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[56]

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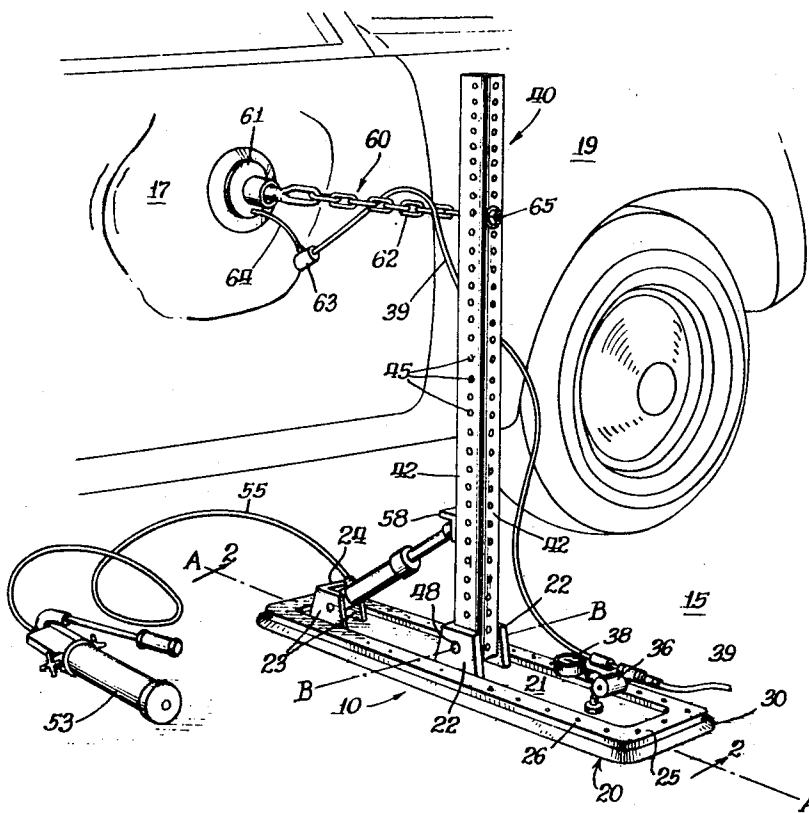
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