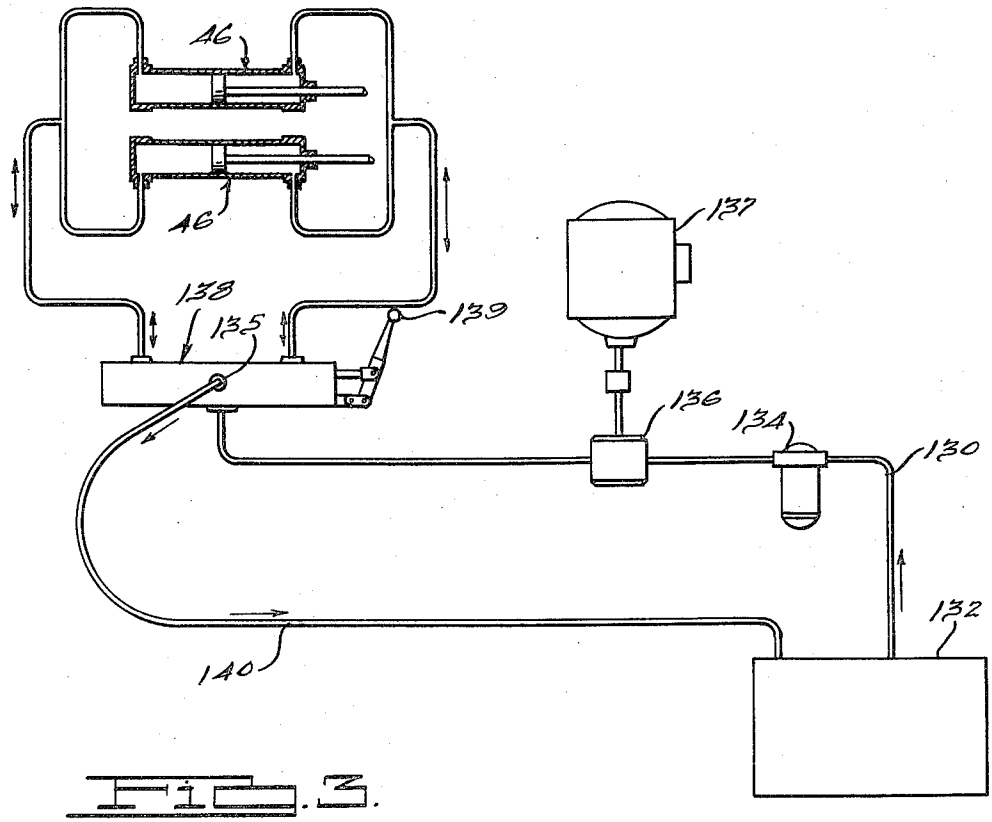


FIG. 3.

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United States Patent Office 2,939,507 Patented June 7, 1960

2,939,507

FREIGHT CAR WALL STRAIGHTENER

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2 Claims. (Cl. 153—48)

The present invention relates to straightening machines and methods and, though it is not so limited, it concerns a method and machine for straightening components, such as posts and sidewalls of railroad boxcars.

One important application being made of the present invention is to straighten walls or railroad boxcars that are equipped with "DF" belt rails. Reference is made to Patent 2,725,826 and related cases assigned to the assignee hereof which describe and claim the aforesaid belt rail construction sold under the trademark "DF." When railroad boxcars are to be equipped with "DF" belt rails, the inner wooden walls of the boxcars are stripped off to bare the metal sidewalls and the vertical steel bracing members. The majority of boxcars have Z section, structural steel bracing members while the remainder generally have hat section bracing members spaced along the walls. The "DF" belt rails are usually welded to the aforesaid vertical bracing members and extend horizontally along the boxcar walls as illustrated in Fig. 1 of the aforesaid patent.

The straightening machine of the present invention is used to straighten any bowed or leaning condition existing in the walls, doorposts, or wall components such as verticals and "DF" belt rails. This is ordinarily done when the "DF" equipment is installed and will, of course, straighten both horizontal and vertical components. However, should the boxcar walls subsequently bow outwardly from continued humping, the straightening machine may be used to reset them.

