United States Patent

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[54] **APPARATUS FOR RETURNING VEHICLE BODY AND FRAME COMPONENTS TO THEIR ORIGINAL LOCATIONS DURING REPAIR AND SERVICING OF VEHICLES**
8 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **72/305,** 72/705
[51] **Int. Cl.** **B21d 11/04**
[50] **Field of Search** 72/705, 305; 254/132, 133, 93

[56] **References Cited**

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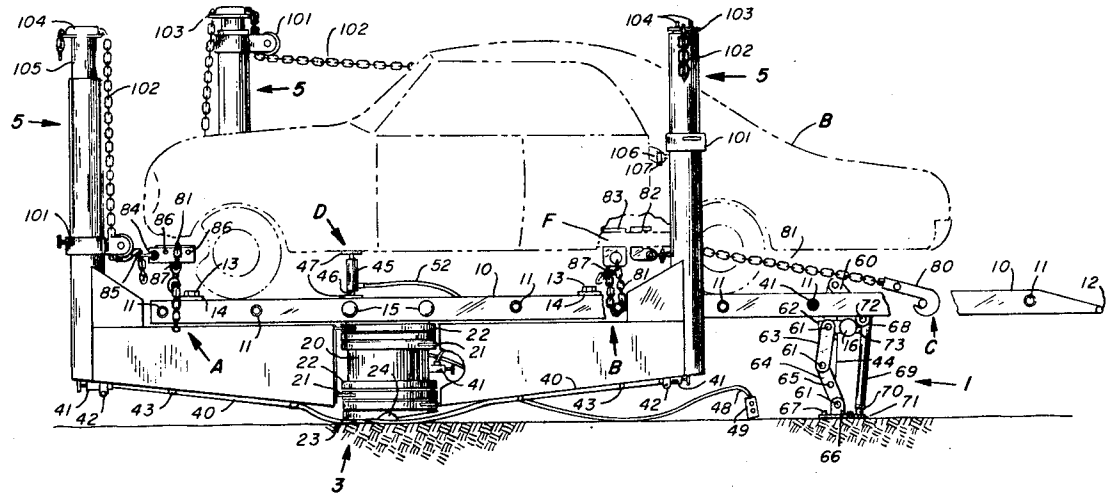
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ABSTRACT: Apparatus is provided to apply pulling forces from any direction from any elevation around a vehicle being repaired and/or serviced. The apparatus is arranged so personnel using it are concerned with minimal physical lifting movements and minimal setup arrangements of the apparatus. Each embodiment of the apparatus utilizes at least one tower assembly equipped with an elongating subassembly to move a tension member, through directional change devices, as it remains secured to some portion of a vehicle, thereby undergoing at least one repositioning pull in a direction opposite to at least one prior force that previously caused some of the damage and/or misalignment Depending on the magnitude of the restoring force required, the tower, other towers, and/or other structures may be secured together and/or to the vehicle as well, to create a firm basis for anchoring the apparatus and/or the vehicle as one or more reactive forces are controllably created. Depending on the anticipated use of the apparatus and the capital expenditures to be made, the apparatus is made available in different embodiments, ranging from a sole location of a tower to multiple locations of several towers related to overall reactive structures and/or vehicle ramps serving as mutual multiple holding or anchoring places of forces applied to the vehicle, as the elongating subassemblies of the towers are moved to create the restorative pulling forces.