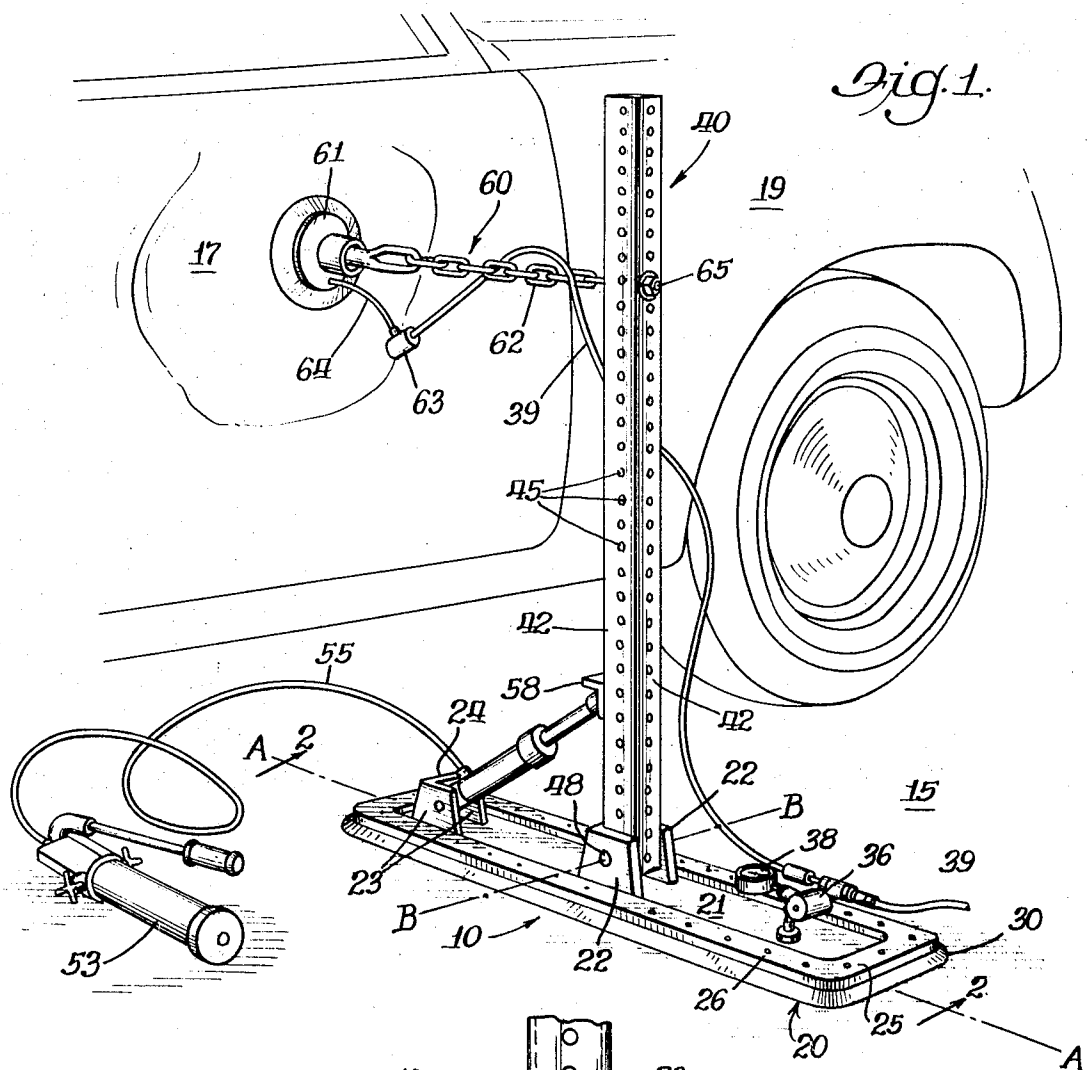
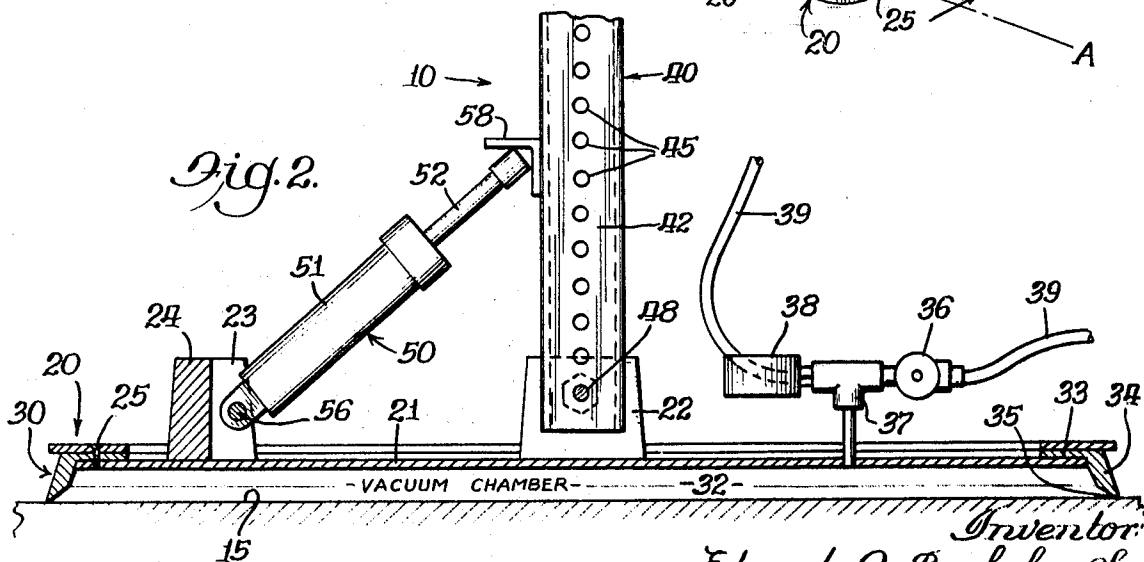
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[54] PORTABLE FORCE APPLICATOR 10 Claims, 2 Drawing Figs.

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ABSTRACT: A portable force applicator having selectively operable vacuum anchorage for a power actuated mast and a hydraulic ram for pivotally actuating the mast. A power-actuated vacuum cup for attachment to an object upon which force is to be exerted, is connected by an articulate chain at selected adjustable positions along the mast.





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PORTABLE FORCE APPLICATOR

BACKGROUND OF THE INVENTION

The present invention relates generally to portable force applicators, and more particularly, to a portable device for applying pulling or pushing forces which is adapted to be anchored to a surface by selectively actuated vacuum means and which employs a power-actuated ram to generate the applied force.

In the past, dented or caved-in panel repair jobs for automobiles in particular have demanded either filling the indentations with body solder and similar plastic materials or manually reshaping the dented panel portion into original configuration. The use of vacuum cups and other gripping means, attached to the dented panel, have been employed with limited success for the purpose of pulling out panel indentations. It has been found, however, that in addition to pulling the indentation out of a damaged panel a strong and steady application of force must be maintained on the indented portion while the metal thereabout is reworked to relieve stresses. For such purpose, previous practice has developed cumbersome pulling equipment, usually utilizing fixed floor anchorage systems, or heavy bracing devices generally applied against the automobile frame. Such known pulling equipment, however, has proven undesirable because of expensive fixed anchorage systems employed therewith, such as rails or the like embedded in the work floor, which greatly limits positioning capability. Also previously known bracing devices likewise are limited in use, since they are applied against solid portions of the automobile frame, a situation which does not always lend itself to the particular location of the damaged panel area. In a similar fashion, such pulling equipment and bracing devices are limited when employed for straightening damaged automobile frames.

SUMMARY OF THE INVENTION

In order to overcome the foregoing and other recognized shortcomings of the prior art, the present invention provides a new and improved portable force applicator which is particularly distinguished by its capacity to successfully operate without regard to any fixed anchorage location. To this end, the present invention comprises a readily portable base member having vacuum-gripping means, selectively operable to effect positive anchorage thereof to any convenient flat surface such as a supporting floor. A mast member is pivotally joined to the base and power actuated ram means operate between the mast and the base to provide selective force actuation of the mast. Suitable gripping means, such as a vacuum cup, is employed for attachment to a dented automobile panel, for instance, and such is coupled to the mast at selected positions therealong. Actuation of the power ram forcefully pivots the mast in a direction appropriate to pull against the dented panel, to reverse the indentation thereof and hold the panel outwardly as desired. Both the power-actuated ram and mast are pivoted on an axis traversing a longitudinal axis of the anchored base so that the transmission of force generally parallels the maximum axis of the vacuum anchoring system. Suitable evacuator means are coupled to the anchoring system and the vacuum cup panel-gripping means to positively actuate the same.

One of the objects of this invention is to utilize vacuum anchorage and power actuation means in a portable force applicator.

Another object of this invention is to minimize the vacuum required to a force applicator as aforesaid by applying the forces generated thereby in a direction paralleling the maximum axis of stability for the anchorage means.

Another object of this invention is to eliminate the need for fixed anchoring means in a force applicator, particularly as employed in automobile body repair work.

A still further object of this invention is to provide a simple, portable, efficiently operable force applicator which is

economical to produce, and utilizes a minimum of conventional currently available materials and components leading to economies of mass production and manufacturing techniques.

The foregoing and further objects, features and advantages of this invention and its utility will be recognized with reference to the foregoing description and appended claims, taken in conjunction with the illustrated embodiment set forth in the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

For the purpose of illustrating the invention, there is shown in the drawings a form thereof which is presently preferred, it being understood, however, that this invention is not necessarily limited to the precise arrangement, instrumentalities and field of utility as therein demonstrated.

FIG. 1 is a perspective view of a portable force applicator according to this invention, showing the same in use for automobile body repair work; and

FIG. 2 is an enlarged partial cross-sectional view, with parts in full elevation, taken substantially along vantage line 2-2 of FIG. 1 and looking in the directions of the arrows thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like numerals indicate like elements, FIGS. 1 and 2 illustrate a portable force applicator according to this invention which is designated generally at 10 therein. As shown best in FIG. 1, the portable force applicator is normally anchored to an underlying support surface 15 and positioned for operation adjacent an indented or damaged portion 17 of an automobile body 19, or the like.

The force applicator 10 includes a vacuum actuated anchoring means 20 comprising a generally elongated rectangular baseplate 21 having a central longitudinal axis designated A-A in FIG. 1. Other shapes than the elongated rectangular configuration shown also are contemplated according to this invention. However, the form shown is preferred in automobile body repair work for reasons which will appear presently.

The baseplate 21 includes a centrally located, laterally spaced and upwardly extending pair of lugs 22, 22 and an additional pair of similarly spaced lugs 23, 23, the latter of which are located near one end of the baseplate, as shown in FIG. 2. Plate 21 and the lug pairs may be integrally cast of a durable metal, such as aluminum magnesium alloy or, if preferred, such may be constructed by welding the lugs to the baseplate in a conventional fashion. The two lugs 23, 23 preferably are interconnected by a back wall portion 24 for reinforcement purposes. A peripheral holddown ring clamp 25 is also associated with the baseplate 21 and is suitably fastened thereto by space fastener means, such as machine screws 26, 26. In this regard, it will be noted that the clamp member 25 is positioned over the top face of the plate member 21, about the periphery of the latter.

Resilient vacuum gripper pad means 30 are provided for sealed anchoring engagement with the underlying support surface 15; the resilient character thereof accommodating variations in the surface 15. Pad means 30 is suitably clamped to and sealed between the plate 21 and clamp member 25, as best seen in FIG. 2, to define a vacuum chamber 32 between the underface of the baseplate and the support surface 15 in operation. The gripper pad means bears a generally L-shaped cross section, which comprises a planar retention portion 33 adapted to extend over the upper periphery of baseplate 21 whereat it is securely clamped between the plate 21 and the overdisposed clamp member 25 by means of the spaced fastener means 26 (see FIG. 1). The remainder of the L-shaped section for the gripper pad means is somewhat thicker than portion 33 and depends angularly downwardly from the latter, tapering to a ground-engaging tip portion 35 at its outer or lower end. In operation, portion 34 flexibly hinges relative to the retention portion 33 to effect sealing engagement with surface 15 when chamber 32 is evacuated.

An evacuator means, such as a venturi 36, cooperates with the gripper pad means 30. When utilizing such a venturi, the suction side thereof is connected by suitable connector means 37 to the vacuum chamber 32 beneath the baseplate 21 and a pressure gauge 38 is preferably employed therewith to indicate proper operating supply pressure in the order of 50—60 p.s.i. As shown, the connector means 37 comprises suitable lengths of connective tubing and T connectors of conventional construction. The inlet side of the venturi 36 is joined to a source of compressed air, such as a shop compressor (not shown) by means of a flexible hose or conduit 39 utilizing standard tube fittings and connectors well known in the art. In operation, the evacuator means, such as the illustrated venturi, draws a vacuum in chamber 32 beneath the anchoring means to effectively clamp the latter to the support surface of floor 15.

A rigid mast member 40, herein shown as a tubular member of square cross section and made of a material such as steel or the like, extends generally upright from the upper surface of the baseplate 21. Opposing sidewalls 42 of the mast are provided with a series of evenly spaced and registering aligned openings 45, 45 and the lower end of the mast member 40 is pivotally connected to and between the centrally spaced lugs 22, 22 as by pivot means 48. Thus the mast is pivotally movable about an axis B-B at its lower end which is perpendicular to the longitudinal axis A-A of the anchoring means. Pivot 48 may be provided by a conventional nut and bolt fastener, for instance, passing through appropriate openings in the opposing lugs 22, 22 and opposing sidewalls 42 of the mast member.

Extensible-contractible power actuated means 50 are provided between the mast 40 and the anchoring means 20 for actuating the mast. In the illustrated embodiment, means 50 comprises a hydraulic ram which includes the usual cylinder 51 and an extensible piston 52 connected to a manual hydraulic pump 53 by a conduit means 55. Preferably, one end of cylinder 51 is pivotally connected, as by pin means 56, to and between the lugs 23, 23 for movement about an axis parallel to the mast's pivot axis B-B. A suitable angle bracket 58 is affixed, as by welding, to an opposing, adjacent sidewall 42 of the mast member and near the lower end of the latter, for abutting engagement with the outer end of the ram piston 52. Preferably the positioning of the bracket 58 is such as to dispose the ram or power-actuated means 50 at substantially 45° to the plane of baseplate 21 for maximum force transmission. If desired, piston 52 also may be pivotally joined to the mast member 40 at bracket 58 in which instance a double-acting ram may be utilized whereby to power actuate the mast bidirectionally. By this expedient the mast will effect both pulling and pushing force. If a single acting ram is used, as illustrated, pushing force may be obtained therefrom by simply reversing the position of the anchoring means 180° from that illustrated in FIG. 1.