The present invention can also be used to straighten leaning walls and doorposts, as well as, those which bow inwardly or outwardly. In addition, although a principal use is to straighten boxcar walls after the aforesaid "DF" belt rails have been installed, the present invention may also be used to straighten boxcar walls prior to their installation and for subsequent maintenance purposes. Of course, as stated at the outset, the use of the present invention is not limited to straightening boxcar walls.

In preferred form, the present invention includes a box-like frame member having a walking beam pivoted from its top and extending the vertical height of the frame. A pair of hydraulic cylinders are pivotally fixed to the base of the frame and operably connected to the bottom of the walking beam. In operation the frame is moved into position against the wall or part to be straightened and suitable connections are made between the walking beam and the wall or part. The hydraulic cylinders are then actuated to slowly pivot the walking beam away from the wall or part whatever distance is necessary to straighten any curvature or deflection.

Therefore, it is an object of this invention to provide a machine for straightening walls, posts, or other parts which may be integral with a large device such as a railroad boxcar.

It is another object of this invention to provide a mobile machine which may be positioned within a boxcar to straighten its walls.

It is a further object of this invention to provide a wall straightener which can straighten leaning walls as well as curved walls.

Another object is to provide a device to straighten vertically disposed parts.

An additional object is to provide an improved straightening method.

Other objects and features of novelty of the invention will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawings wherein:

Fig. 1 is a front elevation view of the present invention;

Fig. 2 is a side elevation view of the present invention;

Fig. 3 is a diagram of the hydraulic control system for operating the hydraulic cylinders of the present invention;

Fig. 4 is a view taken along the line 4—4 of Fig. 1 of the gauge bar used to indicate the distance through which the walking beam has been pivoted;

Fig. 5 is a perspective view of a Z bar pulley attachment;

Fig. 6 is a perspective view of a door post pulley attachment; and

Fig. 7 is a perspective view of a scissors-type Z puller attachment.

Referring to Figs. 1 and 2 the present invention is comprised of a lower frame **10** composed of four lengths of angle iron which are coped and welded together at their ends to form a rectangular frame. The lower frame **10** is braced by two parallel, spaced-apart, reinforcing channels **12** which are coped and welded to the centers of opposite sides of the lower frame **10**. The upper face of the lower frame **10**, excepting the space between the reinforcing channels **12**, is covered by a floor plate **14** which is welded to the lower frame at its corners. An upper frame **16** is constructed in the same manner as the lower frame **10** and is held in spaced relation to the lower frame **10** by four vertical corner posts **18** which are welded to both frames. Two walking beam support angles **20** are coped and welded to the opposite sides of the upper frame **16** in spaced relation and parallel to the reinforcing channels **12** across the lower frame. Two walking beam support gussets **22** are welded to the walking beam support angles **20** at their midpoints. A channel **24** is welded to the upper surfaces of the beam support angles **20** to further reinforce the upper frame assembly.

A walking beam **26**, constructed from two channels welded together to form a box section, is pivotally supported from the gussets **22** by a pin **28**. Pin **28** is retained by two washers **30** welded to its extremities. Hookup units **32** are slidably mounted on the walking beam **26** and are comprised of two end plates **34**, and two side plates **36** welded together to form a box-like structure. Angles **38** are welded to two corners of the hookup units **32** to further reinforce the unit. A pull bar attachment plate **40** and two supporting plates **42** are welded to one of the end plates **34** and a spring plunger **44** is fixed to the other end plate. Holes **45** are provided in spaced relation along the walking beam **26** so that the hookup units **32** may be positioned at any one of the holes by means of the spring plunger **44**.

Two hydraulic cylinders **46** are pivotally mounted within the channels **12** by means of a bolt **48** which passes through four brackets **50** welded to a plate **52** which is in turn welded to the ends of the channels **12**. The floating ends of the cylinders **46** are pivotally connected to the bottom of the walking beam **26** by a bolt **54** which passes through the four brackets **56** welded to the bottom of the walking beam **26**. Of course, the hookup units **32** would be slipped onto the walking beam **26** before its installation in the frame.

