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Chargements d'aéronefs

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EP 1 092 671 B1

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Description

[0001] This invention relates to a tricycle vehicle according to the preamble of claim 1. Such a vehicle is known from DE-A-2030524

[0002] Space restrictions to be found in certain aircraft types, notably the relatively small ground clearance of aircraft underbellies, the lack of space between the side landing gears of the aircraft undercarriage, the limited fore and aft spacing, even, between such side landing gears and the third landing gear of the aircraft, when attempting to load long and/or bulky items of great weight, such, for example, as certain varieties of missile, render the rapid and easy manoeuvring of a transporter vehicle, carrying such an item (commonly supported on a cradle which is separably attached to the carriage means of the transporter) for proper presentation for capture at an aircraft pylon located at an aircraft sub-wing level, the subsequent raising of the cradle and item thereon, orientated for correct presentation at a level for capture at the pylon, and, the item having been captured at said pylon station, the subsequent extraction of the vehicle from beneath the vehicle, a matter of great difficulty.

[0003] For whilst, before capture of the large and heavy item at an aircraft pylon station, the aircraft may have a certain configuration in which the aircraft underbelly is at a relatively elevated position such that the transporter vehicle with its cradle loaded with the item to be introduced and manoeuvred as appropriate for presentation of the item at the pylon station, the depressed configuration of the aircraft existing after capture, may preclude the ready extraction of the unloaded vehicle from beneath the aircraft.

[0004] According to the invention, a tricycle vehicle for the conveyance of large and heavy items for presentation of said item for capture at an aircraft pylon station at a sub-wing level of the aircraft, is a vehicle constituted as specified in the claims clauses, or any of them, set out in the claims schedule of this Application and, accordingly, the content of said clauses and the inter-relationships between said clauses are to be regarded, notionally, as being here set out.

[0005] The foregoing and other features of tricycle vehicles in accordance with the invention are hereinafter described with reference to the accompanying drawings in which:

Fig.1 is a pictorial view of the first trolley part;
 Fig.2 is a pictorial view showing the trolley part of Fig.1 in a partially disassembled configuration to which the trolley part may be reduced in the course of extraction of the vehicle from beneath an aircraft;
 Fig.3 is a pictorial view showing the second trolley part, entire, the trolley part having its arm-bearing structure at an elevated position;
 Fig.4 is a pictorial view showing the second trolley part in a divided configuration, the arm-bearing

structure thereof being, for the time being, detached from the beam;

Fig.5 shows the second trolley part in side elevation;

5 Fig.6 is a pictorial view showing the second trolley part entire, the trolley part being in a collapsed, or folded, configuration;

Fig.7 shows, in side elevation, a tricycle vehicle with a missile supported on the cradle portion thereof;

10 Fig.8 shows, in rear elevation, the vehicle of Fig.7; Fig.9 shows, in side elevation, the vehicle of Fig.7 beneath an aircraft, the missile carried by the cradle of the vehicle being not yet captured at a sub-wing aircraft pylon station, the belly of the aircraft having, in consequence, a somewhat raised position characteristic of the relatively unladen state of the aircraft;

Fig.10 shows, in side elevation, a missile having been captured at a sub-wing aircraft pylon station, the reduced ground clearance of the aircraft belly;

20 Fig.11 shows, pictorially, the first and second trolley parts in a parking configuration in which the trolley parts are connected together for storage and other non-use purposes.

Fig.12 shows, pictorially, the second trolley part to an improved construction;

Fig.13 shows, pictorially, the second trolley part of Fig.12, when viewed from a different angle;

30 Fig.14 is a plan view of the second trolley part shown in Fig.12 or Fig.13;

Fig.15 shows, pictorially, a portion of an improved construction, for the second trolley part, shown in Figs 12 to 14; and,

35 Fig.16 shows an axial section through one of three substantially identical torque limiter devices respectively incorporated in the several trolley parts of the vehicle.

[0006] The vehicle (Fig.7) comprises: a first trolley part 11, a second trolley part 13, and, between said trolley parts 11, 13, and carried thereby, a cradle 15, on which is supported a long, bulky and heavy missile 17. The first trolley part 11 has a hinged towing handle H by which, in use, the vehicle is adapted to be towed.

40 **[0007]** The cradle 15 has a main body part 19, said body part having first and second opposite ends, 19', 19'', respectively; integral with the body part 19 at said first end 19', first and second laterally spaced axially parallel tubular socket portions, 21a, 21b, respectively; and, integral with said body part 19 at said second end 19'', second and third laterally spaced tubular socket portions 23', 23'', respectively, axially parallel to one another and to the first and second socket portions 21', 21''.

55 **[0008]** The first trolley part 11 comprises: first jacking means 23 having: a main frame 25, jack actuation means 27 comprising first and second cooperable actuation parts 29, 31, respectively; and a ground-contacting wheel arrangement comprising, in the example, a wheel

carrier 33 on which said main frame 25 is carried, said wheel carrier 33 being angularly displaceable about a generally vertical steering axis S---S defined in said main frame 25, and, dependant from said wheel carrier 33, a single steerable ground-contacting wheel 33'. The towing handle H is connected to the wheel carrier 33 at a horizontal hinge axis.

[0009] The first actuation part 29 comprises a threaded rod 35 and adaptor means 37.

[0010] The second actuation part 31 comprises a cylinder 39, forming part of the main frame 25, and, coaxial with the cylinder 39 at the upper end thereof, a nut device 41. The cylinder 39 is upstanding from a plate 43, also forming part of the main frame 25, and the nut device 41 is rotatable in bearings coaxially with respect to the cylinder 39, and is, otherwise, held captive, with respect to the main frame 25 at the upper end of the cylinder 39.

[0011] The threaded rod 35 extends through and has a sliding fit within the cylinder 39 and has a screw engagement with the nut device 41.

[0012] The adaptor means 37 comprises rectangular arch-form, first and second parts 45, 47, respectively.

[0013] The adaptor first part 45 has side walls 49, 51, respectively, and a bridging upper wall 53, each of said walls being of channel section. The threaded rod 35 is secured, at its upper end 35', to the bridging wall 53 at the central position of said wall.

[0014] The adaptor second part 47 is integral with said adaptor first part 45, rear lengthwise-extensive portions of side walls 55, 57, of the adaptor second part 47 being secured, as by welding, to forward lengthwise-extensive portions of the side walls 49, 51, of the adaptor first part 45.

[0015] As may be gathered, the first and second actuation parts 29, 31, have a construction and an inter-operability such that the threaded rod 35 is constrained for movement along a rectilinear path Y---Y with respect to the main frame 25, rotation of the nut device 41 with respect to the cylinder 39 of the main frame 25, under manual effort at the winding handle 59, causing the threaded rod 35 to be displaced lengthwise, carrying with it the adaptor means 37.

[0016] The structure 61, (hereinafter referred to as "first arm-bearing structure) is coupled to the adaptor second part 47. The first arm-bearing structure 61 has rearwardly-extensive first and second parallel arm portions 63, 65, respectively, the spacing between which corresponds the spacing between the socket portions 19', 19", of the cradle 15, at the end 17' thereof.

[0017] A cross member 67 of the structure 61, from which the arm portions 63, 65, extend, is coupled to the adaptor second part 47 by means of first and second readily releasible pins 69, 71, respectively, the pins 69, 71, extending through first and second bushings, the upper one 73, only, of which is depicted, being bushings extending transversely between the side walls 75 of a bracket 77 secured, as by welding, to the cross member

67 of the arm-bearing structure 61.

[0018] The opposed parallel side walls 55, 57, of the adaptor second part 47 are pierced with, in the example, four pairs, H1', H1"; H2', H2"; H3', H3"; and H4', H4", respectively, of transversely aligned holes. The transversely-extensive bushings 73 being vertically spaced apart with a displacement between them equal to that existing between adjacent pairs, such as H3', H3"; H4', H4", of holes through said opposed side walls 55, 57, the latter hole-pairs constitute means whereby the first arm-bearing structure 61 may be set at any one of three vertically spaced positions with respect to the ground.

[0019] With the bushings 73 respectively positioned, axially aligned with respective adjacent such pairs of aligned holes, by the pins 69, 71, the structure 61 is, thereby, locked to the adaptor means 37. Release pins (not shown) enable the pins 69, 71, to be readily releasibly retained in the parts locked together thereby. Removal of the pins 69, 71, after extraction of said release pins, enables the arm-bearing structure 61 to be separated, as shown in Fig.2, from the adaptor second part 47.