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SHEET 1 OF 3

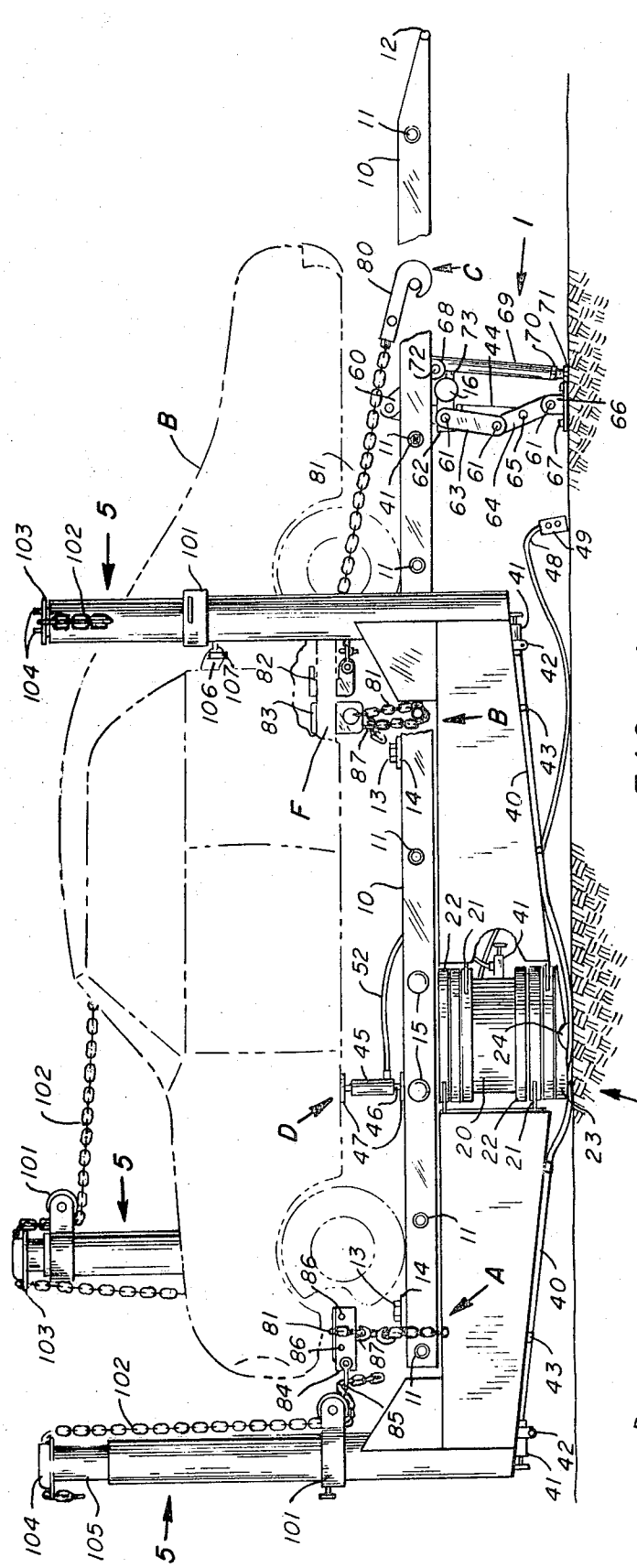


FIG. 1

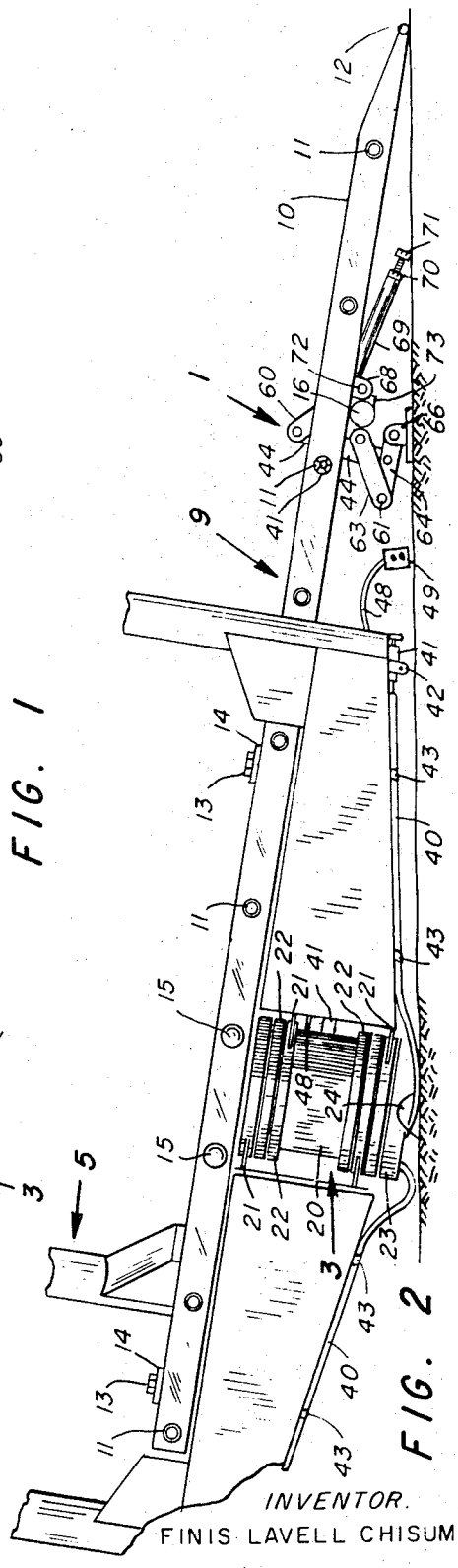


FIG. 2