A gauge bar **58** is mounted parallel to the plane of movement of the walking beam **26** by means of angles **60** welded to one of the channels **12**. The gauge bar **58** is so installed that the number 1 thereon coincides with forward edge **27** of the walking beam **26** when the walking beam is in its fully retracted position. This is most clearly illustrated in Fig. 4.

Two pull bars **62** are constructed from heavy round bar stock and incorporate a 90° bend at each end. At their fixed end they have a retainer washer **64** secured by welding while at their free end they merely have a welded retainer bead **66**. To assemble the pull bars **62** to the hookup units **32**, the free ends of the pull bars are inserted through holes provided in the pull bar attachment plates **40** until the retainer washers **64** make contact with the attachment plates. A variety of suitable pulling attachments may be attached to the free ends of the pull bars **62** depending upon the construction of the wall to be straightened.

To provide the wall straightener with ease of movement and maneuverability, it is mounted on a set of wheels consisting of two rear wheel assemblies **74** welded to the rear corners of the lower frame **10** and a front swivel assembly **76** welded to the lower frame **10** at the center of its front side and guided by means of a handle bar **78**. In addition, at each of the front corners of the lower frame **10**, out-rigger wheel assemblies **80** are welded thereto in the same manner as the rear wheels **74**, however, the out-rigger wheels **80** are so mounted that they are ½" above the floor when the machine is in a level position. Their function is to prevent the machine from overturning if it should tip or lean in any manner.

Electric lights **82** are fixed to the upper frame **16** and are connected to a light switch **84** by cable **86**. A cord hanger **88** is welded to one of the corner posts **18** to store the electric cable. Six bumpers **90** are welded to the working face of the machine (though they can be made adjustable in height and to contact the verticals); three on the upper frame **16** and three on the lower frame **10**. Each set of three bumpers are distributed so that one is welded to each vertical corner post **18** with the third located on the frame intermediate the vertical corner posts.

An electric motor-driven hydraulic pumping unit **92** is bolted to the floor plate **14** at the left front corner of the machine when viewed as in Fig. 1. This places the valve operating lever **94**, which controls the operation of the hydraulic cylinders **46**, within easy reach of the operator whose station is at the right front corner of the machine.

Fig. 5 depicts a Z puller attachment which is comprised of a primary plate **100** having an elongated hole **101** and a notched cutout **102** therein. Reinforcing plates **103** are welded thereto and have corresponding cutouts. Pressure pad **104** is welded to one leg of the notched cutouts. In operation the elongated hole **101** is slipped over the free end of one of the puller bars **62** and the pressure pad **104** is slipped behind the protruding flange of a Z section structural member of the wall so that it may be pulled.

Fig. 6 depicts a door post puller which is comprised of two C shaped plates **110**, two spacer plates **112** and a puller plate **114** having an elongated slot **116** all of which are assembled by welding. When straightening door posts of a boxcar, the door post puller is used. It is fitted over the free end of one of the puller bars **62** in a similar manner as the Z puller attachment of Fig. 5 and the open face of the C shaped plates **110** is slipped over the door post so that the post slides into the enclosure formed by the legs **118** of the C shaped plates **110**.

Fig. 7 depicts a scissors-type Z puller attachment **120** comprised of a primary plate **121** which is notched to receive a pressure pad **122**, drilled to receive a bolt **123**, and contains a slot **124**, and notched reinforcing plates **125** welded to both sides. A secondary plate **126** having a slot **127** corresponding to the slot **124** is pivotally mounted on the primary plate **121** by the bolt **123**. In operation the pressure pad **122** is positioned behind the protruding flange of a Z section structural member to be pulled and pressure is applied to the pull bar **62** which is inserted through the slots **124** and **127** after the pressure pad **122** has been positioned. The extension **128** of the secondary plate **126** serves to hold the pressure pad **122** securely in position during the pulling action.