[0020] The arm-portions 63, 65, of the structure 61 have two transversely aligned pairs of holes, 79', 79"; 81', 81", respectively, the holes in each arm portion being spaced apart in the longitudinal direction of the relevant arm portion. The holes 79' to 81" are adapted to receive eye-bolts by which the first trolley part 11 may be secured to the cradle at its first end 17'. The arm portions 63, 65, have abutment portions, 83, 85, respectively.

[0021] The arm-bearing structure 61 has, between the arm portions 63, 65, near their junctions with the cross member 67, first and second secondary ground contactable wheels 87, 89, respectively.

[0022] The arm portions 63, 65, have, in addition to the holes 79', 81', further holes into which eye-bolts, 91, 93, being eye-bolts to be, in use, inserted in said holes 79', 81', 79", 81", may be inserted for safe storage until required.

[0023] The first trolley part 11 has, further, brake means 95, comprising, in addition to friction wheel engaging means (not shown) a brake actuation means housed within a casing 97 and operated by a rotatable wheel 99.

[0024] The second trolley part 13 comprises: second and third jacking means 101, 103, respectively, said second and third jacking means 101, 103, being, subject to differences in certain subordinate constructional features dictated by differences in configuration between the first and second trolley parts 11, 13, essentially the same as the jacking means 23 of the first trolley part 11, both constructionally and as regards operation of said second and third jacking means 101, 103. For this reason, description of the second trolley part and, especially, of its two jacking means 101, 103, will be confined, substantially, to those features that differentiate the two trolley parts 11, 13.

[0025] The adaptor second parts of each of the jacking means 101, 103, of the second trolley part 13, are constituted by first and second plates, one only, 105, of which is shown, said plates 105 being adapted to be readily releasibly secured, respectively, to the adaptor first parts 107, 109, respectively by locating pins 111 and hand knobs 113.

[0026] Between the plates, as 105, there is a rigid beam structure 117 comprising a shaft 119, the ends of which have rigid connections with the plates 105; and a rigid shaft housing 121 comprising a casing 123 of rectangular cross-section and, fixed within said casing 123, a tubular member 125 through which extends the shaft 119, said shaft being releasibly secured to the tubular member 125 by readily removable pins, as 127, located, respectively, at the ends of the tubular housing member 125.

[0027] Releasibly connected to the beam structure 117, there is, projecting rearwardly of the vehicle, a second arm-bearing structure 129 similar, essentially, to that of the first trolley part 11 but adapted to be releasibly secured to the beam structure casing 123, using, as elsewhere in the trollies 11, 13, eyebolts screwable into aligned holes through the casing 123 and the arm-bearing structure cross-piece 131.

[0028] Whereas the adaptor second part 47 of the first actuation part 29 is integral with the adaptor first part 45, and has opposed parallel side walls 55, 57, which are pierced with, in the example, four pairs, H1', H1"; H2', H2"; H3', H3"; and H4', H4", respectively, of transversely aligned holes, in the case of the second trolley part 13, plates 105, constituting the adaptor second parts of the jacking means 101, 103, are adapted to be connected to inwardly-facing vertical flanges, as 133, of sub-frame first parts 107 or 109, as the case may be, at any one of three positions corresponding to the three spacings between four aligned pairs of holes H1', H1", to H4', H4", corresponding in position to the hole pairs of the flanges side walls 55, 57, of said adaptor second part 47. The hole-pairs, as H1', H1", through said flanges 133 constitute means whereby said plates 105 may be correspondingly set at any one of three positions which are vertically displaced with respect to one another along said flanges 133.

[0029] The arm-bearing structure 129 has, as represented in Fig.5, a ground-contactable wheel 135 on which said arm-bearing structure 129 may, when separated from the beam structure 117, be wheeled independently of the remainder of the trolley 13.

[0030] As shown in Fig.5, also, the casing 123 of the beam structure 117 has a fixed forwardly projecting frame 137 with a ground-contactable wheel 139 dependant therefrom, and a towing handle 141, pivotal about a transverse hinge axis in the frame 137 rests, when not in use, in contact with the side arm portions of the frame 137.

[0031] In use, the trolley parts 11, 13, connected in the parking configuration (Fig.11), are wheeled, towed

by the towing handle H, to the rear of the missile 19, which is to be found supported, secured to the cradle 15 itself, mounted on a base.

[0032] The so-coupled trolley parts are there manoeuvred to bring the rearwardly projecting arm portions of the arm-bearing structure 129 of the trolley part 13 to alignment with the socket portions 23', 23", and, so aligned, the coupled trolley parts 11, 13, are backed, manually, towards the cradle 15 said arm portions penetrating the socket portions 23', 23", until arrested by contact of the arm portions with the abutments therealong. With the arm portions at the abutment arrested position, holes in the cradle are in alignment with holes in the arm portions, at positions downstream of said abutments. With the holes so aligned, eye-bolts are inserted through the cradle holes and screwed into the holes of the arm portions.

[0033] The front trolley part 11 is next separated from the rear trolley part 13 and wheeled to the front of the cradle 15 where, as with the trolley part 13, the front trolley part is advanced to cause the arm portions of its arm-bearing structure to penetrate the socket portions 21', 21", and the cradle and arm portions secured together by eye-bolts.

[0034] The assembled tricycle vehicle is towed by the towing handle H to the proximity of the sub-wing pylon station that is to receive the missile 19. The several jacking means 23, 101, 103, are then operated, independently, the extent demanded to cause the missile to be properly presented at the pylon station, that is to say, to be, at each said jacking means, at a height such that the missile has the correct relationship, both positionally and angularly, for its capture by said station.

[0035] The act of capture of the missile at the pylon station affects the aircraft geometry and can and frequently does introduce obstructions, not previously present, the extraction of the now unloaded trolley from beneath the aircraft being a matter of great difficulty, an effective impossibility even, particularly having regard to the unacceptable delay incurred in the time-critical action of missile loading.

[0036] To assist in the task, the each of the trolley parts is, as previously described capable of being disassembled, at least partially, the arm-bearing structures of the two trolley parts being, in each case adapted for separation, in the case of the first trolley part 11 from the adaptor second part 47 of the jacking means 23, and, in the case of the second trolley part 13 from the cross member connecting the adaptor second parts 105 of the jacking means 101, 103.

[0037] The jacking means 101, 103, or either of them, of the second trolley part 13 may, moreover, be angularly displaced, as shown in Fig.6, to a folded lower position, by removal of the appropriate one of the pins 127. These expedients render the ready removal of the so-changed trolley.

[0038] In an improved form of a vehicle, in accordance with the invention, illustrated in Figs 12 to 16, a means

is provided which permits the lateral adjustment of the arm portions of the arm-bearing structures, or either of them, within a certain limited range, such, for example, 50mm, in either direction from a transverse medial position.

[0039] The need for such a facility for adjustment of lateral position of the arm portions in relation to the remainder of the vehicle arises from the discovery that, the vehicle having been manoeuvred to the closest available position for capture of the missile at a pylon station, the cradle 15 and the missile 19 supported thereon are yet not in a position and orientation proper for such capture, and, still more, the geometry of the aircraft, sub-wing, may preclude the opportunity for further manoeuvre of the vehicle such as to bring the cradle and missile to the desired capture position in relation to the pylon station. The freedom to adjust, even within quite modest limits, the lateral position of the arm portions, proves to be generally adequate to 'fine-tune' the position and attitude of the cradle to achieve the necessary end, the capture of the missile at the pylon station.

[0040] In the improved vehicle construction, the rear trolley part differs from that of the previously described embodiment in that the arms 129a, 129b, respectively, of the arm-bearing structure 129 are secured by bolt devices, as 143, 145, to bracket members, being, in the case of the arm 129a, bracket members 147a, 147b, and, in the case of the arm 129b, bracket members 149a, 149b, respectively. The bracket members 147a, 147b, are coupled together by means of a spindle which carries a roller member 151, and the bracket members 149a, 149b, are similarly coupled by means of a spindle carrying a second roller member 153. The roller members 151, 153, rest upon the planar upper surface of the casing 123 with a displacement between them which is determined by presence of first and second parallel struts, 155, 157, respectively, bracket members 147a, 147b being secured to the strut 155, the bracket members 149a, 149b, to the strut 157.

[0041] The aforesaid bracket members are formed with vertical slots which extend through the bracket vertical walls, as 159, 161. Associated with the several said bracket members 147a, 147b; 149a, 149b, there are axially vertically supported spindles on which rollers, 163, 165, 167 and 169 are respectively supported. The aforesaid four rollers project through respective ones of the aforesaid vertical slots with their cylindrical surfaces in contact with vertical side planar surfaces of the casing 123.

