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Apparatus for straightening deformed parts of bodywork of motor vehicles.

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EP-A- 0 163 216
WO-A-89/11353
US-A- 2 151 063
US-A- 3 340 720
US-A- 4 466 268

Proprietor : **Bartolini, Mauro**
Via A. Di Cambio 1
Scarperia (Florence) (IT)

Proprietor : **Fattori, Alessandro**
Viale Don Minzoni, 23
Cavallina Mugello (Florence) (IT)
Proprietor : **Fattori, Carlo**
Viale Don Minzoni, 23
Cavallina Mugello (Florence) (IT)
Proprietor : **Fattori, Roberto**
Viale Don Minzoni, 23
Cavallina Mugello (Florence) (IT)
Proprietor : **Tagliaferri, Francesco**
Via G. Traversi, 31
Luco di Mugello (Florence) (IT)
Proprietor : **Tagliaferri, Massimo**
Via D. Torelli, 12
Luco di Mugello (Florence) (IT)

Inventor : **Bartolini, Mauro**
Via A. Di Cambio 1
Scarperia (Florence) (IT)

Representative : **Bardini, Marco Luigi et al**
c/o Società Italiana Brevetti S.p.A. Corso dei
Tintori, 25
I-50122 Firenze (IT)

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Description

The subject of the present invention is an apparatus for straightening, that is to say restoring to their original shape, parts of bodywork of motor vehicles, which have suffered deformations as a result of a road accident or impacts of various types.

The mechanical apparatuses and devices currently in use for this purpose consist in general of a basic structure, from which extend adjustable bars or chains, which bear at their free end pincers or other equivalent gripping elements, which make it possible to hold the bodywork at the required point. The basic structure is anchored on the platform or ramp on which the vehicle, of which the bodywork needs repair, is fixed; using mechanical or hydraulic means, the part of bodywork held with the pincers is subjected to a pulling or pushing action. As it is rare that pulling or pushing in one direction only can permit the restoration of the original shape of the deformed part of bodywork, the operator, with the known apparatuses and devices, has to carry out numerous variations of the angle of pushing or pulling by taking steps to move manually the basic structure to which the relevant pushing or pulling elements are fixed. In general, it emerges that the restoration of the original shape of any deformed framework is achieved by performing the pushing and pulling actions according to three orthogonal directions and by means of rotation about these. In particular, the operation of rotation about the three orthogonal directions is extremely difficult to carry out using manual techniques and requires considerable experience on the part of the operator. Special equipment and tools are also necessary according to the type of action required and the part of bodywork which is to be acted upon. In short, with the techniques and the means which are currently available, the restoration of the original shape of the deformed parts of bodywork proves to be extremely laborious and relatively accurate.

An apparatus for straightening deformed parts of bodywork of motor vehicles, which makes it possible to avoid the above disadvantages, has now been conceived and forms the subject of the present invention according to claim 1

The straightening of the deformed part of bodywork is achieved by using an articulated mechanical device, which is operated by means of oil-hydraulic cylinders and affords the gripping elements, with which it is equipped, the three movements along the three orthogonal directions and the three rotations about these. In this manner, the operator is able to hold the deformed framework by means of the gripping element and to restore it to its original position and shape simply by working from a push-button arrangement, which operates the hydraulic commands relating to the different movements.

The economical advantage, in terms of saving

time and of greater precision in relation to traditional techniques, which is realized with the apparatus according to the present invention, is thus clear.

In particular, the base, on which the device is mounted, is provided with wheels.

Further characteristics and advantages of the apparatus for straightening deformed parts of bodywork of motor vehicles according to the present invention will emerge more clearly from the following description of an embodiment of it, which is given, by way of non-limitative example, with reference to the attached drawing, in which it is shown in an overall perspective view.

With reference to the abovementioned figure, a platform or ramp, on which the vehicle (not shown), of which the bodywork needs repair, is mounted and expediently fixed, is indicated generically by 1. 2 then indicates a metal basic structure, which is formed by two robust prismatic bars 2a and 2b, which are arranged essentially in a T shape and mounted on pivoting wheels 3 in order to permit easy movement of the apparatus. The bar 2b is provided with two pairs of hooks 4 (one only shown in the figure), or equivalent means, for anchoring the structure 2 on the ramp 1 by means of fixing screws 5.