In operation the wall straightening machine is rolled into a defective boxcar from a flat bed truck, dock or any convenient means and is positioned so that the bumpers **90** abut against the defective wall. In the case of an outwardly bowed wall, it will be noted that the bumpers **90** will contact the wall at its top and bottom which are reasonably vertical, thus giving the machine vertical alignment with pressure points at both top and bottom. Depending upon the construction of the wall to be straightened, a suitable puller attachment is selected. Assuming, for example, that the "DF" belt rails described and claimed in the aforesaid Patent 2,725,826 and related cases have been installed, the single puller attachment **68** and the double puller attachment **70** illustrated in Fig. 1 would be selected. These puller attachments are comprised of heads **71** which are welded to suitable plates **65** having slots therein so that they can be slipped onto the free end of the puller bar **62** and over the beads **66**. Since puller attachment **70** has two heads **71**, it also has plates **67** and **69** which are welded together to support two heads **71** welded to either end of the plate **69**. The heads **71** are the same as the forgings **72** of Fig. 7 of the aforesaid Patent 2,725,826 with the left portion cut off at a point just to the right of the section line 8—8.

When the puller attachments **68** and **70** have been hooked onto the "DF" belt rails and slipped over the free ends of puller bars **62**, the wall straightener is in position for operation. To begin operation, the valve lever **94** is manually operated to actuate the hydraulic cylinders **46** to pivot the walking beam **26** in a direction away from the wall. This is best depicted in Fig. 1. As the beam pivots, the wall is pulled with it since the bumpers **90** bear against the upper and lower portions of the wall to prevent movement of the frame. The amount of wall movement necessary to correct the bowed condition is normally slightly more than is necessary to draw the wall to a straight position and can be measured by the position of the front surface **27** of the walking beam **26** relative to the graduations on the gauge bar **58**. Experience has proved that the distance a wall of a particular construction must be pulled beyond its straight position to correct its curvature will generally remain constant for all walls of the same construction. Consequently, once this distance is established by a trial and error determination, the indication of the gauge bar **58** can be recorded for subsequent operations on similarly constructed walls.

Referring to Fig. 1, it will be observed that the lower pull bar **62** is longer than the upper pull bar **62**. Consequently, when connecting the pull bars to the wall, the hookup units **32** will have to be adjusted to the vertical position on the walking beam **26** which will permit their related pull bar and puller attachment to reach the bowed wall.

When an outwardly bowed boxcar wall is to be straightened before the "DF" belt rails are installed, the wooden inner walls would again be stripped off to bare the metal walls and vertical bracing members. If the vertical bracing members are the aforesaid Z section structural steel members, either the Z puller attachment of Fig. 5 or the scissors puller attachment of Fig. 7 would be used. Both of these attachments are identical, with the exception that the scissors puller **120** has the secondary plate **126** pivotally connected to the primary plate **121** by the bolt **123**, therefore, the description of the employment of the scissors puller **120** will suffice for both. To attach

the scissors puller **120**, the secondary plate **126** is pivoted out of the way and the pressure pad **122** is slipped behind the protruding flange of one of the vertical Z shaped bracing members in the boxcar wall. The plate **126** is then pivoted back into the position shown in Fig. 7 so that the slot **127** coincides with the slot **124** and the free end of one of the puller bars **62** is slipped through the slots. A second scissors puller **120** would similarly be attached to the other pull bar **62** if the situation so requires.

This completes the attachment of the walking beam **26** to the wall and the straightening machine is again in position for operation. The operating procedure is the same as previously described. The presence of the leg **128** adjacent the notched opening in the scissors puller attachment **120** holds the puller attachments in position so that they will not slip off the protruding flange of the Z section bracing member when the straightening machine pulls the wall inwardly. If one of the scissor pullers should begin to slip laterally on the protruding Z flange, the leg **128** will make contact to prevent further slippage. Since the free end of the puller bar **62** passes through both slots **124** and **127**, the leg **128** cannot pivot on bolt **123**. Therefore, the amount of slippage that can occur before the leg **128** makes contact depends on the space between the leg **128** and the pressure pad **122**. This space would, of course, be just large enough to accept the thickness of the web of the Z section bracing member and still permit the slots **124** and **127** to coincide.

If the outwardly bowed wall to be straightened has the hat section vertical bracing members rather than the Z section members, three short pieces of "DF" belt rails would be welded or fixed to an appropriate hat section member and the puller attachment **68** and **70** of Fig. 1 would be used. The operating procedure would, of course, be the same.