[0042] Secured between associated pairs of bracket members, as 147a, 147b, one to each side of the casing 131, there are first and second further brackets 171, 173, respectively. A passage through said further bracket 171 houses a nut element 175. First and second plummer blocks 177, 179, respectively, are upstanding from the flat upper surface of the casing 123, and a spindle 181, threaded over an end segment 183 thereof, being a segment than that prevailing along the major por-

tion of the spindle, has its ends supported in bearings within said plummer blocks 177, 179, and extends through said nut element 175 such that said nut element 175 and said enlarged spindle segment 183 are threadedly engaged. The spindle segment 183 has a collar portion 185 at that end of the segment which is remote from the block 179. The spindle 181 has a rotary knob 187 by which the spindle 181 may be rotated about its longitudinal axis.

[0043] In use, rotation of the spindle 181, consequent upon rotation of the knob 187, employing, if need be, a tommy bar 189 to be inserted successively into the several angularly spaced radial holes in the knob, causes the nut element 175 and the bracket 171 secured thereto to travel in one direction to the other (according to the sense of rotation of the spindle 181), along the casing 123, the remote further bracket 173 (being tied by the strut 155 to the bracket 171), being correspondingly displaced. The range of limited permissible translation of the brackets 171, 173 is determined, on the one hand, by the collar 185 of the segment 183 and, on the other, by the presence of the plummer block 179. The arms 129a, 129b, are, naturally, correspondingly laterally displaced, the whole lateral motion of the arms 129a, 129b, with respect to the arm-bearing structure 129 proceeding smoothly, by virtue of rolling contact between the rollers 151, 153, and the upper surface of the casing 123 and rolling contact between the rollers 163, 165, 167 and 169 and the vertical side surfaces of said casing 123.

[0044] The improved form, the subject of Figs. 12 to 16, for the vehicle also incorporates means serving to limit the force capable of being developed between the missile or other store and the pylon and, hence the aircraft wing to which the pylon is attached, at capture of the store. Failure to provide such a means gives rise to the real danger that, by virtue of the high mechanical advantage inherent in the several jacking means of the vehicle, excessive rotation of the jack operating handles, or any of them, would give rise to excessive loading, a loading liable to deform the pylon, the cradle of the vehicle, or both.

[0045] To avoid the possibility of damage so arising, and as shown in Figs. 12 and 13, the improved form for the vehicle incorporates first and second load limiter means 191, 193, respectively associated with the jacking arrangements of the rear trolley of the vehicle.

[0046] The load limiter means 191, 193, which, as shown, are respectively incorporated in the winding handles, as 195, of the jacking arrangements of said rear vehicle trollies, are constituted as torque limiter devices which incorporate friction means adapted to slip in the event that torque applied by the operator at the winding handles, or either of them, exceeds a pre-set value.

[0047] More particularly, and as shown in Fig. 16, the winding handles, 195, of each of the rear trollies, are mechanisms each of which comprises: a basic handle

portion 197, a ring 199, a bushing 201, a first bevel gear 203, an axle 205, a second bevel gear 207, first and second sets of intercalated annular friction discs 209, 211, respectively, a torque-setting nut 213, and a cover 215.

[0048] As may be seen, the handle portion 197 is secured to the ring 199 by a pin. The axle 205 is a shaft which is fixed outstanding from a cylinder 217. At this point it is pointed out that the cylinder 217, constitutes part of one or the other of the main frames of the jacking arrangements of the rear trolley of the vehicle, being the cylindrical main frame parts corresponding to that, of the front trolley part, designated by the reference numeral 39 in Fig. 1. The first gear 203 has a cylindrical stem portion 219 through which the axle 205 extends, a roller bearing 221 being provided between the stem portion 219 and the axle 205.

[0049] The gear stem portion 219 extends within the bushing 201, the stem portion and the bushing 201 being pinned together by a means of a screw connection 223. The bushing 201, in turn, extends through the ring 199.

[0050] The intercalated annular friction discs 209, 211 of the first and second sets of such discs are located to the rear of the ring 199, being carried, trapped between the ring 199 and a spring 225, on the bushing 201 and being held, under pressure exerted by said a spring 225 under the force exerted by the nut 213 which is in threaded engagement with the bushing 201 at its free end.

[0051] The threaded rod 35 of the jacking arrangement extends freely through the cylinder 207 of the jacking arrangement main frame, and is in threaded engagement with the second bevel gear 207, the latter gear thereby constituting the nut for driving the threaded rod 35. As previously stated, in relation to the first described embodiment, the nut of the jacking arrangement, that is to say, the gear 207, is constrained with respect to the cylinder 207, the main frame of the jacking arrangement, such that the gear/nut 207 is capable only of rotation about the axis of the threaded rod 25, the rod being thereby longitudinally displaced by rotation of the nut. As may be seen a roller bearing 227 is provided between the upper end of the cylinder 207 and the gear/nut 207.

[0052] In operation, with the torque setting nut 213 set to exert, through the spring 225, a pressure calculated to prevent slippage between the intercalated friction discs 209, 211, below a predetermined load (being a function involving the weight of the store to be captured at the pylon and the mechanical advantage exerted by the jacking arrangement), rotation of the handle portion 197 gives rise to rotation of the bevel gear 203, and, hence, of the meshing bevel gear 207, with the effect mentioned, viz. longitudinal displacement of the threaded rod 35.

[0053] If, as a result of over-winding of the handle portion 197 by the operator, the possibility of excessive load arises, slippage will occur between the inter-calated friction discs 209, 211, the load being, thereby, limited to a safe value.

[0054] Whilst the form and function of the torque limiter has been described in relation to the jacking arrangements of the rear trolley of the vehicle, it will be evident that corresponding means needs be provided in the jacking arrangement of the front trolley of the vehicle, also.

Claims

1. A tricycle vehicle for the conveyance of large and heavy items (17) for presentation of said item for capture at an aircraft pylon station at a sub-wing level of the aircraft, wherein said vehicle comprises:

- (a) a cradle (15) having first and second ends (19', 19'') and being adapted to receive an item (17) for conveyance, as aforesaid;
- (b) a first trolley part (11) adapted to support said cradle (15) at one end (19') thereof;
- (c) a second trolley part (13) adapted to support said cradle (15) at the other end (19'') thereof;
- (d) incorporated in said first trolley part (11), first jacking means (23) supported on a first ground-contacting wheel arrangement (33, 33'),

characterized in that said vehicle comprises :

- (e) incorporated in said second trolley part (13), second and third jacking means (101, 103) respectively supported on second and third ground-contacting wheel arrangements, the several said jacking means (23, 101, 103) being independently operable to enable said cradle (15) to adopt a position and an attitude appropriate for an item (17) supported on said cradle (15) to be presented for capture at an aircraft pylon station; and in which:

- (f) the several jacking means (23, 101, 103) each incorporate respective ones of three cradle-height setting means enabling the three positions of connection between the first, second and third jacking means (23, 101, 103), respectively, and the cradle (15) to be set independently to any one of a multiplicity of predetermined vertical levels from which subsequent vertical adjustment by said jacking means (23, 101, 103) of the cradle (15) at said three connection positions is to be initiated in the positioning of the cradle supported item (17) at an aircraft sub-wing pylon station.

2. A vehicle as claimed in claim 1 **characterized in that:** said trolley parts (11, 13) are constructed such as, an item (17) having been captured at a sub-wing pylon station, to enable said trolley parts, or either of them, to be changed to a configuration, not ex-

cluding a divided configuration in which said trolley parts, or either of them, are in separated portions, being configuration changes calculated to facilitate the extraction of said tricycle vehicle from beneath the aircraft, notwithstanding the presence of parts of, or adjunctive parts to, the aircraft that would otherwise render such extraction difficult or, for practical purposes, impossible to achieve.

3. A tricycle vehicle as claimed in claim 1 or 2 characterized in that:

- . said cradle (15) comprises:
 - .. a main body part (19) adapted to support an item to be transported, said body part (19) having said first and second ends (19', 19"), respectively;
 - .. integral with said main body part (19) at said first end (19)', first and second laterally spaced axially parallel sockets (21',21"); and,
 - .. integral with said main body part (19) at said second end (19"), third and fourth laterally spaced sockets (23',23") axially parallel to one another and to said first and second sockets (21',21");
- . said first jacking means (23) comprises:
 - .. a main-frame (25); and,
 - .. jack actuation means (27) comprising:
 - a first actuation part (29) comprising:
 - a threaded rod (35); and,
 - fixed with respect to the first main-frame (25), means for constraining said threaded rod (35) solely for movement, with respect to the first main-frame (25), in the direction of the longitudinal axis of said threaded rod (35); and,
 - fixed with respect to said threaded rod (35) for carriage thereby, an adaptor (37);
 - cooperable with said first actuation part (29), a second actuation part comprising, in threaded engagement with said rod (35), a nut (41) which is constrained for rotation but which is otherwise fixed with respect to the first main-frame (25); and,
 - .. a steerable ground-contacting wheel arrangement (33, 33') on which said first main-frame (25) is supported;

- . extending from the said first main-frame (25), a structure (61) having first and second parallel arm portions (63, 65) the spacing between which corresponds to that of said sockets at one end of said cradle (15);

- .. said second and third jacking means (101, 103), being each, in construction, as stated, mutatis mutandis, hereinabove, in respect of the jacking means (23) of said first trolley part, save that the ground-contacting wheels arrangements of said second and third jacking means (101, 103) are non-steerable wheel arrangements;

- ... between the second actuation parts of each of said second and third jacking means (101, 103), a beam (117) having, at the ends thereof, first and second connections, respectively, with said second actuation parts (105);

- . integral with said beam (117), a second structure having first and second parallel arm portions, the spacing between which corresponds to that of the sockets at the other end of said cradle (15); and in which:

- . the adaptors of said second actuator parts of the several jacking means each have a multiplicity of fixing positions (as H1',H1" to H4',H4") at which the first and second arm-bearing structures (61, 129) may, optionally, be coupled, in the case of the first trolley part (11), to said first jacking means (23), in the case of the second trolley part (13), to said second and third jacking means (101, 103), said fixing positions being such as, in use of the vehicle, to provide different positions from which said structure may be varied for movement with respect to said frame part; and,

- . said trolley parts (11, 13) are constructed such as, an item (17) having been captured at a pylon station, to enable said trolley parts (11, 13), or either of them, to be changed from a configuration, including a divided configuration, in which said arm-bearing structures, or either of them are, for the time being, freed from the jacking means (23, 101, 103) of said first and second trollies, being, in all cases, configuration changes calculated to facilitate the extraction of the tricycle vehicle from beneath the aircraft, notwithstanding the presence of parts of, or adjunctive parts to, the vehicle that would, but for such change in configuration of the vehicle, constitute obstructions to such vehicle extraction.

4. A vehicle as claimed in claim 3 characterized in

that at least said second trolley part (13) is constructed such as to permit the ready folding of at least a portion thereof to a collapsed configuration.

5. A vehicle as claimed in claim 3 or 4 **characterized in that** the trolley parts (11, 13) or either of them are constructed such as to permit its division into a multiplicity of independently extractable portions. 5
6. A vehicle as claimed in claim 5 **characterized in that** said second and third jacking means (101, 103) of said second trolley part (13) are each constructed such as to be readily freed for angular displacement about the longitudinal axis of said beam (117); and said arm-bearing structures (61, 129), or either of them, may readily be freed from engagement with, in the case of the first trolley part (11), the adaptor first part, and in the case of the second trolley part (13), from engagement with said beam (117). 10
7. A vehicle as claimed in any preceding claim **characterized in that** the several jacking means (23, 101, 103) each incorporate means (195) operative to limit the force capable of being developed between the missile, or such other store as may be carried by said cradle, and the pylon station at which said store is to be captured. 15
8. A vehicle as claimed in any preceding claim **characterized by** means (143, 145; 147a,147b; 151,153; 123; 155,157; 163 to 169; 171,173; 175; 177,179; 183; 185; 187) whereby said arm portions of said second trolley part (13), are laterally displaceable, within predetermined limits, in unison, in either direction, with respect to said second and third jacking means (101, 103) said second trolley part (13). 20

Patentansprüche

1. Ein Dreiradfahrzeug für das Befördern von grossen und schweren Gegenständen (17), für die Präsentation derselben Gegenstände für die Aufnahme an einer Flugzeug-Pylonstation auf einer Unterflügelebene desselben Flugzeugs, wobei dasselbe Fahrzeug das Folgende umfasst:

- (a) ein Gestell (15) mit einem ersten und einem zweiten Ende (19', 19''), welches dafür adaptiert ist, einen Gegenstand (17) für den Weitertransport wie oben beschrieben zu empfangen; 50
- (b) ein erstes Wagenteil (11), welches dafür adaptiert ist, das vorgenannte Gestell (15) an einem Ende (19') desselben zu stützen; 55
- (c) ein zweites Wagenteil (13), welches dafür adaptiert ist, das vorgenannte Gestell (15) an dem anderen Ende (19'') desselben zu stützen;

(d) eine erste Hebevorrichtung (23), welche in das vorgenannte erste Wagenteil (11) mit eingeschlossen ist, und welche auf einer ersten, den Boden kontaktierenden Radanordnung (33, 33') gestützt ist, **dadurch gekennzeichnet, dass** das vorgenannte Fahrzeug in dem vorgenannten zweiten Wagenteil (13) zweite und dritte Hebevorrichtungen (101, 103) umfasst, welche jeweils auf zweite und dritte, den Boden kontaktierende Radanordnungen gestützt sind, wobei die Anzahl von Hebevorrichtungen (23, 101, 103) unabhängig voneinander betrieben werden kann, um es dem vorgenannten Gestell (15) zu ermöglichen, eine Position und eine Einstellung zu adoptieren, welche für den jeweiligen Gegenstand (17) geeignet ist, welcher auf dem vorgenannten Gestell (15) gestützt werden soll, und welcher zur Aufnahme an einer Flugzeug-Pylonstation präsentiert werden soll; und wobei

(f) die Anzahl von Hebevorrichtungen (23, 101, 103) jeweils eine zugeordnete der drei Gestellhöhereinstellvorrichtungen umfasst, welche ein unabhängiges Einstellen der drei Positionen der Verbindung zwischen der jeweiligen ersten, zweiten, und dritten Hebevorrichtung (23, 101, 103), und ein unabhängiges Einstellen des Gestells (15) auf eine von einer Reihe von vorbestimmten vertikalen Ebenen ermöglichen,

wobei eine darauffolgende vertikale Nachstellung mit Hilfe der vorgenannten Hebevorrichtungen (23, 101, 103) des Gestells (15) in den drei vorgenannten Verbindungspositionen durch das Positionieren des von dem Gestell gehaltenen Gegenstandes (17) an einer Unterflügel-Flugzeug-Pylonstation initialisiert werden soll.

2. Ein Fahrzeug nach Anspruch 1, **dadurch gekennzeichnet, dass** die vorgenannten Wagenteile (11, 13) so konstruiert sind, dass nach Aufnahme eines Gegenstand (17) an einer Unterflügel-Pylonstation die vorgenannten Wagenteile, oder eines derselben, auf eine solche Konfiguration umgestellt werden können, welche eine geteilte Konfiguration, bei welcher die Wagenteile, oder eines derselben Wagenteile, getrennte Teile repräsentieren, nicht ausschliesst, wobei Konfigurationsänderungen so berechnet werden, dass dieselben die Extraktion des vorgenannten Dreiradfahrzeugs von unter dem Flugzeug trotz der Gegenwart von Teilen von, oder adjunktiven Teilen für das Flugzeug ermöglichen, welche ansonsten eine solche Extraktion schwierig, oder aus praktischen Gründen sogar unmöglich gestalten würden.
3. Ein Dreiradfahrzeug nach Anspruch 1 oder 2, **da-**

durch gekennzeichnet, dass

- . das vorgenannte Gestell (15):
 - .. ein Hauptkörperteil (19) umfasst, welches dafür adaptiert ist, einen zu transportierenden Gegenstand zu stützen, wobei das vorgenannte Körperteil (19) die jeweiligen vorgenannten ersten und zweiten Ende (19', 19'') umfasst; und
 - .. integral mit dem vorgenannten Hauptkörperteil (19) an dem vorgenannten ersten Ende (19') und ersten und zweiten, lateral getrennten und axial parallel angeordneten Stützen (21', 21'') angeordnet ist; und
 - .. integral mit dem vorgenannten Hauptkörperteil (19) an den vorgenannten zweiten Ende (19'') und dritten und vierten, lateral getrennt angeordneten Stützen (23, 23'') axial parallel zueinander, und zu den vorgenannten ersten und zweiten Stützen (21', 21'') angeordnet ist;
- . und eine erste Hebevorrichtung (27) umfasst, welche das Folgende umfasst:
 - .. einen Hauptrahmen (25); und
 - .. eine Hebeauslösevorrichtung (27), welche das Folgende umfasst:
 - ... ein erstes Auslöseteil (29), welches das Folgende umfasst:
 - einen Gewindestab (35); und
 - mit Bezug auf den ersten Hauptrahmen (25) montiert, eine Vorrichtung für das Halten der vorgenannten Gewindestange (35) einzig und allein für die Bewegung, mit Bezug auf den ersten Hauptrahmen (25), in die Richtung der Längsachse der vorgenannten Gewindestange (25); und
 - mit Bezug auf die vorgenannte Gewindestange (35) für das Eingreifen in dieselbe montiert, einen Adapter (37);
 - welcher mit dem vorgenannten ersten Auslöseteil (29) und einem zweiten Auslöseteil kooperiert, welches in Gewindeverbindung mit der vorgenannten Stange (35) eine Mutter (41) umfasst, welche drehfest gehalten wird, welche aber ansonsten mit Bezug auf den ersten Hauptrahmen (25) fest steht; und

- .. eine steuerbare, den Boden kontaktierende Radanordnung (33, 33'), auf welche der vorgenannte erste Hauptrahmen (25) gestützt ist;
- . wobei sich von dem ersten Hauptrahmen (25) eine Struktur (61) erstreckt, mit ersten und zweiten parallelen Armvorsprüngen (62; 65). Der Abstand zwischen denselben entspricht demjenigen zwischen den vorgenannten Stützen an einem Ende des vorgenannten Gestells (15);
- . wobei die vorgenannte erste und zweite Hebevorrichtung (101, 103) jeweils wie aufgeführt entsprechend des Prinzips ‚mutatis mutandis‘ mit Bezug auf die Hebevorrichtung (23) des vorgenannten Wagenteils wie oben beschrieben konstruiert ist, ausser dass die den Boden kontaktierende Räderanordnung der vorgenannten ersten und zweiten Hebevorrichtung (101, 103) aus einer nicht steuerbaren Radanordnung besteht;
- ... zwischen den zweiten Auslöseteilen einer jeden der vorgenannten zweiten und dritten Hebevorrichtung (101, 103) einen Balken (117) mit ersten und zweiten Verbindungen mit den jeweiligen zweiten Auslöseteilen (105) an den Enden desselben umfasst;
- . integral mit dem vorgenannten Balken (117) eine zweite Struktur mit ersten und zweiten parallelen Armabschnitten umfasst, wobei der Abstand zwischen denselben demjenigen zwischen den Stützen an dem anderen Ende des vorgenannten Gestells (15) entspricht; und bei welchem:
- . die Adapter der vorgenannten zweiten Auslöseteile der Reihe von Hebevorrichtungen jeweils eine Reihe von Feststellpositionen (wie z. B. H1', H1'' bis H4', H4'') umfasst, mit welchen die ersten und zweiten armtragenden Strukturen (61, 129) wahlweise gekoppelt werden können, zum Beispiel das erste Wagenteil (11) mit der vorgenannten ersten Hebevorrichtung (22), oder das zweite Wagenteil (13) mit der vorgenannten zweiten und dritten Hebevorrichtung (101, 103), wobei die vorgenannten Positionen so ausgeführt sind, dass während der Anwendung des Fahrzeugs verschiedene Positionen vorhanden sind, mit welchen die Struktur für eine Bewegung mit Bezug auf den vorgenannten Rahmenabschnitt variiert werden kann; und
- . wobei die vorgenannten Wagenteile (11, 13) so konstruiert sind, dass dieselben Wagenteile (11, 13), oder eines derselben, von einer Konfiguration einschliesslich einer geteilten Konfi-

- guration, bei welcher die armtragenden Strukturen, oder eine derselben, für eine Zeit von der Hebevorrichtung (23, 101, 103) des vorgenannten ersten und zweiten Wagens freigestellt werden können, geändert werden können, nachdem ein Gegenstand (17) an einer Pylonstation aufgenommen wurde, wobei in allen Fällen Konfigurationsänderungen berechnet werden sollen, um eine Extraktion des Dreiradfahrzeugs von unter dem Flugzeug zu ermöglichen, d.h. trotz der Gegenwart von Teilen des, oder adjunktiven Teilen für das Flugzeug, welche ohne eine solche Änderung der Konfiguration des Fahrzeugs Hindernisse repräsentieren würden, welche eine solche Extraktion verhindern würden.
4. Ein Fahrzeug nach Anspruch 3, **dadurch gekennzeichnet, dass** zumindest das vorgenannte zweite Wagenteil (13) so konstruiert ist, dass es ein einfaches Einklappen von mindestens einem Abschnitt desselben auf eine zusammengeklappte Konfiguration ermöglicht.
5. Ein Fahrzeug nach Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** die Wagenteile (11, 13) oder eines derselben so konstruiert sind, dass dieselben eine Trennung derselben in eine Reihe von unabhängig extrahierbaren Abschnitten ermöglichen.
6. Ein Fahrzeug nach Anspruch 5, **dadurch gekennzeichnet, dass** die vorgenannte zweite und dritte Hebevorrichtung (101, 103) des vorgenannten zweiten Wagenteils (13) jeweils so konstruiert ist, dass dieselbe einfach freigelegt werden kann, für eine Winkelverdrängung um die Längsachse des vorgenannten Balkens (117) herum; und die vorgenannten armtragenden Strukturen (61, 129), oder eine derselben, können einfach von ihrem Eingriff in - im Falle des ersten Wagenteils (11) - das erste Teil des Adapters freigelegt werden, und im Falle des zweiten Wagenteils (13) von dem Eingriff in den vorgenannten Balken (117).
7. Ein Fahrzeug nach einem der obigen Ansprüche, **dadurch gekennzeichnet, dass** die Reihe von Hebevorrichtungen (23, 101, 103) jeweils eine Vorrichtung (195) umfasst, welche dazu betrieben werden kann, die Kraft einzuschränken, welche zwischen der Rakete, oder einer ähnlichen Ladung, welche von dem vorgenannten Gestell getragen wird, und der Pylonstation entwickelt wird, an welcher dieselbe aufgenommen werden soll.
8. Ein Fahrzeug nach einem der obigen Ansprüche, **dadurch gekennzeichnet, dass** dasselbe eine Vorrichtung (142, 145; 147a, 147b; 151, 153; 123; 155, 156; 163 bis 169; 171, 173; 175; 177, 179; 183; 185; 187) umfasst, wobei die vorgenannten Armabschnitte des vorgenannten zweiten Wagenteils (13) innerhalb von vorbestimmten Grenzen zusammen mit Bezug auf die vorgenannte zweite und dritte Hebevorrichtung (101, 103) des vorgenannten zweiten Wagenteils (13) in beide Richtungen lateral verdrängt werden können.
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- 10 **Revendications**
1. Un tricycle pour le transport d'articles légers et lourds (17) et la présentation desdits articles pour leur capture à un pylône d'avion, au niveau sous-aile de l'avion, dans lequel ledit tricycle comprend :
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- (a) un berceau (15) avec une première extrémité et une seconde extrémité (19', 19'') et conçu pour recevoir un article (17) pour son transport, tel que susmentionné ;
- 20
- (b) un premier chariot (11) conçu pour supporter ledit berceau (15) à une extrémité (19') de ce dernier ;
- (c) un second chariot (13) conçu pour supporter ledit berceau (15) à l'autre extrémité (19'') de ce dernier ;
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- (d) intégré audit premier chariot (11), un premier dispositif de levage (23) supporté sur une première disposition d'essieux avec contact au sol (33, 33'), **caractérisé en ce que** ledit tricycle comprend :
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- (e) intégré audit second chariot (13), un deuxième et un troisième dispositifs de levage (101, 103) respectivement supportés sur une deuxième et une troisième dispositions d'essieux avec contact au sol, lesdits différents dispositifs de levage (23, 101, 103) pouvant fonctionner de manière indépendante pour permettre audit berceau (15) d'adopter une position et un comportement appropriés à un article (17) supporté sur ledit berceau (15) et devant être présenté pour sa capture à un pylône d'avion ; et dans lequel
- 35
- (f) les différents dispositifs de levage (23, 101, 103) comprennent chacun un des trois dispositifs de réglage de la hauteur du berceau permettant les trois positions de raccordement entre le premier, le deuxième et le troisième dispositifs de levage (23, 101, 103), respectivement, et le berceau (15), à fixer de manière indépendante à un des très nombreux niveaux verticaux prédéfinis, dont le réglage vertical obtenu par lesdits dispositifs de levage (23, 101, 103) du berceau (15) auxdites trois positions de raccordement doit être initié en positionnant l'article (17) supporté par le berceau à un pylône d'avion au niveau sous-aile.
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2. Un tricycle selon la revendication 1, **caractérisé en ce que** : lesdits chariots (11, 13) sont construits de façon à, après capture d'un article (17) à un pylône d'avion au niveau sous-aile, permettre de modifier la configuration desdits chariots, ou de l'un d'entre eux, sans exclure une configuration divisée dans laquelle lesdits chariots, ou l'un d'entre eux, sont en sections séparées, les modifications de configuration étant calculées pour faciliter l'extraction dudit tricycle du dessous de l'avion, nonobstant la présence de parties de, ou de parties annexes à, l'avion qui rendraient sinon l'extraction difficile ou, pour des raisons pratiques, impossible à réaliser. 5
3. Un tricycle selon la revendication 1 ou 2, **caractérisé en ce que** : 15
- . ledit berceau (15) comprend :
 - .. un élément principal (19) conçu pour supporter un article à transporter, ledit élément (19) disposant desdites première et seconde extrémités (19', 19''), respectivement ; 20
 - .. intégrées audit élément principal (19) à ladite première extrémité (19'), des première et deuxième douilles axialement parallèles et espacées latéralement (21', 21'') ; et, 25
 - .. intégrées audit élément principal (19) à ladite seconde extrémité (19''), des troisième et quatrième douilles espacées latéralement (23', 23'') et axialement parallèles l'une de l'autre et desdites première et deuxième douilles (21', 21''), 30
 - . ledit premier dispositif de levage (23) comprend : 35
 - .. un cadre fort (25) ; et,
 - .. un système d'actionnement des vérins (27) comprenant : 40
 - ... un premier élément d'actionnement (29) comprenant :
 - une tige filetée (35) ; et, 45
 - fixé par rapport audit premier cadre fort (25), un dispositif contraignant le déplacement de ladite tige filetée (35), par rapport au premier cadre fort (25), uniquement dans la direction de l'axe longitudinal de ladite tige filetée (35) et, 50
 - fixé par rapport à ladite tige filetée (35) pour le transport par ce moyen, un adaptateur (37) ; 55
 - co-utilisable avec ledit premier élément d'actionnement (29), un second élément d'actionnement
- comprenant, dans l'accouplement fileté avec ladite tige (35), un écrou (41) qui est contraint à la rotation mais qui est sinon fixé par rapport au premier cadre fort (25) ; et,
- .. une disposition d'essieux orientable avec contact au sol (33, 33'), sur laquelle ledit premier cadre fort (25) est supporté,
 - . en prolongement dudit premier cadre fort (25), une structure (61), disposant d'un premier bras et d'un second bras parallèles (63, 65), dont l'espacement entre eux correspond à celui desdites douilles à une extrémité dudit berceau (15) ;
 - .. lesdits deuxième et troisième dispositifs de levage (101, 103) étant chacun, de construction, comme stipulé, mutatis mutandis, ci-dessus, lié au dispositif de levage (25) dudit premier chariot, à cette exception près que les dispositions d'essieux avec contact au sol desdits deuxième et troisième dispositif de levage (101, 103) ne sont pas orientables ;
 - ... entre le second élément d'actionnement de chacun desdits deuxième et troisième dispositifs de levage (101, 103), un profilé (117) ayant, à ses extrémités, un premier et un deuxième raccords, respectivement, avec ledit second élément d'actionnement (105) ;
 - . intégrée audit profilé (117), une seconde structure disposant d'un premier bras et d'un second bras parallèles, dont l'espacement entre eux correspond à celui des douilles à l'autre extrémité dudit berceau (15), et dans laquelle :
 - . les adaptateurs dudit second élément d'actionnement des différents dispositifs de levage sont munis chacun d'un grand nombre de positions de fixation (de H1', H1'' à H4', H4''), auxquelles les première et deuxième structures de support des bras (61, 129) peuvent, optionnellement, être accouplées, dans le cas du premier chariot (11), audit premier dispositif de levage (23), dans le cas du second chariot (13), auxdits deuxième et troisième dispositifs de levage (101, 103), lesdites positions de fixation étant telles qu'elles permettent, pendant l'utilisation du tricycle, de proposer plusieurs positions, à partir desquelles ladite structure peut être modifiée pour se déplacer, par rapport audit cadre fort ; et,

- lesdits chariots (11, 13) sont construits de façon à, après capture d'un article (17) à un pylône d'avion, permettre la modification de configuration desdits chariots (11, 13), ou de l'un d'entre eux, y compris une configuration divisée, dans laquelle lesdites structures de support des bras, ou l'une d'entre elles, pour le moment en cours, étant dégagées des dispositifs de levage (23, 101, 103) desdits deuxième et troisième chariots, les modifications de configuration étant dans tous les cas calculées pour faciliter l'extraction dudit tricycle du dessous de l'avion, nonobstant la présence de parties de, ou de parties annexes à, l'avion qui entraîneraient, sauf en cas de modification correspondante de configuration du tricycle, des obstructions à l'extraction dudit tricycle.
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4. Un tricycle selon la revendication 3, **caractérisé en ce que** au moins ledit second chariot (13) est construit de façon à supporter un pliage immédiat, au moins d'une partie de celui-ci, selon une configuration écrasée.
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5. Un tricycle selon les revendications 3 ou 4, **caractérisé en ce que** les chariots (11, 13) ou l'un d'entre eux sont construits de façon à supporter une division en un grand nombre de parties extractibles de manière indépendante.
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6. Un tricycle selon la revendication 5, **caractérisé en ce que** lesdits deuxième et troisième dispositifs de levage (101, 103) dudit second chariot (13) sont chacun construits de façon à pouvoir être libérés immédiatement pour un déplacement angulaire autour de l'axe longitudinal dudit profilé (117); et lesdites structures de support des bras (61, 129), ou l'une d'entre elles, peuvent être libérées immédiatement de l'accouplement avec, dans le cas du premier chariot (11), le premier adaptateur, et dans le cas du second chariot (13), de l'accouplement avec ledit profilé (117).
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7. Un tricycle selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les différents dispositifs de levage (23, 101, 103) comprennent chacun un dispositif (195) utilisé pour limiter la force capable d'être développée entre le missile, ou tout autre armement susceptible d'être transporté par ledit berceau, et le pylône auquel l'armement doit être capté.
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8. Un tricycle selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les dispositifs (143, 145; 147a, 147b; 151, 153; 123; 155, 157; 163 à 169; 171, 173; 175; 177, 179; 183; 185; 187), à l'aide desquels lesdits bras dudit second chariot (13) peuvent être déplacés latérale-
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- ment, dans des limites prédéfinies, à l'unisson, dans toute direction, par rapport auxdits deuxième et troisième dispositifs de levage (101, 103) dudit second chariot (13).

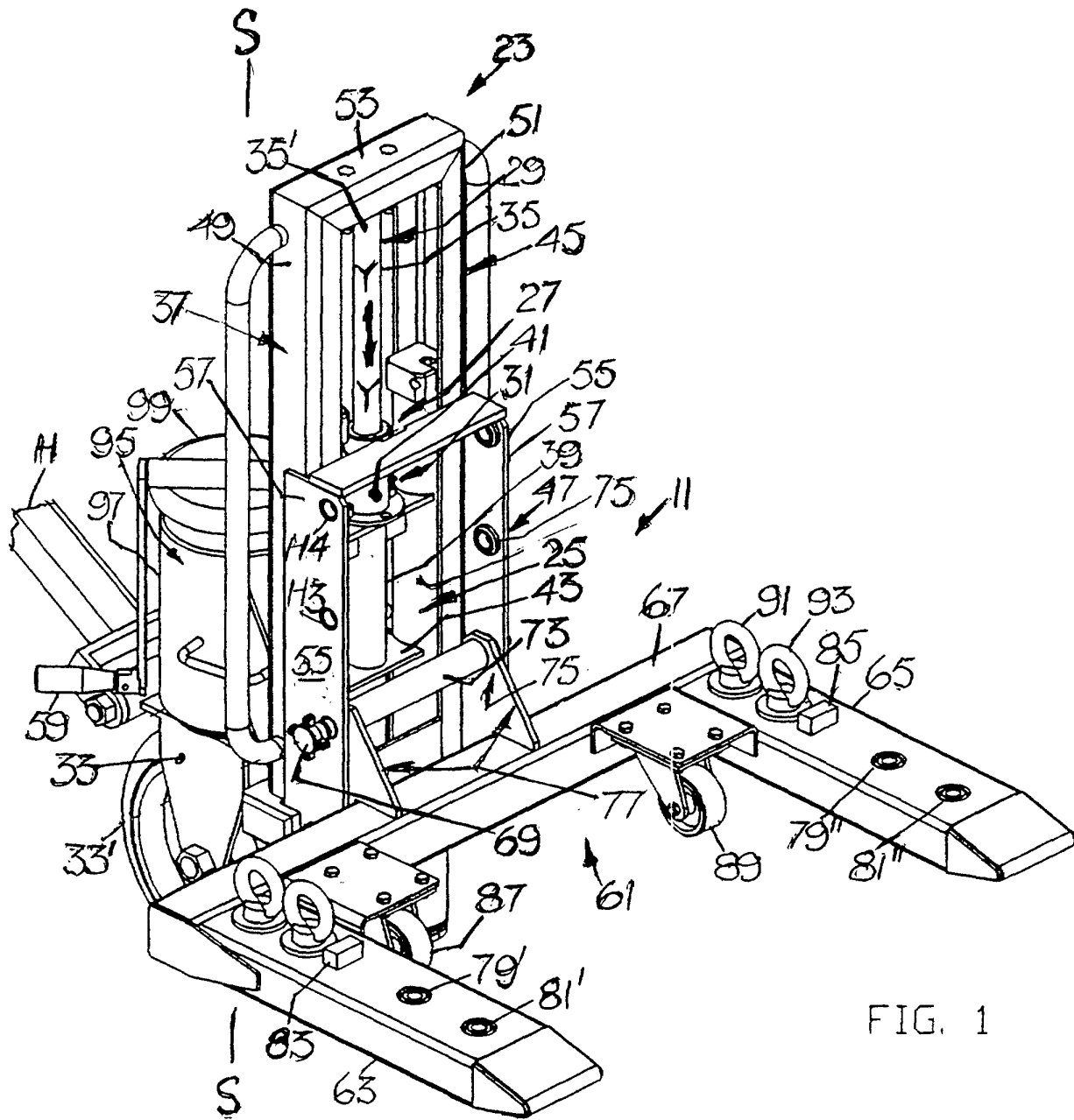


FIG. 1

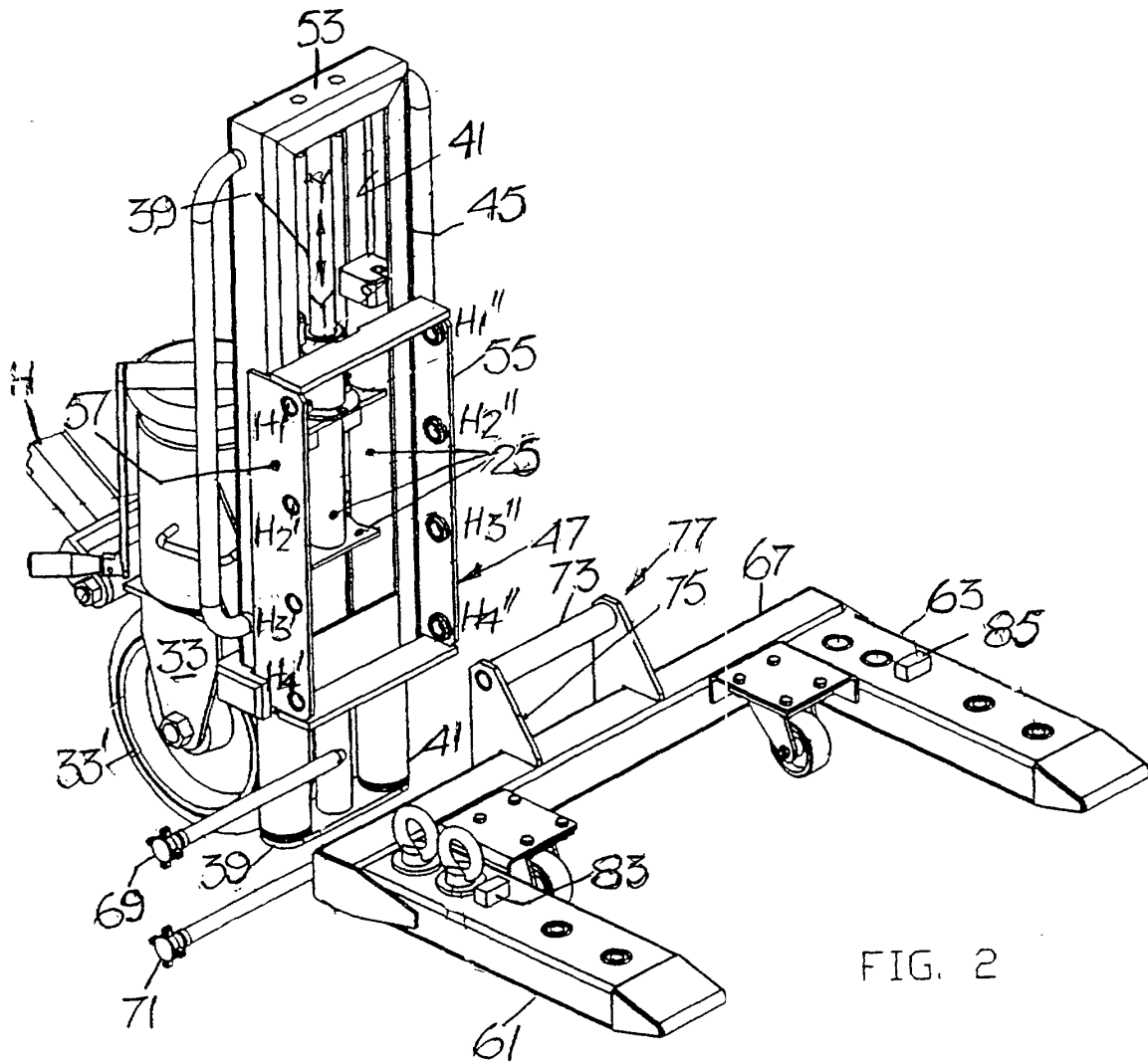


FIG. 2

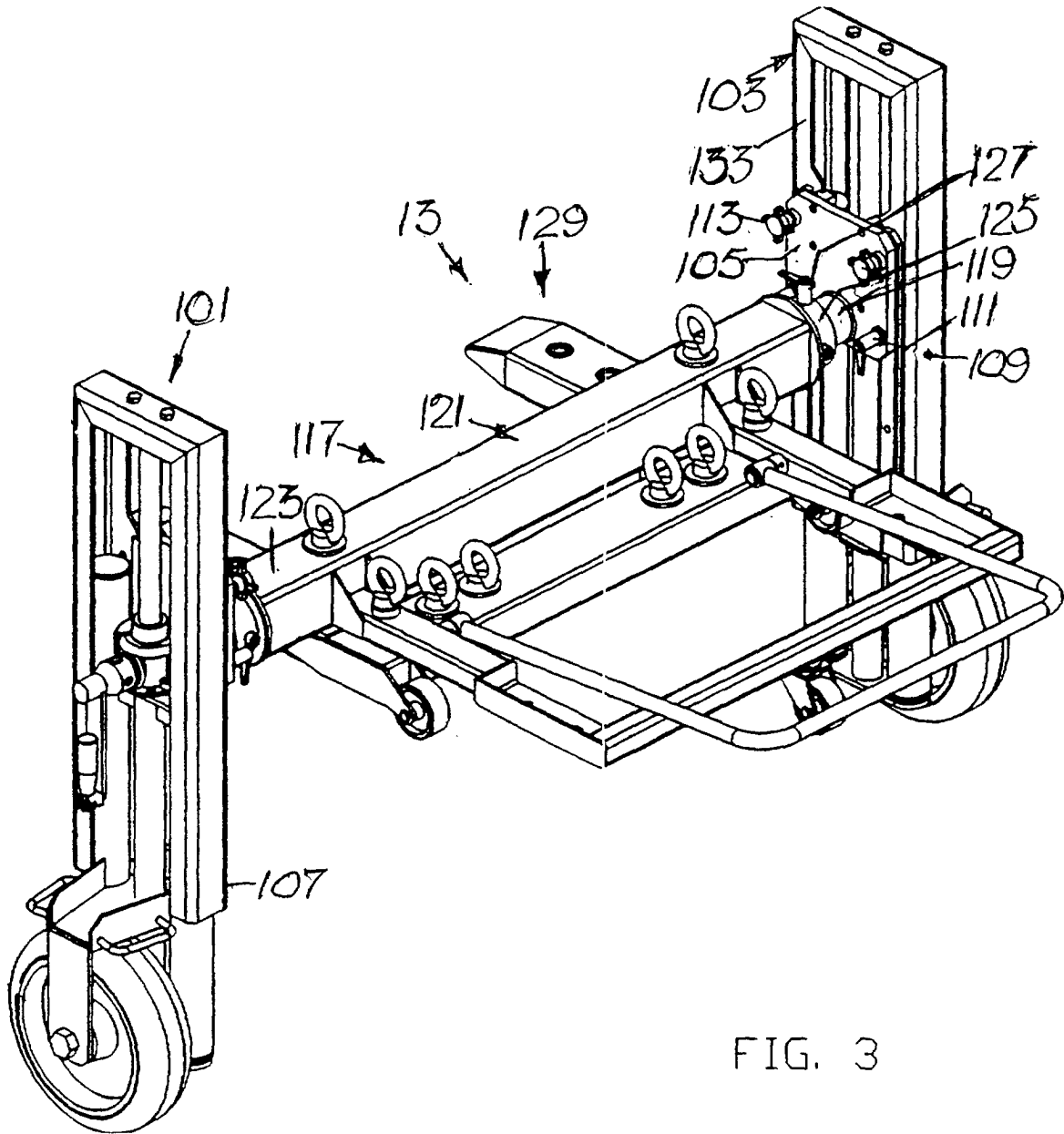