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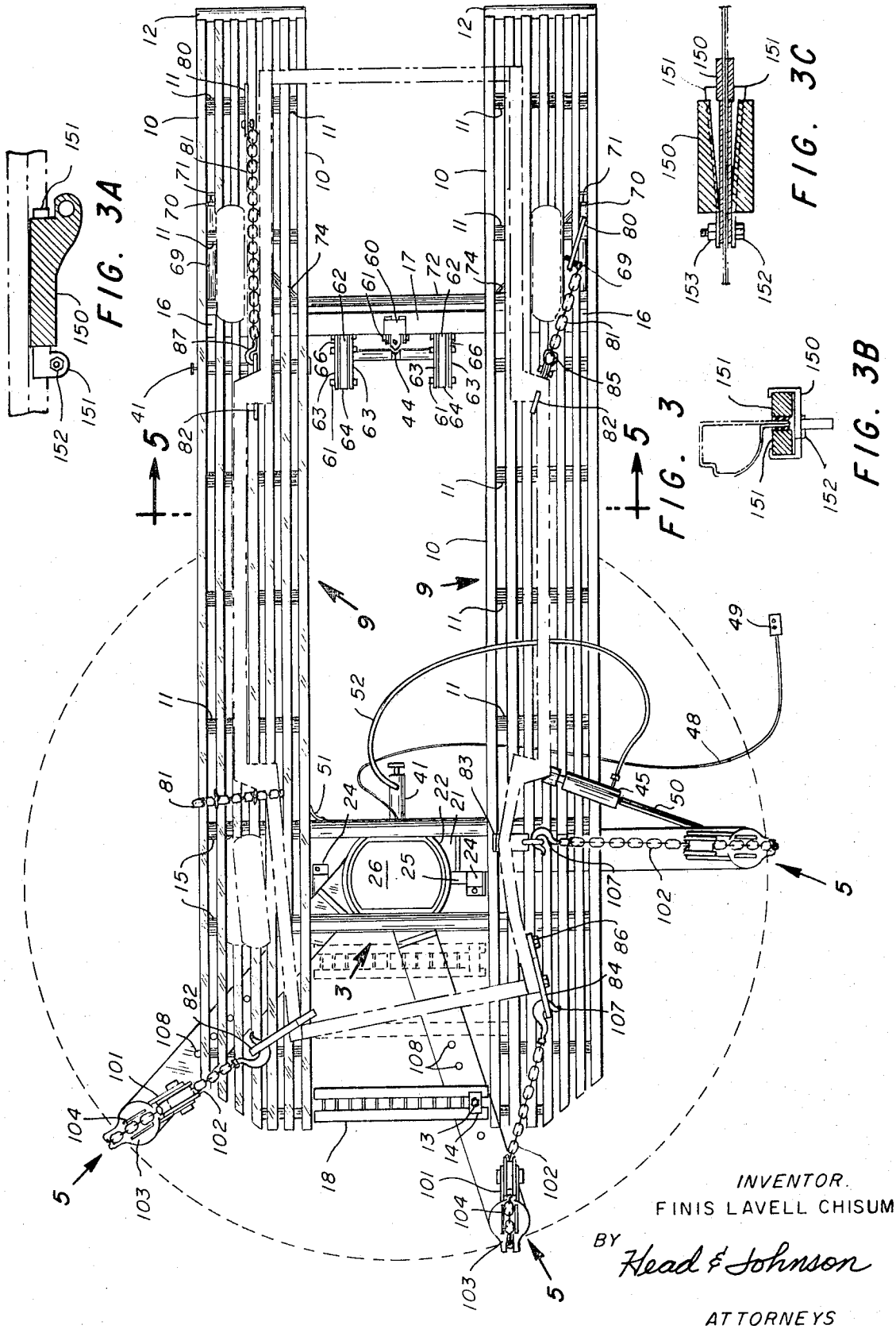


FIG. 3A

FIG. 3C

FIG. 3B

FIG. 3

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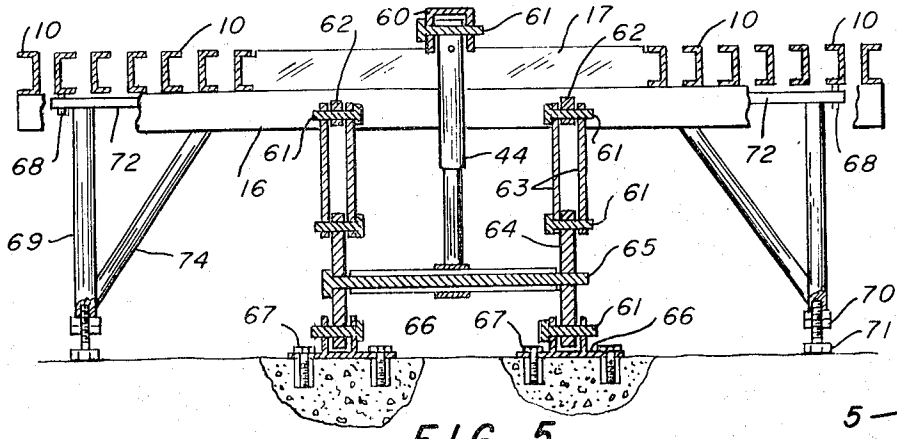


FIG. 5

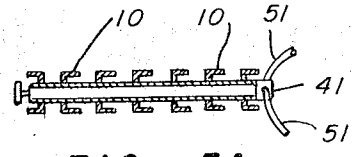


FIG. 5A

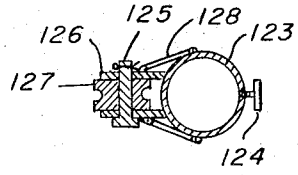


FIG. 4A

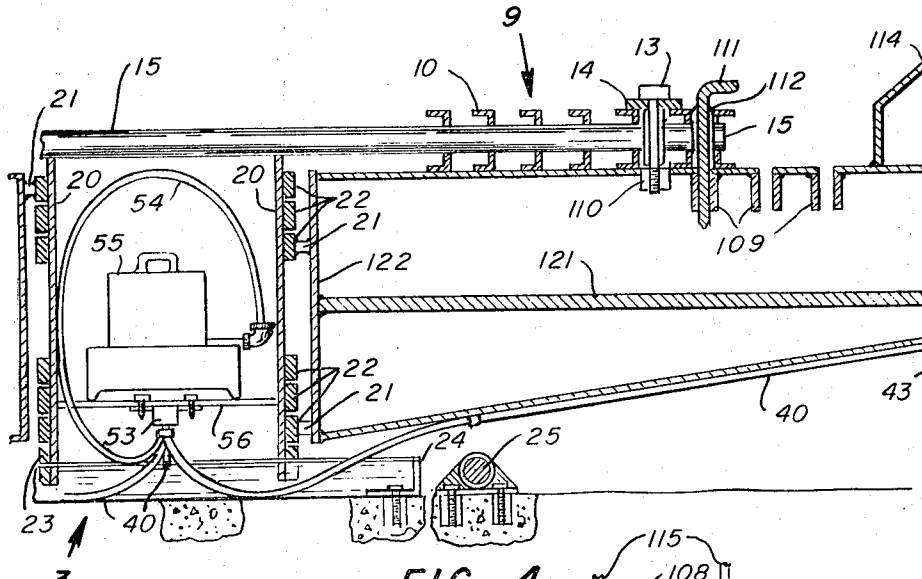


FIG. 4

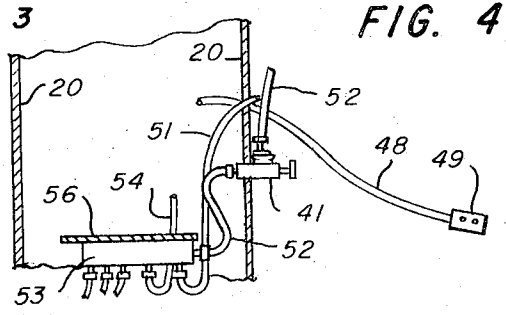


FIG. 4B

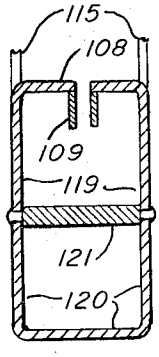
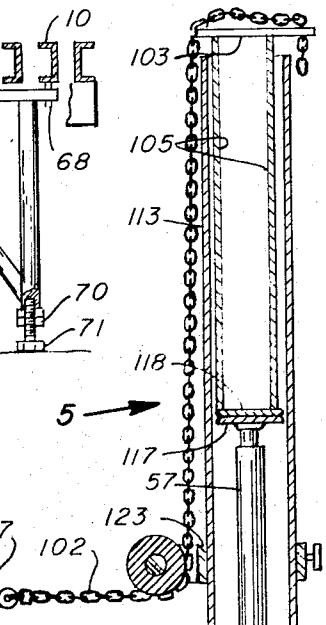


FIG. 4C



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APPARATUS FOR RETURNING VEHICLE BODY AND FRAME COMPONENTS TO THEIR ORIGINAL LOCATIONS DURING REPAIR AND SERVICING OF VEHICLES

BACKGROUND OF THE INVENTION

Present apparatus known to be available for correcting misalignment of vehicles and for returning frame and body members of vehicles back to their predamage locations, as such services are preformed by personnel in body shops and other service and repair shops, are not conveniently set up and operated to meet the demands of personnel in various size repair shops. This invention is offered in multiple embodiments to meet different requirements of cost, convenience and service of many shops wherein personnel are seeking better apparatus to more economically perform their re-alignment and body repair services.

The apparatus known to be available prior to this invention, required personnel using it to make many lifts of heavy and/or awkward components under awkward footing and overhead conditions during time consuming setup periods. This was necessary to try to place components in various wanted positions, many not being directly obtainable, where the resulting pulling forces would be applied most advantageously to restore vehicle frames and bodies to their originally designed positions. Where prior attempts were made to obtain a greater range of pulling and anchoring locations, the resulting apparatus was often complex, large, costly, and inconvenient to manipulate, and moreover, often requiring special building configurations such as higher overhead space and/or floor pits.

In contrast, this invention, in its various embodiments, to be selected depending on the anticipated volume of such repairs to be undertaken and the capital funds available, is provided so personnel may conveniently and quickly arrange the apparatus to pull on a vehicle frame and/or body in the most advantageous direction at one or more locations. As a business grows, the offered embodiments are conveniently and economically increased in capacity by acquiring components of other embodiments. Moreover at all times with respect to all personnel, straining, overtiring and dangerous situations are avoided.

SUMMARY

Apparatus for returning vehicle body and frame components to their original locations during repair and servicing of vehicles is provided in various embodiments, each centering on the use of one or more towers or pedestals including a length changing subassembly as the basis of creating a restorative force applied in a selected direction to return one or more vehicle components to their original designed relative location. The apparatus in all its embodiments: simplifies body and frame straightening operations; permits simple hookups for faster correction to damage at any point on a vehicle; reverses the damage sequencing of the wrecked car for a faster and more accurate body and/or frame correction; allows more freedom for workmen who do not have to move over or under any supporting beams or other structures; eliminates heavy lifting by personnel; pulls in any desired angular direction; fits in minimum amount of space; sets up in buildings with low ceilings; complies with equipment specifications presented by both small, medium and large shop operators; requires no pit but may be used in conjunction with one; needs no special surrounding building.

DRAWINGS OF PREFERRED EMBODIMENTS

FIG. 1, including location designations noted respectively as subsections A, B, C, and D is a side elevation, with some portions broken away for illustrative purposes, of a preferred embodiment of the apparatus being used to create restorative forces applied to the vehicle shown;

FIG. 2, is a partial side elevation of the embodiment shown in FIG. 1 positioned to receive a vehicle which is electively either driven forward on to the apparatus or backed on depending on where and how the vehicle is damaged;

FIG. 3, is a top plan view of the embodiment shown in FIG. 1, indicating, however, only the placement of the frame and some of the wheels of a vehicle;

FIGS. 3A, 3B, and 3C, indicate partially sectioned respective side, end and top views, of a body gripping clamp used particularly where only body portions and not heavier frame portions are available to receive a restoring force;

FIG. 4, is a partial cross section view of the embodiment of FIG. 1 indicating structure, arrangement, and operation of apparatus with respect to one tower, its force creating accessories and its multiposition attachment to other towers and their common attached supporting and servicing structures;

FIGS. 4A, 4B, and 4C, indicate partially sectioned views related specifically to FIG. 4 and more respectively to: adjustable height accessories secured to a tower and used in determining the elevation of a direct pulling force; some of the hydraulic accessories viewed at right angles with respect to their view in FIG. 4; and some of the cross section structure of the radially positioned beam or arm structure supporting the tower;

FIG. 5, is a view, primarily in section, taken along the line 5—5 of FIG. 3, indicating the raised position of the rail or ramp subassemblies and both their actuating accessories and safety brace accessories, as all appear when a vehicle is lifted into a horizontal position for undergoing repairs;

FIG. 5A, is a partial sectional view related to FIG. 5, indicating how a control is located to operate hydraulic accessories used in raising the rails or ramps near or at their ends that are conveniently lowered to receive a vehicle and thereafter raised to position the vehicle horizontally while repairs are undertaken.

DESCRIPTION OF PREFERRED EMBODIMENTS

Introduction to all Embodiments

Throughout all embodiments, the purpose is to provide apparatus that is quickly, safely and conveniently utilized to create one or more restorative forces which create, in reverse, the forces originally causing damage and/or misalignment. The embodiments of apparatus are offered to meet the operational and economic specifications of all persons so engaged in various sized shops as a part of the overall automotive servicing industry.

In shops that do a large volume of frame and body alignments and an occasional front end alignment, the machine shown in FIGS. 1, 2, and 3 is ideal.