From the middle of the bar 2a of the base 2, a tubular support 6 with a vertical axis rises, inside which there engages rotatably the foot 7a of a vertical fork 7, which has horizontal pivots 8 on which a tubular guide 9 is rotatably mounted. The latter can, therefore, rotate in relation to both the vertical axis of tubular support 6 (axis X) and the horizontal axis of the pivots 8 (axis Y).

The tubular guide 9 intersects with its longitudinal axis the plane defined by the axes of rotation X and Y and is turned towards the ramp 1 with one of its ends. From the ends of the bar 2a of the base 2, two hydraulic cylinders 10 extend, which converge towards the other end 9a of the tubular guide 9, to which they are connected in an articulated manner by means of the respective piston rods 11. Similarly, the cylinders 10 are connected to the bar 2a in an articulated manner at 12.

From the above it is clear that, by operating the two hydraulic cylinders 10 simultaneously, an angular movement of the tubular guide 9 about the horizontal axis Y is brought about whereas, by operating the two hydraulic cylinders 10 separately, an angular movement of the tubular guide 9 about the vertical axis X is brought about.

On the inside of the tubular guide 9, a prismatic guide 13 is coaxially housed, which is provided with a ring gear 14, on which a rack 15 engages, which is operated by hydraulic cylinders 16, by means of which the prismatic guide 13 can be rotated about its own longitudinal axis. In the prismatic guide 13, a tubular arm 17 of square cross-section is housed, which is axially slidable inside the prismatic guide 13, to this

end being operated by an hydraulic cylinder 18. The arm 17 is thus slidable along the longitudinal axis Z of the tubular guide 9 and rotatable in relation to the same.

The tubular arm 17 has an end 17a in the form of a fork, to which a cross journal 20 is connected by means of a pivot 19, which is perpendicular to the axis of the arm 17. Pincers 22 are in turn connected to the cross journal 20 by means of a pivot 21, which is perpendicular to the pivot 19. In the tubular arm 17, two hydraulic cylinders 23 are also housed, the piston rods 24 of which are connected in an articulated manner to the cross journal 20. To the latter, two piston rods 25, which extend from hydraulic cylinders 26 located inside the two jaws of the pincers 22, are also connected in an articulated manner. From the above explanation, it is clear that, by appropriately operating the hydraulic cylinders 23 and 26, it is possible both to open and close the pincers 22, and to impart to them angular movements in any direction about the axis Z. In particular, by operating one or other of the cylinders 23, the cross journal 20 is made to rotate in one direction or the other on its pivot 19, thus imparting a corresponding angular movement to the pincers 22. Similarly, by operating the two hydraulic cylinders 26 simultaneously, opening or closing of the pincers is brought about whereas, by operating them separately, an angular movement is imparted to the pincers in one direction or the other about the pivot 21.

The apparatus according to the invention is provided with a control panel (not shown) with a push-button arrangement, from which the operator controls both the positioning of the pincers 22 and the angle of pulling or pushing from time to time considered necessary. In particular, by operating cylinders 10 and 18, the operator will achieve the correct positioning of the pincers on the part of bodywork to be straightened whereas, by operating the hydraulic cylinders 16, 23 and 26, he will also vary continuously the angle of pulling or pushing employed by the arm 17, which is made to slide axially by action of the cylinder 18.

The gripping ends of the pincers 22 can advantageously be provided with teeth 27 in order better to hold the part of bodywork to be deformed. Furthermore, the pincers 22 can advantageously delimit a space 28, which is suitable for the use and the locking of special tools.

The apparatus according to the present invention has a constructional geometry such that it is afforded a great rigidity and capacity for deforming even very resistant frameworks, while retaining very compact dimensions.

It is to be noted that, although in the present embodiment of the invention, a polar configuration has been adopted for the connection of the tubular guide 9 to the base 2, a configuration which, however, is considered preferable for reasons of dimensions, it is clear that the same connection can be brought about

in a likewise convenient manner for specific applications according to a cartesian configuration.

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Claims

1. Apparatus for straightening deformed parts of bodywork of motor vehicles, of transportable type and comprising means of anchorage (4) on a ramp (1) on which the vehicle to be repaired is locked, characterized in that it comprises:
 - a base (2);
 - support means (9) mounted on said base (2) and movable in two orthogonal directions, relative to said base (2);
 - an operating arm (17), mounted on said support means (9), having a longitudinal axis which intersects the plane defined by said two orthogonal directions, said axis being turned towards said ramp (1), said operating arm (17) being able to slide along the longitudinal axis and being able to rotate around the longitudinal axis;
 - pincers means (22), for holding the damaged part of the bodywork, mounted at the free end of said arm (17);
 - an articulated connection (20) between the free end of said arm (17) and said pincer means (22), being capable of providing angular movements of said pincer means (22) in two orthogonal planes, which intersect along the axis of said arm;
 - actuating means (10, 18, 16, 23, 26) for achieving the above mentioned movements of said support means (9) relative to said base (2), said arm (17) relative to said support means (9) and said pincers means (22) relative to said arm (17).
2. Apparatus according to Claim 1, in which said support means comprises a tubular guide (9), which is mounted rotatably about a horizontal axis which is perpendicular to its longitudinal axis, on a fork (7) which is rotatable about a vertical axis which is fixed in relation to said base (2), a pair of hydraulic actuators (10) being provided, which extend in a symmetrical manner between said base and one end of said tubular guide and can be operated jointly or separately in order to impart to said arm angular movements about said horizontal and vertical axes respectively.
3. Apparatus according to the preceding claims, in which said operating arm (17) is slidably housed inside a corresponding prismatic guide (13), which in turn is rotatably housed inside said tubular guide (9).

4. Apparatus according to Claim 3, in which, for the rotation of said prismatic guide (13) in relation to said tubular guide (9), a coaxial ring gear (14), which engages with and hydraulically operated rack (15), is provided around said prismatic guide (13). 5
5. Apparatus according to Claim 3, in which, for the sliding of said operating arm (17) along said prismatic guide (13), hydraulically actuating means (18) are provided, which are connected to the end of said arm and pass inside said prismatic guide. 10
6. Apparatus according to Claim 1, in which said articulated connection (20) between the free end of said operating arm (17) and said pincers means (22) comprise a cross journal, which is pivoted on said free end and on which in turn are pivoted said pincers means, the two respective axes of articulation (19, 21) being orthogonal to one another and situated in a plane, which is perpendicular to the longitudinal axis of said arm. 15
7. Apparatus according to Claim 6, in which hydraulic actuator means (23) is provided, which is housed inside said operating arm (17) and articulated on said cross journal (20) in order to control its rotation about its articulation axis (19) in relation to said arm (17). 20
8. Apparatus according to Claim 6, in which said pincers means (22) comprises two jaws incorporating hydraulic actuator means (26) which is connected in an articulated manner to said cross journal in order both to control the opening and closing of said means with pincers and to control their rotation about the axis of articulation on said cross journal. 25
9. Apparatus according to the preceding claims, in which the facing ends of said pincers means (22) are toothed. 30
10. Apparatus according to the preceding claims, in which said pincers means delimit a space (28) for the locking of special tools. 35
11. Apparatus according to the preceding claims, in which said base (2) is trailer-mounted. 40

Patentansprüche

1. Vorrichtung zum Richten verformter Teile von Kraftfahrzeugen, die transportabel und auf einer Rampe (1) mittels einer Verankerung (4) festzulegen ist, auf der auch das zu reparierende Fahrzeug festzulegen ist, dadurch gekennzeichnet 45

die Vorrichtung enthält:

- ein Fußteil (2)
 - ein dem Fußteil (2) baulich zugeordnetes, diesem gegenüber in zwei orthogonalen Richtungen verstellbares Tragmittel (9);
 - ein Stellglied (17), daß dem Tragmittel (9) baulich zugeordnet ist und dessen Längsachse die Ebene schneidet, die dadurch die beiden orthogonalen Richtungen definiert ist und gegen die Rampe (1) gerichtet ist, wobei das Stellglied (17) in Richtung der Längsachse verstellbar und um die Längsachse schwenkbar ist;
 - ein dem freien Ende des Stellgliedes (17) zugeordnetes Greifmittel (22) zum Halten des durch die Verformung beschädigten Fahrzeugteils;
 - eine gelenkige Verbindung (20) zwischen dem freien Ende des Stellgliedes (17) und dem Greifmittel (22), um Winkelbewegungen des Greifmittels (22) in zwei orthogonalen Ebenen zu bewirken, die sich in Längsrichtung der Achse des Betätigungsarmes in dieser schneiden;
 - ein Betätigungsmittel (10, 18, 16, 23, 26) zum Bewirken der vorgenannten Bewegungen des Tragmittels (9) relativ zum Fußteil (2), des Stellgliedes (17) relativ zum Tragmittel (9) und des Greifmittels (22) relativ zum Stellglied (17).
2. Vorrichtung gemäß Anspruch 1, bei der das Tragmittel eine rohrförmige Führung (9) aufweist, die um eine senkrecht zur Längsachse der Führung gerichtete, horizontale Achse schwenkbar auf einer Gabel (7) angeordnet ist, wobei die Gabel um eine vertikale, relativ zum Fußteil (2) feste Achse schwenkbar ist, wobei weiter ein Paar hydraulische Stellmittel (10) vorgesehen ist, die in symmetrischer Anordnung zwischen Fußteil und einem Ende der rohrförmigen Führung liegen und gemeinsam oder unabhängig voneinander zu betätigen sind, um auf das Stellglied Winkelbewegungen um die horizontale bzw. vertikale Achse aufzubringen.
3. Vorrichtung gemäß den vorausgehenden Ansprüchen, bei der das Stellglied (17) gleitbar innerhalb einer entsprechend ausgebildeten prismatischen Führung (13) angeordnet ist, die ihrerseits drehbar innerhalb der rohrförmigen Führung (9) angeordnet ist.
4. Vorrichtung gemäß Anspruch 3, bei der zur Drehung der prismatischen Führung relativ zur rohrförmigen Führung (9) ein der prismatischen Führung zugeordneter, die rohrförmige Führung koaxial umgebender Getriebering (14) mit einer hy-

- draulisch zu betätigenden Zahnstange (15) zusammenwirkt.
5. Vorrichtung gemäß Anspruch 3, bei dem zur Bewirkung translatorischer Verstellbewegungen des Stellgliedes (17) gegenüber der prismatischen Führung (13) hydraulische Betätigungsmittel (18) vorgesehen sind, die mit dem Stellglied verbunden und durch die prismatische Führung hindurchgeführt sind. 5 10
6. Vorrichtung gemäß Anspruch 1, bei der die gelenkige Verbindung (20) zwischen dem freien Ende des Stellgliedes (17) und dem Greifmittel (22) einen Quersapfen aufweist, der auf dem freien Ende drehbar ist und auf dem wiederum das Greifmittel drehbar ist, wobei die beiden Achsen der Gelenkigkeit (19, 21) orthogonal zueinander in einer Ebene liegen, die senkrecht zur Längsachse des Stellgliedes liegt. 15 20
7. Vorrichtung gemäß Anspruch 6, bei der ein hydraulischen Betätigungsmittel (23) vorgesehen ist, das innerhalb des Stellgliedes (17) sich befindet und gelenkig dem Quersapfen zugeordnet ist, um die Drehung um seine Gelenkachse (19) relativ zum Stellglied (17) zu steuern. 25
8. Vorrichtung gemäß Anspruch 6, bei der das Greifmittel (22) zwei mit hydraulischen Betätigungsmitteln (26) versehene Klemmbacken aufweist und gelenkig mit dem Quersapfen verbunden ist, um sowohl das Öffnen und Schließen des Greifmittels mit den Klemmbacken als auch seine Drehung um die Gelenkachse des Quersapfens zu steuern. 30 35
9. Vorrichtung gemäß den vorstehenden Ansprüchen, bei der die Anlageflächen des Greifmittels (22) Zähne aufweist. 40
10. Vorrichtung gemäß den vorstehenden Ansprüchen, bei der das Greifmittel einen Abstand (28) zum Festhalten von Spezialwerkzeugen definiert. 45
11. Vorrichtung gemäß den vorstehenden Ansprüchen, bei der das Fußteil (2) auf einem Wagen angeordnet ist. 50
- Revendications**
1. Appareil pour redresser des pièces de carrosserie de véhicules automobiles déformées, du type transportable et comprenant des moyens d'accrochage (4) sur une rampe (1) sur laquelle le véhicule à réparer est immobilisé, caractérisé par le fait qu'il comprend:
- une embase (2);
 - des moyens de support (9) montés sur ladite embase (2) et déplaçables suivant deux directions orthogonales par rapport à ladite embase (2);
 - un bras de commande (17), monté sur lesdits moyens de support (9), ayant un axe longitudinal qui coupe le plan défini par les deux directions orthogonales, ledit axe étant dirigé vers ladite rampe (1), ledit arbre de commande (17) étant apte à se translater le long de l'axe longitudinal et étant apte à pivoter autour de l'axe longitudinal;
 - des moyens de pince (22), pour maintenir la pièce de carrosserie endommagée, montés à l'extrémité libre dudit bras (17);
 - une connexion articulée (20) située entre l'extrémité libre dudit bras (17) et lesdits moyens de pince (22), apte à donner auxdits moyens de pince (22) des mouvements angulaires dans deux plans orthogonaux se coupant suivant l'axe dudit bras;
 - des moyens d'actionnement (10, 18, 16, 23, 26) pour donner les mouvements angulaires mentionnés ci-dessus auxdits moyens de support (9) par rapport à ladite embase (2), audit bras (17) par rapport auxdits moyens de support (9) et auxdits moyens de pince (22) par rapport audit bras (17).
2. Appareil selon la revendication 1, dans lequel lesdits moyens de support comprennent un guide tubulaire (9), qui est monté rotatif autour d'un axe horizontal qui est perpendiculaire à son axe longitudinal, sur une fourche (7) montée rotative autour d'un axe vertical qui est fixe par rapport à ladite embase (2), une paire de vérins hydrauliques (10) étant prévus, qui s'étendent de façon symétrique entre ladite embase et une extrémité dudit guide tubulaire et qui peuvent être commandés ensemble ou séparément dans le but d'imprimer des mouvements angulaires audit bras autour respectivement desdits axes horizontal et vertical.
3. Appareil selon les revendications précédentes, dans lequel ledit bras de commande (17) est monté coulissant dans un guide prismatique correspondant (13), qui à son tour est monté rotatif à l'intérieur dudit guide tubulaire (9).
4. Appareil selon la revendication 3, dans lequel un engrenage coaxial en anneau (14) coopérant avec un vérin de commande hydraulique (15) est agencé autour dudit guide prismatique (13) pour lui donner son mouvement de rotation par rapport audit guide tubulaire (9).

5. Appareil selon la revendication 3, dans lequel sont prévus des moyens de commande hydrauliques (18) qui sont connectés à l'extrémité dudit bras et passent à l'intérieur dudit guide prismatique pour obtenir le coulissement dudit bras de commande (17) le long dudit guide prismatique (13). 5
6. Appareil selon la revendication 1, dans lequel la connexion articulée (20) entre l'extrémité libre dudit bras de commande (17) et lesdits moyens de pince (22) comprend un croisillon de cardan, qui pivote sur ladite extrémité libre et sur lequel à leur tour pivotent lesdits moyens de pince, les deux axes d'articulation respectifs (19, 21) étant orthogonaux l'un par rapport à l'autre et situés dans un plan qui est perpendiculaire à l'axe longitudinal dudit bras. 10
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7. Appareil selon la revendication 6, dans lequel sont prévus des moyens de commande hydrauliques (23), qui sont logés à l'intérieur dudit bras de commande (17) et articulés sur ledit croisillon de cardan (20) dans le but de contrôler sa rotation autour de son axe d'articulation (19) par rapport audit bras (17). 25
8. Appareil selon la revendication 6, dans lequel les moyens de pince (22) comprennent deux mâchoires incorporant des moyens de commande hydrauliques (26) qui sont reliées de façon articulée audit croisillon de cardan dans le but, à la fois, de commander l'ouverture et la fermeture desdits moyens avec des pinces et de commander leur rotation autour de l'axe d'articulation sur ledit croisillon de cardan. 30
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9. Appareil selon les revendications précédentes, dans lequel les extrémités se faisant face desdits moyens de pince (22) sont crantées. 40
10. Appareil selon les revendications précédentes, dans lequel lesdits moyens de pince délimitent un espace (28) pour bloquer des outils spéciaux. 45
11. Appareil selon les revendications précédentes, dans lequel ladite embase (2) est montée en remorque. 50

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