A second condition which frequently plagues boxcar walls is that they often bow inwardly. To straighten an inwardly bowed wall, the straightening machine is moved into position with its working face, and bumpers **90**, against the opposite wall. A 6" x 6" wooden beam, or similar object, is placed between the wall to be straightened and the walking beam **26** and force is applied by means of the hydraulic cylinders **46**. This causes the walking beam to pivot toward the wall being straightened and places the 6" x 6" wooden beam in compression. The machine cannot move away from the wall being straightened because, as stated previously, the bumpers **90** on the working face of the frame are in contact with the opposite wall at the top and bottom thereof. The opposite wall would not be outwardly bowed by the reaction force of the frame because this force is applied at the top and bottom of the wall.

A third condition which plagues boxcar walls is that they sometimes slant or lean inwardly from the vertical at their upper extremities. To straighten such a wall, the upper bumpers **90** on the working face of the wall straightener are positioned against the top of the leaning wall. A 6" x 6" section of wooden beam, or similar object, is placed between the walking beam and the base of the opposite wall of the boxcar to restrain movement of the walking beam **26** in this direction. Force is then applied to the walking beam by means of the hydraulic cylinders **46** which causes the upper bumpers **90** to exert a force against the upper portion of the leaning wall. Force is thus exerted by the upper bumpers **90** against the upper portion of the leaning wall until the wall is moved sufficiently to remain vertical when the force is removed. If need be, the lower bumpers of the frame may be restrained by blocks fixed to the floor of the boxcar.

Bowed or leaning boxcar door posts may also be corrected by employing an operating procedure similar to those already described depending upon the fault to be corrected. The only difference being that when an outwardly bowed post is to be pulled straight, the door post puller attachment of Fig. 6 would be used. It is attached to the puller bars **62** in the same manner as the other puller attachments. The open face of the C shaped plates **110** is then slipped laterally over the door post and pulled inwardly so that the leg **118** hooks the door post to prevent the puller attachment from slipping off when the door post is pulled straight.

Referring to Fig. 3, the hydraulic system for operating the hydraulic cylinders **46** is comprised of a suitable hydraulic line **130**, a fluid reservoir **132**, a fluid filter **134**, a pump **136** driven by an electric motor **137**, a three-position, 4-way valve **138** and a return line **140**. Fluid under pressure flows from the pump **136** to the manually controlled three-position, 4-way valve **138**. By means of a control handle **139** the fluid may be directed to either of the ends of the hydraulic cylinders **46** which act in unison. The control handle **139** automatically returns to its neutral position when released by the operator. This diverts fluid from the pump through outlet **135** of the 4-way valve **138** and back to the reservoir **132** by means of the return line **140**. However, the walking beam will retain its position until the handle **139** is again actuated. To return the walking beam to its original position, the handle **139** is actuated to reverse the pressure in the hydraulic cylinders **46**.

What is claimed is:

1. A machine for straightening a metal wall of a boxcar, having longitudinal flanged projections, comprising a mobile, structural steel frame adapted to be positioned against said wall, a walking beam pivotally supported from the center of the top of said frame and extending the length of said frame, attaching means adjustably mounted on said walking beam, gripping means for connecting to said attaching means and adapted to grip said flanged projections, two parallel channels fixed to the bottom of said frame in spaced relation to form a slot within which the lower end of said walking beam may swing toward and away from said wall, a hydraulic cylinder disposed within said slot pivotally connected to a plate fixed across one end of said channels and operably connected to the lower end of said walking beam, and an electric motor-driven hydraulic pumping unit fixed to said frame and connected to operate said hydraulic cylinders to pivot said walking beam.

2. The subject matter as claimed in claim 1 wherein said gripping means comprises, a primary plate having an elongated slot at one end and a notched portion at the other end thereof, two notched reinforcing plates fixed to said other end of the primary plate, and a secondary plate pivotally connected to said primary plate intermediate the ends thereof and having an elongated slot at one end corresponding to the slot in said primary plate and an offset leg on the other end thereof which overlies the open face of said notch.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,939,507 June 7, 1960

Fred B. Miller

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, lines 20 and 22, for "pulley", each occurrence, read -- puller --; column 6, lines 37 and 38, for "for connecting" read -- connected --.

Signed and sealed this 13th day of December 1960.

(SEAL)
Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents