

Free Arranging Gun Carriage and Weapon Arrangement with a Free Arranging Gun Carriage

The present invention relates to a free arranging gun carriage for height and side arrangeable firearms: for instance, machine guns, garnet throwers, garnet automatic weapons, etc. Such free arranging gun carriages could be positioned on the ground on a suitable base, such as a tripod. However, they also could be mounted on a vehicle or a building. A free arranging gun carriage that is suitable for the infinitely variable side and height arranging of a weapon via a handle-like control unit is known from US 2,458,956. The directional movements of the shooter are thereby transferred via a column, in the interior of which a vertically running shaft can be turned for side arranging, which is coupled with the weapon and the handle-like control unit. For the arranging of the height, a vertical pivoting movement of the control unit is transformed into a vertical (height) pivot movement of the weapon via a shaft drive. A trigger device is provided on the control unit for the firing of the weapon. A device for adjusting the side and height is not known from US 2,458,956. A crank-drive arranging machine, in which a switch-over drive converts the crank rotation with different selectable gear transmission ratios into corresponding arranging movements, is known from CH 222826. Depending on the switch position of the drive, the crank movements are transmitted differently and are converted into arranging movements. CH 222826 relates to a sight device, in which the sight angle between the optical axis of a telescope and a gun tube core is adjustable via a worm gear drive. An arranging movement of the gun carriage or the weapon is not effected with this device.

A free arranging gun carriage has to meet various requirements: it has to be smooth running and precisely adjustable. It should not affect the handling of the weapon but rather improve its handling.

It should also be precise and stable in adjustment. If used for particular equipment that shoots garnets with range firing, the free arranging gun carriage is required to have adjustable height and side direction in order to increase the ammunition effect in the target area. Free arranging gun carriages should be suitable for different types of weapons and should allow for consistent handling.

Traditional free arranging gun carriages only meet these requirements partly or inadequately. Therefore, the objective of this invention is to provide a free arranging gun carriage on which different types of weapons could be handled consistently and easily. With a consistent operating concept, it would be adaptable to different types of weapons. By means of an intuitively manageable control element, all important aiming and firing functions could be performed. Another objective would be to manufacture this control element in a way that it could be used for different types of weapons.

This objective is achieved by means of a free arranging gun carriage according to claim 1. Therefore, the free arranging gun carriage involves equipment that allows for continuously adjustable height and side direction. It also has a device to adjust the height and side position, that is, more precise adjustments could be made in height or side direction after being brought into positioning. The free arranging gun carriage also has a trigger to activate the firearm as well as suitable control elements by means of which the shooter could continuously adjust the height or side direction and could make more precise adjustments in height or side direction after being brought into positioning. Via the control element, the shooter is also able to activate the trigger. According to the invention described herein, one control unit involves the function elements required to make continuous height or side adjustments and to make more precise height or side adjustments after being brought into positioning. There could be several control units, in particular two, so that, for instance, the shooter could operate with his right hand one control unit which has a

device for continuous adjustment of height direction and for more precise adjustment of height direction. With his left hand, he could operate an analogous control unit which has a control element for continuous adjustment of side direction and for more precise adjustment of side direction.

According to further development as described in claim 2, these control units are assembled on a handlebar and are located on the rear end of the firearm facing the shooter, running transverse to the principal axis (running axis) of the firearm and forming a connecting axis between both control units. One control unit includes at least one additional control element which preferably consists of a hand lever and by means of which a trigger could be activated.

According to claim 3, the control unit involves a turning handle by means of which a spring-loaded brake mechanism could be activated which arrests the free arranging gun carriage in position of side direction or height direction. In this way, the right hand could operate a turning handle by means of which a brake mechanism is activated which arrests the height-directional position, and the left hand could operate a turning handle by means of which a brake mechanism is activated which arrests the side-directional position. According to further development as described in claim 4, the turning handle is connected to an actuator which releases the brake mechanism by actuating, that is, turning the turning handle against spring force. This means that, with an equipment of two turning handles, the shooter would be able to adjust the height direction in arrested side-directional position and to adjust the side direction in arrested height-directional position. If he activates both turning handles, he would be able to adjust the firearm horizontally (sideways) and vertically (in height). The hydraulic model according to claim 5 allows for particularly secure, self-cleaning, and precise activation of a brake-releasing hydraulic device. At the same time, by means of a particularly selected "hydraulic transmission," it is possible to overpower the braking force of a very strong spring by hand, that is, the directional position could be firmly fixed by means of particularly

designed brake systems. As a result, it is possible to avoid that, even in cases of heavy firearms or firearms with powerful recoil, the motion of the firearm is changed after firing.

According to claim 6, the turning handle is connected to a hydraulic component which, upon releasing the brake, or tightening the brake spring, exerts a reset force on the turning handle, resetting the turning handle into its starting position. As a result, upon releasing the turning handle, the free arranging gun carriage accepts a fixed position. At the same time, the turning handle will accept an arrested position if it is turned beyond the dead center, which is at the edge of the turning area. In this arrested position, the turning handle is fixed in position by the force exerted on the hydraulic component so that it does not return into its starting position even if it is released. Consequently, the brake remains released, and the firearm could freely be rotated in any position on the free arranging gun carriage without activating the turning handle. In this position, the handles only serve the purpose of rotating the firearm into the proper position. For resetting, it is required to overpower – through manual turning – the dead center in the other turning direction. As a result, the turning handle automatically returns to its starting position in which the gun carriage has been fixed. According to claim 7, in order to carry out the displayed operating mode of the turning handle, a connecting rod coupling is provided by means of which the rotation of the turning handle is transmitted into a linear movement of the hydraulic component which is designed as a piston functioning with hydraulic fluid. According to further development as described in claim 8, it is possible to have an optimum arrangement between the point of contact at the turning handle and point of contact at the hydraulic component which is connected to the turning handle via the connecting rod. In this way, the operating mode described in claim 6 could be carried out via a knee-lever system. At the start, by means of the hydraulic component, the connecting rod exerts force against the turning direction of the turning handle. After overpowering the dead center which

decreases this force to zero, another force is built up in turning direction of the turning handle, keeping the force exerted on the connecting rod via the hydraulic component in a fixed position. Depending on the predetermined overextension of the "knee joint," even the force required for release from the arrested position could be determined.

According to claim 9, the control element for establishing fine adjustment of side or height direction could be made up of an adjustment gear which could also be placed at the control unit. By placing it at the end of the control unit, it is functionally connected to the control element (such as a turning handle) for continuous height or side adjustments. According to claim 10, the integration function is further increased by means of the coaxial assembly toward the rotating axis of the turning handle. Consequently, in case of a two-handle assembly, there is always a close functional connection between the control elements (turning handle and control gear) for height direction (adjustment and precision adjustment) and the control elements for side direction. By means of this assembly, it is especially easy for the shooter to adjust the gun carriage without taking his eyes off the sights.

According to claim 11, the adjusting of directional positioning is performed by means of linear actuation which, according to further development as described in claim 12, takes the form of a spindle transmission, in particular a self-locking spindle transmission. According to claim 13, this spindle transmission is coupled with the respective control gear via a bell crank gear, for instance, a bevel gear. It is possible to assemble the adjustable bell crank transmission in practically any angle to the rotating axis of the control gear. According to claim 14, the control gears are equipped with fixed detents which define adjustment ranges that are arranged on the respective firearm or sights in a way that the range (rotating angle) between adjacent rotating positions of the control gear corresponds to a particular angle difference of the side or height direction. As a result, the shooter

is able to perform a precise, tangible, and accurately defined readjustment of the directional position. By coupling the gun mounting plate, via a joint with two degrees of freedom, to the base (which remains movable during the process of free adjustment), the continuous adjustments and the more precise adjustments of the directional positioning are mechanically completely decoupled. However, because of the special arrangement of the control elements, they are functionally integrated.

According to the model described in claim 16, this joint has the form of a joint rod with one section on each end and a middle section in between the two end-sections. Each of these sections are connected by means of tapered adapters. The bending and torsion resilience in flexible joints of this joint rod, which is achieved in this way, results in flexibility of the gun mounting plate around a defined center of rotation with regard to the base required for making adjustments.

According to claim 17, the end sections are interconnected in the sidewalls of the base. At least at one end (fixed bearing), they are attached to the base. The middle section is attached to the gun mounting plate. The actuators function between gun mounting plate and base in a way that a firearm mounted into the gun mounting plate turns around a rotating center which is located on the axis of the joint rod as soon as the actuators are activated.

According to claim 19, there would be an additional guidance between the gun mounting plate and the base. This guidance would transmit the recoil forces resulting from the firing the weapon from the gun mounting plate to the base without excessively straining or warping the joint rod. This guidance could be made, for instance, by means of a guideway which would be attached to the base and would run transverse to the principal axis and which would have a pin moving in the

guideway. Characteristically, the guideway would run in a radius of curvature which corresponds to the distance from the center of rotation of the adjustment joint rod.

According to the model described in claim 20, the base is suspended vertically adjustable in a pivot fork via lateral trunnions for the purpose of adjusting the height direction. The pivot fork, in turn, is placed in a swing-out drum via a vertically running pivot pin which is horizontally adjustable (pivoting) for the purpose of adjusting the side direction. According to claim 21, a brake mechanism is provided between base and pivot fork and between pivot fork and swing-out drum. These brake mechanisms interact with the actuators which are controlled by means of the respective control elements.

According to further development as described in claim 22, there will be a hydraulic coupling of the activating device (on the free arranging gun carriage) with a trigger mechanism on the weapon. The coupling of the respective hydraulic device is made in a way that it has the desired effect on the trigger mechanism of the weapon. Consequently, the control concept realized in the free arranging gun carriage could be used with various weapons which are, for instance, equipped with completely different trigger mechanisms (activation with the thumb, activation with the index finger, etc.). That is why a shooter familiar with the free arranging gun carriage as described in the invention would not have any difficulty to operate any weapon mounted on the carriage.

According to further development as described in claim 23, this versatility is increased by making use of adapters which form the cut surface between various types of guns and gun mounting plates. As a result, principally, any suitable weapon could be connected to the free arranging gun carriage described in the invention without having to make any changes on the gun carriage or on the weapon.

Finally, claim 24 involves a weapon arrangement in which a free arranging gun carriage as described in the invention with a mounted weapon is connected to a particular secondary gun carriage. This secondary gun carriage, in turn, is connected to a vehicle or, by means of a suitable stand, to the ground or carrier in order to secure the weapon arrangement. In this way, by using the invented free arranging gun carriage, any operation with particular weapon arrangements could be performed.

One embodiment of the invention is described by means of the enclosed diagram in which the following is shown:

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| Fig. 1 | a perspective view of the invented free arranging gun carriage with a mounted weapon as well as a partial view of another weapon which is located in an adapter by means of which it is mounted to the free arranging gun carriage, |
| Fig. 2 | a rear view of the free arranging gun carriage from Fig. 1 without a weapon, |
| Fig. 3 | a side view of the free arranging gun carriage from Fig. 1 and 2, also without a weapon, |
| Fig. 4 | a partial view (A-A) through the control units according to Fig. 2, |
| Fig. 5 | a partial view (B-B) through the control units according to Fig. 4, |
| Fig. 6 | a partial view (C-C) of the free arranging gun carriage in the area of the pivot pin according to Fig. 3, |

- Fig. 7 a partial view (D-D) of the free arranging gun carriage in the area of the trunnions according to Fig. 3,
- Fig. 8 a cross section through base and gun mounting plate in the area of the joint rod,
- Fig. 9 a longitudinal section through base and gun mounting plate in the area of the joint rod,
- Fig. 10 a diagram of the coupling between a turning handle and a hydraulic component in two control positions (I and II).

Following is a description of the assembly of the invented free arranging gun carriage as shown in figures 1, 2, and 3. The free arranging gun carriage (1) allows for the adjustment of height and side direction of a weapon (2) which is fixed in the free arranging gun carriage (1). By means of suitable adapters (3), it is possible to place various weapons (2) in the free arranging gun carriage (1) without having to make any structural alterations on the weapon (2) or the free arranging gun carriage (1). With the free arranging gun carriage (1) it is possible to adjust the height direction along a height direction axis (4) running horizontally and the side direction along a side direction axis (5) running vertically. In addition, it is possible to adjust more precisely the height directional position along a height direction axis (6) running horizontally and the side directional position along a side direction axis (7) running vertically (see Fig. 8). The free arranging gun carriage (1) has a pivot dish (8) in which, by means of trunnions (9), a base in form of a pivot fork (10) is suspended vertically pivoting along the height direction axis (4). The height direction axis (4) runs through the two trunnions (9). The pivot dish (8) is put in place in a particular swing-out drum shaped as a bearing box (12) with a pivot pin (11) which protrudes vertically downward (see Fig. 6), pivoting

along the side directional axis (5). The bearing box (12) is securely attached to a secondary base, which is not shown, which connects the free arranging gun carriage (1), for instance, with a tripod which is secured in the ground, on a vehicle, or on a building.

Either directly or via an adapter (3), the weapon (2, 2') is securely attached to a gun mounting plate (13). With regard to the pivot fork (10), the gun mounting plate could be vertically adjusted along the height adjustment axis (6) or horizontally along the side adjustment axis (7). Gun mounting plate (13) and pivot fork (10) are connected via a joint rod (14) (see figures 8 and 9) and via two adjustment transmission units (15 and 16) (see figures 4 and 5). The adjustment transmission unit (15) serves the purpose of adjusting the side directional position, and the adjustment transmission unit (16) serves the purpose of adjusting the height directional position.