FIG. 3

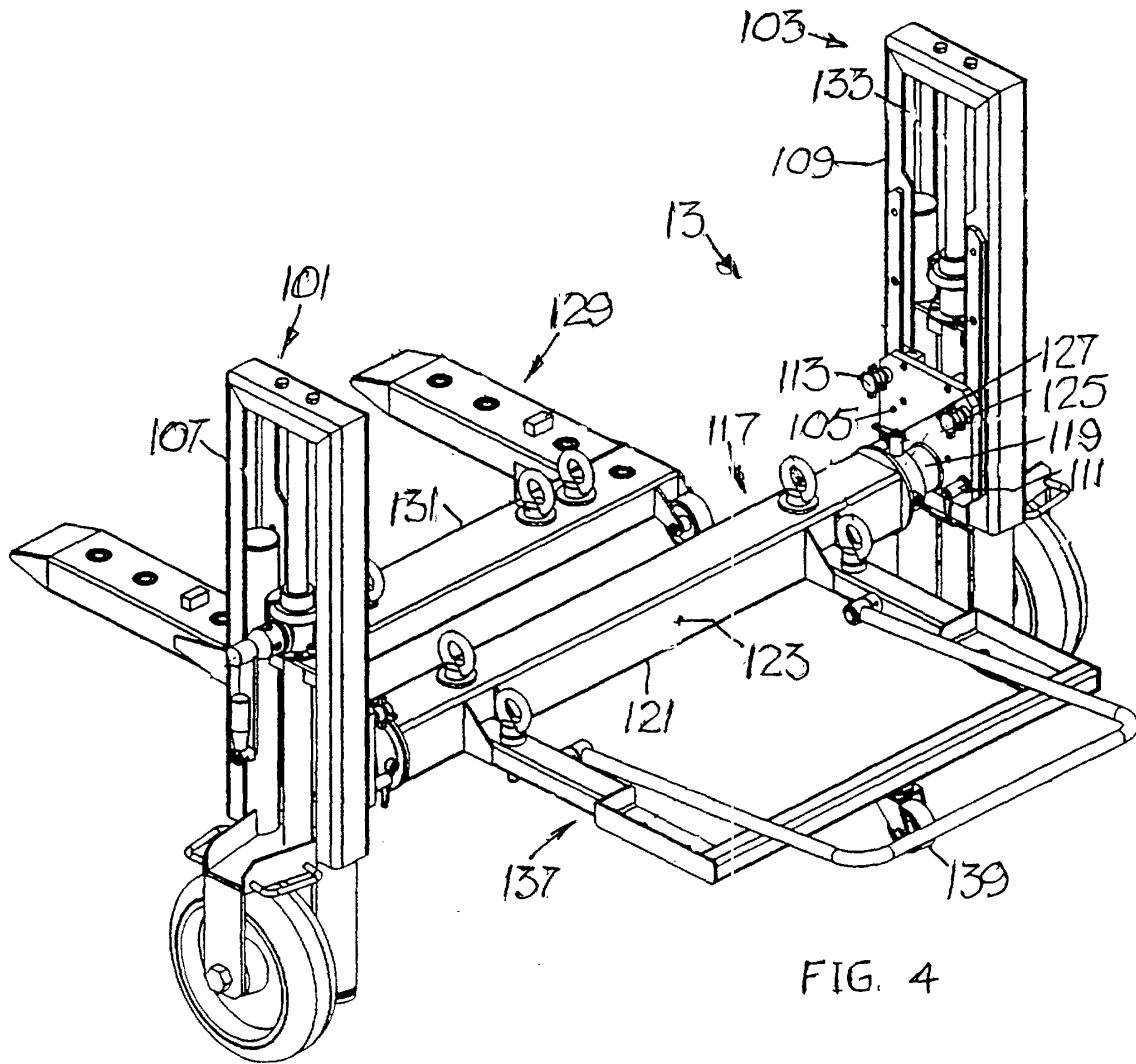


FIG. 4

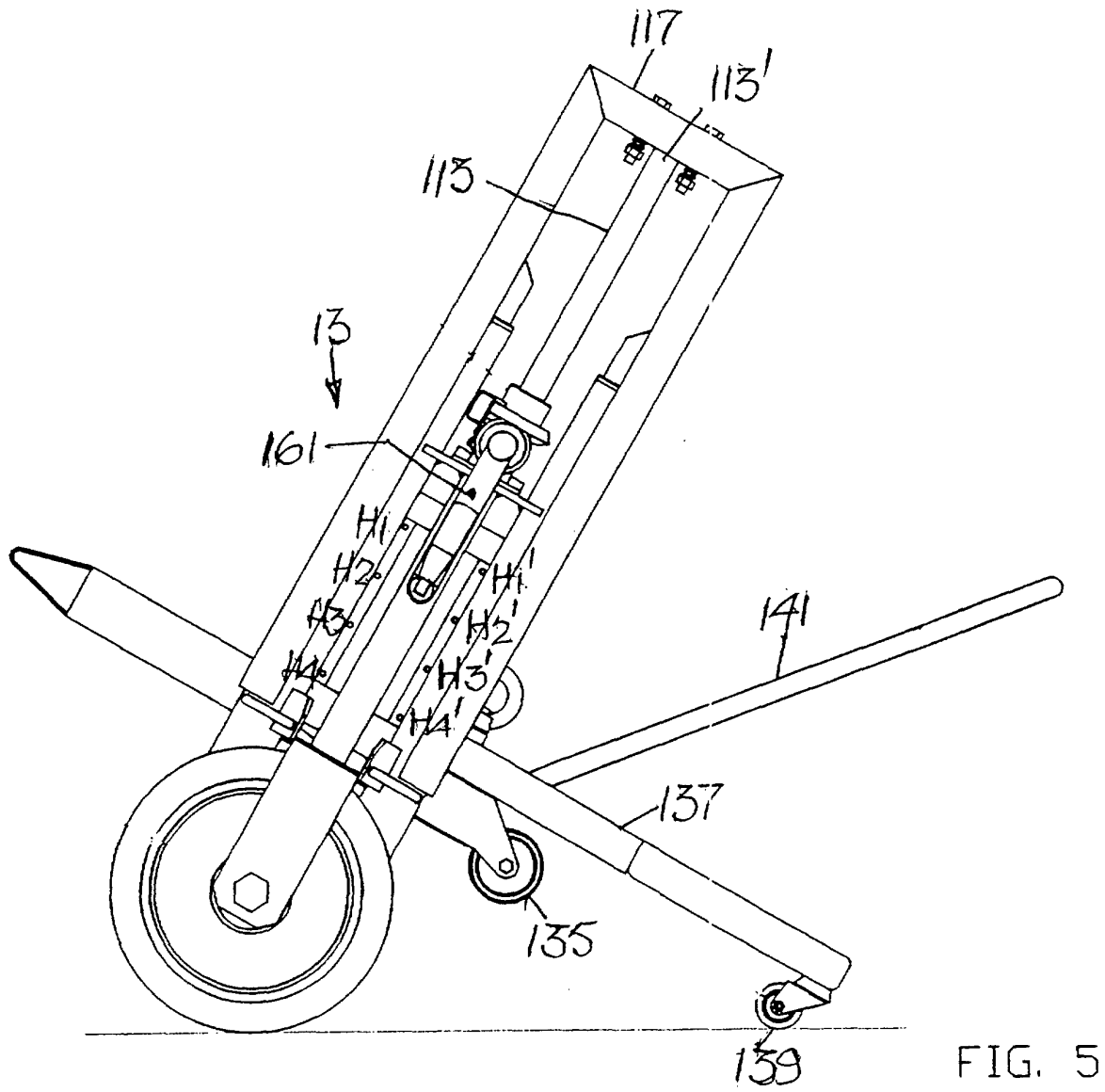


FIG. 5