Means for transmitting force between the power actuated mast 40 and an object upon which force is to be applied, such as the dented panel 17 of the automobile illustrated, or a bent frame member, is provided and designated generally by numeral 60 in FIG. 1. In the particular embodiment shown, force-transmitting means 60 comprises a vacuum cup attachment means 61 coupled to the dented panel portion 17 and a chain 62 extending between the vacuum cup and mast 40. Operational actuation of the illustrated vacuum cup attachment means is effected by a venturi 63 having a suction inlet connected by conduit 64 to the vacuum cup; the pressure side of the venturi being joined to the source of compressed air by an extending section of the flexible air supply conduit 39, associated with the anchoring means, venturi 36.

Means for adjustably positioning the force-transmitting means along the length of the mast is provided in order to align such transmitting means substantially at right angles to the mast. For this purpose, a threaded eye bolt fastener 65 connected to one end of the chain 62 and passing through a chosen pair of the opening 45, 45 of the mast may be employed, in the manner illustrated in FIG. 1.

Operation of the invention for automobile body repair work is initiated by positioning the anchoring means 20 on a clear flat surface 15 at a desired and selected location oppositely adjacent the panel area 17 to be repaired. Preferably, the elongated axis A-A of the anchoring means is aligned, as shown, generally at right angles to the plane of the body panel. Vacuum chamber 32 is then evacuated by means of the venturi 36 powered from the compressed air source. That is to say, high pressure air passing through venturi 36 creates a continuing suction in the venturi inlet which communicates with chamber 32 and effectively evacuates the latter according to recognized principles. The vacuum cup attachment means 61 engaged with the indented panel portion 17 is likewise actuated to positively couple the force-transmitting means between the panel and the mast 40. Pulling force is then applied to the dented panel portion 17 by actuation of the hydraulic pump 53 which serves to extend the ram actuator 50 extending piston 52 thereof against the mast 40 and pivoting the latter about axis B-B at its lower end. In this respect, it will be noted that movement of the mast about axis B-B is generally in a vertical plane coincident with the maximum or lengthwise axis A-A of the anchoring means. This arrangement provides maximum stability to the force applicator in operation. Application of the pulling force on indented panel portion 17 may be maintained as desired, by locking the hydraulic ram 50 at any selected position. Thereafter, the panel material surrounding the indented portion 17 may be worked or hammered in a known fashion, to stabilize the pulled out panel area and cause the same to retain its repaired configuration upon release of the pulling force therefrom.

The present invention may be embodied in other specific forms and applied to other fields of use without departing from the spirit or potential attributes thereof.

I claim:

1. A portable force applicator comprising, in combination: a base having vacuum gripping means operable to detachably anchor the base on a selected support surface, an elongated mast pivotally connected at one end to said base, and extensible-contractible power-actuated means mounted between said base and mast and selectively operable to forcefully pivot said mast relative to said base whereby movement of said mast may be coupled to an object for the purpose of applying force thereto.

2. A portable force applicator in accordance with claim 1, and evacuator means for actuating said gripping means.

3. A portable force applicator in accordance with claim 2, and means adjustably connected to said mast, between the outer end thereof and said power-actuated means, and having connection with said mast and said object.

4. A portable force applicator in accordance with claim 1 wherein said base has a longitudinal axis and said mast pivots on an axis perpendicular to said longitudinal axis and in a plane coincident with the latter.

5. A portable force applicator in accordance with claim 1 wherein said base has an elongated configuration and said gripping means includes a resilient portion depending from the periphery of said base to enclose a vacuum chamber between said base and surface.

6. A portable force applicator in accordance with claim 2 wherein said power-actuated means is a hydraulic ram extending angularly between said mast and base.

7. A portable force applicator in accordance with claim 1 including transmitting means extending between said mast and said object for transferring force to the latter.

8. A portable force applicator in accordance with claim 7 wherein said transmitting means includes means adjustably connected along the length of said mast, and attachment means adapted to be connected to said object and having articulate connection with said means connected to said mast.

9. A portable force applicator in accordance with claim 8 wherein said attachment means includes a vacuum-actuated cup means engageable with said object.

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10. A portable force applicator in accordance with claim 8 wherein said gripping and attachment means cooperate with venturi means communicating with a source of pressurized air

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and said chamber and vacuum cup for vacuum actuation thereof.

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