In addition, the depicted free arranging gun carriage also includes a belt box attachment (17) (see figures 2 and 3), a component frame (18), and an adjustable shoulder support (19). From a belt box (not shown), which is connected to the belt box attachment (17), the weapon (2, 2') is supplied with an ammunition belt (not shown). By means of adapter rails (20), it is possible to arrange various extension components on the component frame (18), as for instance, sights, target devices, night vision equipment, range finder, lamps, etc. In the depicted embodiment, the shoulder support is attached to such an adapter rail (20), a so-called Picatinnyrail.

In order to activate (fire) the weapon (2, 2'), and in order to operate and control the free arranging gun carriage (1), there are two control units (21, 22), one left control unit (21) and one right control unit (22), viewed from the position of the shooter standing behind the weapon (2, 2'). These control units (21 and 22) include all control elements required to fire the weapon, to perform height and

side adjustments, as well as to perform more precise height and side adjustments.

For the purpose of height direction, the pivot fork (10) is suspended in the pivot dish (8) via two trunnions (9) (see Fig. 7). The trunnions (9) connect particular sidewalls (23, 24) of the pivot dish (8) or pivot fork (10). The pivot fork (10) involves a secondary base (25) which connects the two side walls (24). On the secondary base (25), receivers (26) are located on which a main brake mechanisms (28) are arranged transverse to the principal axis (27) of the weapon (2, 2'). The brake mechanism (28) includes two brake endings (29, 30) which are located in the receivers (26) and which retain at their external side brake pads (31). A spring (33) attached at the end (30) and at one axial locking device (32) forces the brake end sections (29 and 30) apart so that the brake pads (31) touch the interior side of the pivot dish (8) side walls (23). As a result, the pivot fork (10) is fixed inside the pivot dish and the height direction position of the weapon (2, 2') is determined.

In order to activate (release) the first brake mechanism (28), the end section (30) takes the form of a hydraulic component. In the interior of this hydraulic component, at one end of the rod (34), there is a piston (35) which is able to move inside the end of the brake (30). Through a guideway (36), which also closes the right end (30), the rod (34) is guided to the outside. The chamber located between the piston (35) and the interior of the guideway (36) is connected to the right control unit (22) via an attachment and a hydraulic line (not shown) (see Figures 4 and 5). In the right control unit (22), there is a hydraulic component (40) which is connected to a turning handle (42) via a steering rod (41). For the purpose of adjusting the height direction, the shooter activates the turning handle (42) manually. The steering rod (41) transmits the rotary motion to the hydraulic component (40) which builds up pressure in the hydraulic line (39) and the chamber (37) (Fig. 7). This pressure moves the piston (35) against the spring force to the right and shortens the total length of the first

brake mechanism (28). As a result, the brake pads (931) are detached from the sidewalls (23) of the pivot dish (8), and the pivot fork (10) is now freely rotating in the trunnions (9) (see Fig. 7). By moving the free arranging gun carriage (1) up and down with the help of the control units (21, 22) and, if required, the shoulder support (19), the shooter is now able to adjust the vertical position of the free arranging gun carriage (1) and, consequently, the weapon (2, 2'). As soon as the right position has been set, the shooter releases his grip on the turning handle (42). The spring (33) forces the two ends (29, 30) apart. The piston (35) presses the hydraulic liquid out of the chamber (37) and, via the attachment (38) and the hydraulic line, back into the hydraulic component (40), which, by means of the steering rod (41), brings the turning handle (42) into its starting position. As a result, the pivot fork (10) is once again attached to the pivot dish (8) and the weapon (2, 2') is vertically adjusted. The adjustment of the height direction is completed.

For the purpose of adjusting the side direction (see Fig. 6), the pivot pin (11) is attached at the bottom side of the pivot dish (8). The pivot pin (11) is located inside the bearing box (12) rotating around the side direction axis (5). The pivot pin has a lower cylindrical bearing area (43) and an upper cylindrical bearing area (44) with different cross-section dimensions which are surrounded by particularly designed interior areas of the bearing box (12). A downward pointing bearing area (45), running radially to the side direction axis (5), is located on a particularly designed area opposite of the bearing box (12). Consequently, radial as well axial forces could be transmitted between the pivot dish (8) or pivot pin (11) and the bearing box (12). An attachment protects the pivot pin (11) from being pulled out. Through the upper area of the trunnion (11) adjacent to the bottom (47) of the pivot dish (8) runs a second brake mechanism (48) which, analogous to the first brake mechanism (28), is forced apart via a spring (49) into a brake-drum-like coil area (50) of the bearing

box (12). In this way, the pivot dish (8) is attached in the bearing box (12), and the weapon (2, 2') could be kept in the position of side direction.

In order to adjust the position of side direction (see Fig. 5), the second brake mechanism (48), like the first brake mechanism (28), is activated via the left turning handle (51), a steering rod (52), a hydraulic component (53), and a hydraulic line (55) which is connected to the second brake mechanism (48).

Because of the fact that the shooter could activate with each hand one turning handle (42, 51) on the right and left control unit (22, 21) respectively, it is possible to perform adjustments in side and height direction of the weapon (2, 2') or free arranging gun carriage (1) simultaneously. This means that the weapon (2, 2') could be freely rotated and adjusted along the height and side direction axis (4, 5) via the turning handles (42, 51) with released brake mechanisms (28, 48).

Figure 10 shows a detailed diagram of a turning handle (51, 42) of the steering rod (52, 41) and the actuating piston (56) of the hydraulic components (40, 53) in longitudinal section. Drawing I shows the turning handle (51, 42) in starting position. Drawing II shows the turning handle (51, 42) in working position. From both drawings (I, II), it is apparent how the rotary motion is transferred in the direction of the arrow (57) via the steering rod into a linear movement in the direction of the arrow (58). On its respective ends, the steering rod (52, 41) has a spherical segment (59) which is positioned in particular retainers (60, 61) at the turning handle (42, 51) in the actuating piston (56). The retainer (60) in the actuating piston is tapered so that it is possible to adjust the angle position of the steering rod (52, 41) toward the turning handle (51, 42) or toward the actuating piston (56). Consequently, a knee joint assembly is implemented which has a dead center (62) at its adjustment range of the turning handle 51, 42). This dead center is adjusted in a way that the turning handle (51, 42) has to be turned out of its position (I) and beyond the dead center (62) in order to release the brake. As a result, the reset force (F) of the brake mechanism (28 or 48) which is transmitted to the actuating piston (56) has such an effect on the steering rod (41, 52) that it keeps the turning

handle (42, 51) in position (II) without the requirement of an outside rotating force. In this position, the turning handle (51, 42) could be released without the requirement that the springs (33, 49) have to bring the brake mechanisms (28, 48) into braking position. In this position, the free arranging gun carriage (1) could be horizontally and/or vertically rotated without signs of wear. For instance, this operating method is advantageous for detecting and battling moving targets. For repeated setting, the turning handle (42, 51) is turned back, against arrow direction (57), beyond the dead center (62) so that the reset force (F) exerted on the actuating piston (56) brings the turning handle into its starting position (I). Consequently, the brake mechanisms (28, 48) could be released or kept in released position with or without any rotating force exerted on the turning handle (42, 51).

The hydraulic connection of the brake mechanisms (28, 48) with the turning handles (42, 51) allows for very direct control. With proper "hydraulic" transmission, it is also possible to overpower even high braking forces. However, besides the depicted hydraulic connection, it is also possible to make the connection by means of linkages or particularly designed leverages.

The process of making adjustments in height and side direction is described figures 4, 5, 8, and 9. For this purpose, the left control unit (21) is attached to the rear (side facing the shooter) end of the gun mounting (13) which is coupled with a connecting piece (63) of the pivot fork (10) via the adjustment transmission unit (15). The adjustment transmission unit for the purpose of adjusting the position of side direction involves a control gear (64) which engages in an inside thread sleeve (66) via an outside thread block (65). The inside thread sleeve (66) is connected to a coupling piece (68) via a rod (67) which is attached by means of a bolt (69) to a socket (70) in the connecting piece (63) for positioning the side direction. The socket (70) is vertically movable and could be pivoted around its axis (71) in the connecting piece (63).

For the purpose of adjusting the position of side direction, the shooter turns the control gear (64) around the rotating axis (72). During this process, the thread of the outside thread block (65), which is connected torque proof with the control gear (64), is screwed into or out of the inside thread sleeve (66). During the process of screwing in, the total length of the adjustment transmission unit (15) for adjusting the position of side direction is shortened. The rod (67) moves the connecting piece (63) over the coupling piece (68) and the socket and, consequently, moves the rear end of the gun mounting (13) toward the connecting piece (63) of the pivot fork (10). This means that the gun mounting (13), which is connected with its front end via the joint rod (14) to the pivot fork (10), is rotating around the side adjustment axis (7) (see Fig. 8). During this process, the joint rod (14) is warped (bent). In addition, the joint rod (14) has two end sections (72, 73), each of which is connected to the middle section (76) via tapered adapters (74, 75). The joint rod runs coaxial to the height adjustment axis (6). Each of the end sections (72, 73) is interconnected to particular retainers in the sidewalls (24) of the pivot fork (10). For this purpose, one end (72) is attached with a screw bolt (760). The other end section (73) is interconnected in the respective retainer having free rotation. The gun mounting (13) has a socket which receives the middle section (76) of the joint rod. This middle section (76) is also attached via a bolt (not shown) which penetrates the retainer socket and the middle section (76).