In respect to all those embodiments, most of the following objectives are met: installation is made within a normal one stall area without altering a building or without requiring any special wiring or plumbing beyond a standard electrical plug and a compressed air outlet; a vehicle is tied down, pushed or pulled at any angle or height, with ample power to bend any part of the vehicle without the use of heat or time-consuming, back-breaking labor; all hookups are made, including many tiedown hookups, by an operator from a standing position, without lifting any heavy, awkward handling attachments or having to climb over or under any supporting beams; any good body man can operate the apparatus without receiving an extensive amount of instruction, the apparatus does not become a permanently fixed part of the building, once it is installed; the apparatus does not require handling of heavy jacks or components; the apparatus is capable of pushing or pulling from one direction or several directions at one time; the apparatus is designed to eliminate practically all physical strenuous lifting stooping and squatting labor; operational capabilities of the apparatus is limited only by the operator's imagination; the apparatus is capable of applying power from exactly the same angle of least resistance; the apparatus is simple enough to use throughout the range from a minor bumper alignment job to a major frame and body alignment job; the apparatus is used for front-end alignments; etc.

In reference to using the apparatus of most embodiments, procedures followed are: position a vehicle on or near the apparatus orientated so the maximum of damaged portions of the vehicle is adjacent the range of multiple positions of the towers and then tie or secure the vehicle to the rails or bumps; move towers to the desired angular positions and secure them to the rails or ramps; place hooks and/or clamps of the respective chains or other tensioning members to the damaged portions of the vehicle and position the elevation determining accessories to guide these tensioning members as they are passed on to the respective forms of the towers for securing there or over and back down to a more convenient securing location; and operate the controls to elongate the towers creating the restorative forces used in pulling out the damaged vehicle components to their original or near original design relative locations.

Embodiment Shown in FIGS. 1 through 5, Elongatable Towers Radially Adjusted About a Pedestal Secured to Inclinable Holddown Ramps

In FIG. 1, a vehicle or car is shown positioned on the apparatus or machine using a selected few hookups from among many that are available. Regardless of where the damage is on the vehicle or in what direction the damage occurred, it is possible to pull it back in line from the same angle the damage occurred By pulling at the damage from the same angle as the point of impact, the metals have much less resistance, permitting a much faster, more accurate alignment job, almost completely eliminating the use of heat, for straightening of critical parts, avoiding changes in the temper in metals causing weak spots or breakage.

The three pull towers **5** are adjustable to pull from any direction desired. To move any tower, simply unscrew bolt **13** (see FIG. **4**), push tower around to the desired angle and reinstall bolt **13** and plate **14**. Hook pull chain to damaged area and hookup is complete. With three pull towers adjustable to pull at any height or angle, the frame and body of the damaged vehicle are all pulled back into alignment in the same operation, rather than pulling one and then the other, by pulling both the frame and body at just the right angle and height. Such pulling cuts down on the resistance, resulting in a much faster and better job. Construction of these pull towers allows the use of much larger and longer actuating cylinders, that do not have to be handled by hand.

Subsection A shows the tiedown at front of car. Subsection B shows the tiedown further back on car. Subsection C shows the tiedown for pulling from the pull towers. While pull tower movement is stretching frame, auxiliary jack **44** applies pressure upwardly to the frame.

The series of crossmembers in each rail **9** provides a ready place for tiedowns at any angle or point on the rails **9**, regardless of angle desired, as shown in subsections A, B, and C. Also there is no problem finding a spot to set jacks **45** on rail assembly **9**, for pushing up on body or frame or both, as shown in subsection D.

The entire machine is mounted on a pedestal **3**, hinged from the floor and secured by lag-screws. The pedestal **3** is also an axis for the pull towers **5**, permitting the towers **5** to be positioned for pulls from any desired angle. The hydraulic pump **55** is mounted inside the pedestal **3**, for both protection and convenience. Pump **55** is activated by remote control **49**. Pump **55** is easily removable from pedestal **3** for servicing.

In FIG. **2**, the apparatus or machine, is shown lowered at one end completely tilting it to receive a vehicle, not shown without using removable ramps. In order to lower it, a safety stand **69** must first be pulled and pivoted from its upright position which is automatically taken when the apparatus is tilted back up to its horizontal position. In such elevated horizontal position, any vehicle raised by the apparatus is sufficiently high so no pit volume in the building is needed below the vehicle being repaired.

In FIG. **3**, the apparatus or machine, is shown in a top view to illustrate the almost unlimited number of tie-down or anchoring locations available along rail assemblies **9**. Also indicated are the multiple radial positions of the pull towers **5**. As shown, the towers **5** are applying power in three different directions at one time. Also, the auxiliary jack **45** is pushing on a short link in the frame of the vehicle forcing it to bend in the desired location or spot. There is no lost time or heavy lifting in making hookups, since the pull towers **5** stay rigged for action at all times. The auxiliary cylinder **45** is a standard 10-ton body jack, hooked into the hydraulic system on the machine to be used as shown in subsection D and FIG. **3**.