During the process of adjusting via the adjustment transmission unit (15), the rear end of the gun mounting (13) is moved in horizontal direction (sideways) relative to the pivot fork (10) or to the connecting piece (63). The attachment of the joint rod (14) described above in the pivot fork (10) and the retainer socket of the gun mounting allows for rotary motion around the side adjustment axis (7). As a result, the tapered adapters (74 and 75) are warped, and the end section (73) moves linear in the sidewall (24) of the pivot fork (10). In the depicted embodiment, the adapters (74, 75)

are flattened to the extent that the flexibility is increased particularly in horizontal direction while in vertical direction the cross-sectional area is completely developed. This increases the rigidity of the joint rod (14) in vertical direction. This means that the weight force of the weapon (2, 2') and associated structural parts causes no or only minimum warping of the joint rod (14).

Fig. 9 shows an additional guideway (78) for the purpose of receiving the recoil forces. This guidance consists of a curved guideway (79) running in a longitudinal ridge (80) of the gun mounting (13) and a curved cross nib (81) at the pivot fork (10). The radius of these curvatures corresponds to the distance between the guidance areas and the side adjustment axis (7). The cross nib (81) runs inside the guideway (79) and receives the recoil forces when the weapon (2, 2') is fired without straining and warping the joint rod (14) and without moving the weapon (22') from its adjusted position.

In some models (not shown), the guideway is inside the pivot fork (10) and the cross nib or a pin is on the gun mounting (13).

Fig. 5 shows that the adjustment transmission unit (16) for adjusting the position of height direction is assembled analogous to the adjustment transmission unit (16) for adjusting the position of side direction. The only difference is the fact that the control gear (82) is connected, via a shaft (83), with a bell crank transmission (84) with bevel gears (85, 86). The vertically arranged bevel gear (86) has an inside screw thread (86) which interacts with the outside screw thread of a control pin (87) which is coupled, via a cross bar (88), with an adapter base (89) that is connected to the pivot fork (10). Upon turning the control gear (82), the bevel gear (86) is powered by means of the shaft (83) and the bevel gear (85). Through the rotation, the bevel gear (86) is moved vertically up or down on the control pin (87) along the outside screw thread together with the rear end of the gun mounting (13). As a result, the joint rod (14) is torqued end in the middle section (74),

and the gun mounting (13) together with the weapon (2, 2') is rotated vertically up or down around the height adjustment axis (6).

In an alternative model (not shown), the joint rod is designed in a way that the end sections (72, 73) and the middle section (77) are connected torque proof with the pivot fork (10) or gun mounting (13) via a positive-fit connection. Such torque proof, positive-fit connections are, for instance, realized by means of particular grooves, multi-sided profiles, or in other appropriate ways. In such a connection, both tapered adapters (74, 75) are torqued during the process of height adjustment. The axial attachment of the end section (72) in the pivot fork and the gun mounting (13) on the middle section (77) could be carried out in the usual positive-fit or friction-locked manner (clamping fit, interference fit).

In other models, the described joint rod is gimbal-mounted with two degrees of freedom. For instance, this could be formed by means of a rigid joint rod with a vertical drill hole through which a bolt is fed that is located on the bottom side of the gun mounting. In this way, the gun mounting (13) could be rotated horizontally around the rotating axis of the bolt and vertically around the rotating axis of the rod.

The socket (70) is located in the connecting piece (63) in sliding position so that it is vertically movable toward the socket (70) and, consequently, toward the adjustment transmission unit (15) without having to apply bending forces. However, the suspension of the control pin (87) on the transverse bolt (88) is performed in a way that, during the process of adjusting the position of side direction, it is possible to perform a relative movement from the holding frame (89) to the control pin (87) by moving the transverse bolts (88) back and forth in the mounting hole of the control pin (87). For this purpose, the mounting frame has respective holes (90) (see Fig. 5).

The control gears (64, 82) have detents (91) so that it is only possible to turn the control gears (64, 82) from one indexed position to the next. As a result, depending on the thread pitch of the elements (65, 66; 86, 87), the gun mounting (13) is only turned to a definite degree. To this end, the distance of the detents (91) and the thread pitches are selected in a way that the rotating angle between the rotating positions of the control gears (64, 82) corresponds to a definite height or side angle difference which is aligned according to the weapon (2, 2') or the associated sights or target devices.

In some models (not shown), the height adjustment or side adjustment could also be performed by means of suitable hydraulic drives rather than by means of the spindle/linear transmission depicted. In this regard, suitable cylinder/piston assemblies assume the horizontal or vertical adjustment of the gun mounting (13) to the pivot fork. In such cases, there are respective hydraulic components on the control gears (64, 82).

Fig. 4 shows that in order to trigger the weapon (2, 2'), each control unit (21, 22) has operating levers (92) with hydraulic components (93) which are connected via hydraulic lines (94) with actuators (95) which effect the trigger mechanism of the weapon (2, 2') (see Fig. 1). For this purpose, one actuator (95) could be provided to activate a single shot mechanism, and a second actuator (95) could be provided to activate a sustained fire mechanism. In addition to the hydraulic coupling depicted in the embodiment which is particularly safe and low in maintenance, the coupling could also be performed by means of suitable mechanical elements, such as linkages, leverages, or elements and triggers which are operated electrically or electromagnetically.

The free arranging gun carriage (1) shown above offers a horizontal pivoting range (side direction) of 360° and a vertical pivoting range (height direction), relating to a horizontal level, of -10° to + 40°.

With suitable adjustment of the respective structural parts, it is also possible to construct other pivoting ranges.

The adjustment area of the gun mounting (13) toward the pivot fork (10) amounts to $\pm 20'$ each, horizontally and vertically. The adjustment of the control gears (64, 82) from one indexed position to the next always results in an adjustment of $1'$ of the position in height or side direction. $1'$ relates to an angle adjustment which corresponds to a deviation of the sights of one meter in one kilometer distance. There are models in which the position difference between two indexed positions corresponds to multiple or fraction amounts of the unit $1'$. The experts could find other variation or alternatives in the context of the following patent claims.

CLAIMS

1. Free arranging gun carriage (1) for height and side arrangeable weapons (2, 2'), in particular, machine guns, including:
 - ♣ An equipment that allows for continuously adjustable height and side direction (8, 10, 12),
 - ♣ A device for making more precise adjustments in height and side direction (13), and
 - ♣ Particular control elements (42, 51; 64, 82),in which the control elements for the adjustment of height or side direction and for more precise adjustment of height or side direction are combined with a manually controllable control unit (21, 22).
2. Free arranging gun carriage according to claim 1, in which two control units (21, 22) in form of a handle bar are located at the rear end of the weapon (2, 2'), generally running transverse to the principal axis (27) of the weapon (2, 2') so that, by means of these control units (21, 22), the height or side direction could be adjusted or even more precisely adjusted. At least at one control unit (21, 22), there is a control element (92), in particular a hand lever in order to activate the trigger (95).
3. Free arranging gun carriage according to claims 1 or 2, in which the control unit (21, 22) has a turning handle (42, 51) by means of which a spring-loaded brake mechanism (28, 48) could be activated which arrests the free arranging gun carriage in position of side direction or height direction.
4. Free arranging gun carriage according to claim 3, in which the turning handle (42, 51) is connected to an actuator which releases the brake mechanism (28, 48) by actuating the turning handle (42, 51) against spring force.

5. Free arranging gun carriage according to claim 4, in which the actuator works hydraulically and possesses, in particular, a hydraulic component (40, 53), a hydraulic line (55), and a brake-device-releasing hydraulic device, e.g. a piston (35).
6. Free arranging gun carriage according to claim 5, in which the turning handle (42, 51) is connected to a hydraulic component (40, 53), which, upon actuating the turning handle (42, 51) within an adjustment range, the power transmitted through the spring force via the hydraulic device (35) and the hydraulic line (55) exerts a force against the turning direction (57) of the turning handle (42, 51), resetting the turning handle (42, 51). By turning the turning handle (42, 51) beyond the dead center (62), the force (F) operating in the hydraulic component (40, 53) will put the turning handle into an arrested position. As a result, the brake remains in released position without any external force being exerted on the turning handle (42, 51).
7. Free arranging gun carriage according to claims 5 or 6, in which the connection between turning handle (41, 52) and hydraulic component (40, 53) is performed by means of a connecting rod (41, 52) which transmits a rotary motion of the turning handle (42, 51) into a linear movement of the hydraulic component (40, 53), which is particularly designed as a actuation piston (56) functioning with hydraulic fluid.
8. Free arranging gun carriage according to claim 7, in which each end of the connecting rods (41, 52) is connected to the turning handle (41, 52) and the hydraulic component (40, 53) via ball joints (59).
9. Free arranging gun carriage according to one of claims 1 to 8, in which a control element

for the precise adjustment of height and side direction is formed by a control gear (64, 82) which is located, in particular, at the ends of the control unit (21, 22).

10. Free arranging gun carriage according to claim 9, in which the control gear (64, 82) is located coaxial to the rotating axis (720) of the turning handles (42, 51).
11. Free arranging gun carriage according to one of claims 1 to 10, in which the equipment for the precise adjustment of height or side direction has a gun mounting (13) which is horizontally and vertically adjustable via an adjustment drive unit (15, 16) that could be activated by means of the control gear (64, 82).
12. Free arranging gun carriage according to claim 11, in which the adjustment drive unit (15, 16) takes the form of a linear drive and, in particular, a self-locking spindle transmission.
13. Free arranging gun carriage according to one of claims 11 to 12, in which the linear actuation (15, 16) is coupled, via a bell crank transmission (84), in particular, a bevel gear (85, 86), with the control gear (64, 82).
14. Free arranging gun carriage according to one of claims 9 to 13, in which, by means of evenly distributed detents (91), the control gear (64, 82) accepts definite rotating positions. In this regard, the rotating angle between rotating positions of the control gear (64, 82) corresponds to a particular angle difference of the height or side direction.
15. Free arranging gun carriage according to one of claims 11 to 14, in which the gun mounting (13) is coupled, via a joint with two degrees of freedom, in vertical and horizontal direction with a base (10), particularly a pivot fork.

16. Free arranging gun carriage according to claim 15, in which the joint with two degrees of freedom involves a joint rod (14) which has two end sections (72, 73) and a middle section (76). At each end of the middle section (76), tapered, flattened adapters (74, 75) form the connection to the end sections (72, 73) so that each end section forms a flexible connection with the middle section (76). The flexible joints are actually made up of the tapered adapters (74, 75).
17. Free arranging gun carriage according to claim 16, in which the joint rod (14) runs transverse to the principal axis (27) of the weapon (2, 2'). The end sections (72, 73) protrude into the sidewalls (24) of the base (10) surrounding the gun mounting and are interconnected in particular openings. The middle section (76) of the joint rod (14) is connected to the gun mounting.
18. Free arranging gun carriage according to claim 17, in which one end section (72, 73) is axially movable interconnected in the base (10).
19. Free arranging gun carriage according to one of claims 15 to 18, in which a guidance (78) which runs transverse to the principal axis of the weapon (27) serves the purpose of receiving the recoil force between gun mounting (13) and base (10). This guidance (78) takes the form of a guideway (79) which is attached to the base and a transverse nose (81) which runs in a groove (79) assembled on the gun mounting (13).
20. Free arranging gun carriage according to one of claims 15 to 19, in which the base (10) is suspended vertically adjustable in a pivot dish (8) via two lateral trunnions (9) for the purpose of adjusting the height direction. This pivot dish (8) is placed in a storage drum (12) via a vertically running pivot pin (11) which is horizontally adjustable for the purpose of adjusting the side direction.

21. Free arranging gun carriage according to claim 20, in which a first brake mechanism (28) takes effect in arresting the height direction adjustment between base (10) and pivot dish (8). A second brake mechanism (48) takes effect in arresting the side direction adjustment between pivot dish (8) and storage drum (12).
22. Free arranging gun carriage according to one of claims 2 to 21, in which the trigger involves a hydraulic component (93), a hydraulic line (94), and a hydraulic device. The hydraulic component (93) is functionally coupled, in particular via a connecting rod, with the control (92). The hydraulic device is functionally coupled with an actuator (95) for a trigger of the weapon (2, 2').
23. Free arranging gun carriage according to one of claims 1 to 22, in which different weapons (2, 2') could be attached to the gun mounting (13) via a particular adapter (3).
24. Weapon arrangement with:
 - ♣ A free arranging gun carriage (1) according to claims 1 to 23,
 - ♣ A weapon (2, 2') assembled in the free arranging gun carriage (1), in particular a machine gun,
 - ♣ A free arranging gun carriage (1) mounted on a secondary gun carriage.
This secondary gun carriage is connected to a vehicle and/or a suitable stand, by means of which the weapon (2, 2') is secured to the ground or a carrier.