Rail assemblies **9** consists of a series of single beams **10** on edge, welded to a series of crossmembers **11**. The two rail assemblies are mounted on two main crossmembers **15** which are welded to the pedestal **3**, and they are also mounted on one crossmember **16** at the rear of the machine. The lift device is also fastened to the rear crossmember **16**. The advantage of fabricating the rail assemblies **9** in this manner is the creation of spaces between the beams and regular spacings of crossmembers **11**, making it a very simple operation to tie any vehicle to a rail assembly **9**, regardless of angle or location required by each repair job.

Throughout the utilization of all apparatus of the various embodiments, special body clamps are provided and often used. Some cars do not have frames and it is very difficult at time to find a place suitable for tying the car down, in order to pull as hard as necessary at times, without causing damage to an undamaged part of the car. However, usually on a unitized body there is a small flange on the lower part of the body sill, that is a suitable tiedown location, provided you have clamps capable of holding on to this small flange. These clamps of FIGS. 3A, 3B, and 3C are designed for this purpose and they are very simple to use. The clamp, placed in position, bolt **152** and nut **153** are tightened snugly to hold clamp until pressure is applied. The chain is hooked in the space provided in part **150** and, as pressure is applied, part **150** slips back on parts **151**, sinking teeth into the body flange. The harder the pull, the tighter the squeeze. It will not slip.

In FIGS. **4** and **4C**, portions are broken away to indicate construction of pull tower assemblies **5**, pedestal assemblies **3**, the hydraulic system leading to and departing from hydraulic pump **55**, and the locking devices **13/111** to keep pull towers **5** in their respective selected radial positions. There are two pull tower lock systems shown. The pin system **111**, is the most desireable of the two. The hydraulic cylinder **57**, etc., is tucked inside the pull tower poles **113**. This enables the use of large, long cylinders and leaves the hookup ready to use at all times without any handling of jacks, heavy attachments, etc. The only setting up required, is to adjust the height of pull and angle, merely by setting idler assembly **101** to the desired spot on the pull tower pole **113**. This pull tower pole may be attached to many other types of frame machines not shown improving them considerably and it may be mounted in the floor of a shop to provide a ready pull facility when needed on minor body repair jobs.

In FIGS. **4** and **4A** and in all embodiments, an idler assembly **101** for each pull tower **113** is adjustable to any desired height and angle. Set screw **124** holds idler assembly **101** at the desired location until pressure from cylinder **57** is applied. As chain **102** is pulled, a resulting upward force on one side of idler assembly **101** creates a binding action between it and tower pole **113**. The harder the pull, the tighter this gripping or binding action becomes thereby holding idler assembly **101** at the proper height and angle throughout the entire pulling operation utilized to pull out damaged portions of a vehicle.

In FIGS. **4** and **4B**, the hydraulic system is illustrated. After a vehicle is in place, the lift assembly shown in FIG. **5**, is raised to that position as a valve type **41** located adjacent to it is opened. After the apparatus or machine is leveled, this valve is closed. Thereafter, other valves **41** controlling fluid flow to other cylinders are selectively opened and closed to cause movement of their respective actuators. Any cylinder may be left under pressure while adjustments are made to others. One

or more hydraulic cylinders may be regulated while keeping pressure on all those that previously received hydraulic liquid under pressure. A central pump **55**, driven by an electrical motor or a compressed air motor, selectively supplies hydraulic fluid under pressure through these various valves **41** to actuators **44**, **45** and those actuators referred to as pull tower cylinders **57**.

Although a hydraulic system is shown and described, compressed air actuators and mechanical actuators may also be used.

In regard to this embodiment presented in FIGS. **1** through **5**, the following numerals identify the following parts in reference to the specific groupings indicated:

Hydraulic Components, and Related Components

40 Hydraulic hose to pull towers; **41** Control Valves; **42** Bracket fastens control valve to machine; **43** Clip to secure hydraulic hose; **44** Hydraulic cylinder, operating lift apparatus; **45** auxiliary jack, coupled into the hydraulic system; **46** Nipple (body jack); **47** Jack attachments (body jack); **48** Remote control line; **49** remote control switch; **50** Body jack attachments; **51** Hydraulic hose to lift cylinder; **52** Hydraulic hose to auxiliary body jack; **53** Hydraulic line junction box; **54** Hydraulic hose to pump assembly; **55** Hydraulic pump (air driven or electric); **56** Plate supporting pump assembly and junction box; and **57** Pull tower cylinder.

Lift and Stand Assembly—**1**

60 Bracket holding Hydraulic Cylinder **44**; **61** Pins; **62** Brackets; **63** Upper arms; **64** Lower arms; **65** Shaft (cylinder pushes on this shaft to raise machine); **66** Mounting bracket (fastened to floor); **67** Mounting bracket lag screws (fastens lift assembly to floor); **68** Bracket; **69** Leg stand; **70** Jam nut; **71** Leg Bolt; **72** Shaft; **73** Stop; and **74** Brace.

Tiedown Attachments

80 Tiedown or pull hook with chain hook slot for fast chain adjustment; **81** Tiedown chain; **82** Tiedown or pull hook; **83** Tiedown or pull hook; **84** Pull plates; **85** Shackles with chain hook slots (for fast adjustments) **86** Bolts (usually bumper bolts); **87** Chain hooks.

Pull Tower Assembly **5**

101 Idler assembly; **102** Pull chains; **103** Upper push rod cap with chain hook slot for chain adjustments; **104** Guide flanges for holding pull chain in center of push rod; **105** Push rod (Moveable up and down and will turn 360 degrees); **106** weld on pull plate; **107** Pull chain hook; **108** Holes for bolts or pins (for hooking pull towers into position) **109** Sleeve (used with pins **111**); **110** Nut (if bolts **13** are used); **111** Pin for securing pull tower; **112** Spacer flange secured to pin **111**; **113** Pull tower pole; **114** Upper part of pull tower pole brace; **115** Gussets (pull tower pole Brace) **116** Bar (welded inside of pull tower pole **113**); **117** Flange (secured to cylinder **57** to keep cylinder centered); **118** Lower push rod cap; **119** Upper part of pull tower beam; **120** Lower part of pull tower beam; **121** Inner brace (pull tower beam welded to **119–120–122** and **113**); and **122** End plate (Pull tower beam).

Idler Assembly **101**

123 Collar; **124** Thumb set screw; **125** Pin; **126** Bracket; **127** Idler pulley; and **128** Brace.

Rail Assembly **9**

10 Beams in main rails; **11** Crossmembers in rails; **12** End crossmembers; **13** Anchor bolts or pins to secure pull tower to rails; **14** Plate or washers under bolts **13**: **15** Main crossmembers, supporting rails, welded to pedestal; **16** Rear crossmember, supporting rail assembly lift device; **17** upper section of crossmember **16**; and **18** Moveable crossmember, (Moveable between rails).

Pedestal Assembly **3**

20 Pedestal; **21** Bracket; **22** Collar; **23** Flange collar, welded to Pedestal **20**; **24** Mounting bracket; **25** Mounting shaft, welded to Pedestal **20** and Flange **23**; and **26** Door (Pump assembly lifts out through this door for service);

Body Clamps

150 Clamp housing can be fabricated or forged; **151** Wedges with teeth attached; **152** Bolt; and **153** Nut.

Car Body B

Car Frame F

Other Embodiments on Pedestal Radially Adjusted Elongatable Towers of FIGS. **1** Through **5**.

Although FIGS. **1** and **2** show one central pedestal **20**, two pedestals one on each side of a vehicle location may be used. Also one pedestal at the front and one at the back of each vehicle location may be used. Such arrangements are dependent on the requirement for even greater convenience in effecting repairs. Where more pedestals are to be used generally additional facilities such as pits or ramps are included in the overall building.

SUMMARY OF ADVANTAGES

The apparatus selected in one or more of its embodiments performs the versatile function of pulling damaged parts in directions reversed from those causing such damage. The metals, without heating, are pulled back to their originally specified relative locations or at least within the original factory designated tolerances. Depending on the volume and nature of jobs to be undertaken in a shop, the apparatus may be increased in size, function and capacity with added components being adaptable with no change or minor changes to previously acquired apparatus.

Throughout all components, the utilization of the pulling towers and their conveniently arranged selective positioning and holddown accessories, results in quick and accurate setups requiring no lifting nor awkward stances or manipulations on the part of anyone in a shop who is repairing a vehicle.

I claim:

1. Apparatus to apply pulling force to a vehicle comprising:
a pedestal above which said vehicle is supported;
at least one vertical pull tower assembly pivotally connected to and movable about said pedestal to a desired position relative to said vehicle, said tower including
means to vertically elongate said tower, and
pull means connectable between said vertically elongate means and a portion of said vehicle to apply said pulling force to said portion.

2. Apparatus of claim **1** including means movable on said tower to adjust said pull means whereby said pulling force is applied at a desired angle relative to said tower.

3. Apparatus of claim **1** including a rail assembly attached to said pedestal to receive and support said vehicle.

4. Apparatus of claim **3** wherein said rail assembly is pivotal to one position forming a ramp to receive said vehicle and to a second position substantially perpendicular to said tower.

5. Apparatus of claim **3** including means to affix said vehicle to said rail assembly.

6. Apparatus according to claim **1** wherein said means to vertically elongate said tower is hydraulically actuatable.

7. Apparatus according to claim **1** wherein said pull means is a chain or cable.

8. Apparatus according to claim **2** wherein said pull towers are cylindrical.

* * * * *