Weapon with Recoil Damper

The present invention relates to a small arm, in particular a grenade or a so-called attachment, with a barrel assembly mounted in a housing assembly and a recoil damper arrangement which acts between the housing assembly and the barrel assembly.

Directional indications such as to the front, rear, above, below, to the right and left are considered from the view of a marksman holding the weapon in firing position.

In particular for large caliber small arms it is known to provide mounted barrel assemblies in order to reduce the occurring recoil effects on the marksman. For example it is known from EP 0 911 599 B1 to provide a mounted barrel in which case a recoil damper arrangement acts between the housing assembly and the barrel assembly, said recoil damper arrangement being constructed as an elastomer ring spring assembly, and surrounding the barrel assembly, being arranged within one of the guide tube assigned to the housing assembly.

From US 4,689,912 a hand high-speed grenade launcher is known in which case the barrel is likewise mounted with respect to the housing. The recoil damping takes place here via disk spring assemblies surrounding the barrel and acting between said barrel and the housing.

In the case of the known mountings the problem exists that the recoil damper or buffer arrangements arranged around the barrel assembly must either be constructed rather long (see EP 0 911 599 B1) or, in the case of short compact design

the space requirements around the already large caliber barrel must be additionally enlarged (see US 4,689,912). Both of these problems are undesirable.

From DE 717 000 a rifle grenade launcher with a recoil brake or recoil damper arrangement is known, in which case the launcher tube is longitudinally displaceably arranged. The recoil brake can be a rubber buffer, a spring or also a fluid brake and is axially arranged between a breech block region of the launcher tube and a support region of a frame unit.

In particular in the case of such small arms, in which case grenade ammunition or also smart grenade ammunition is fired, and which under circumstances exhibit a barrel arrangement which swings out transversely to the bore of the axis, such known mountings cannot at all be realized or can only be realized with considerable design or production engineering expenditure. For this reason such small arms (for example see DE 10 2005 019 594 A1), have been realized up to now only without mounting and without recoil damping.

For modern small arms systems however there is increasing demand to fire grenade ammunition with higher projectile impulses of 25 N/s or above instead of firing grenade ammunition conventional up to now with a projectile impulse of about 13 N/s, and this in a caliber range of 25 mm to 40 mm. Such projectile impulses are however can only be tolerated by the marksman with difficulty for the marksman without effective mounting.

Proceeding from this thus the object exists of specifying an improved mounting in conjunction with an effective recoil damper arrangement. An additional object can be seen in providing a compact small arm with a recoil damper arrangement, which is suitable for high

projectile impulses (25 N/s and more) and/or large caliber (25 mm and more) as well as being simple to operate (swing-out barrel) and easy to maintain or can be re-equipped (interchangeable barrel assemblies).

The small arm in accordance with Claim 1 fulfills this object, said small arm in particular being able to be designed as a so-called attachment, and which can be used by itself or with another weapon (e.g. automatic pistol).

The invention is characterized by the fact that the recoil damper arrangement is arranged axially between the breech block region of the barrel assembly and a support region of the housing assembly or frame unit, wherein the recoil damper arrangement is pushed through by a firing pin guide. This measure makes it possible to separate the mounting – the linear bore guide/barrel vice – spatially and functionally from the recoil damper. With this the barely assembly can be designed simpler and additional function features of the barrel assembly can be realized with low design expenditure (operability, maintainability, interchangeability of function elements). The recoil damper arrangement or the buffer arrangement is hence extensively independent from the most important barrel functions (cartridge receptacle, seating of projectile). The installation space around the barrel thus gained is thus available for data transmission devices (programming coils) which are required in connection with so-called smart ammunition. Thus small arms can also be suitable for extraordinarily large caliber (40 mm and more) and high projectile impulses without the space requirements transverse to the bore of the axis growing unduly. The invention facilitates a compact, slim, versatile and utilizable small arm

with effective recoil damping which can be provided with additional advantageous features.

In accordance with Claim 2 the barrel assembly is arranged in a receptacle which fulfills two functions: It assumes the responsibility for the bore guide or mounting, without which these would have to absorb great forces, since the recoil damper arrangement is realized separately from this mounting. Simultaneously this receptacle – and with it the barrel itself – is can be pivoted around a swivel pin running perpendicular to the axis of the bore between a reloading position and a firing position. This swiveling arrangement has proven itself in particular in the reloading of grenade weapons. In the case of the barrel being swung out the cartridge chamber region for reloading is thus easily accessible. Depending on the design of the weapon the barrel can be swung out laterally to the right or to the left or laterally upward or downward for reloading or for removal of cartridge cases. This flexibility is advantageous in particular in the case of so-called attachments which can be attached to another weapon. The small arm in accordance with the invention can namely be arranged in this way beneath or laterally on any other weapon. The pivotability of the barrel can be adjusted in such a way that the necessary hand grips for reloading the weapon can also be carried out in the case of a weapon being held in firing position, without the marksman having to change his body position or the position of the weapon for this purpose.

In accordance with Claim 3 the recoil damper arrangement comprises an elastomer spring arrangement. Such elastomer springs are particularly well adjustable with regard to their spring and damper properties and are also to a large extent insensitive to external environmental influences. Tried and tested materials are for example polyurethane foam or other elastomer materials.

Claims 4 through 6 relate to advantageous developments of the firing pin guide and cartridge ejection mechanism in connection with the recoil damper arrangement. The firing pin guide pushing through the elastomer spring arrangement simultaneously assumes a guide function of the spring arrangement and forms if necessary a pair of friction surfaces with spring arrangement additionally advantageously influencing the damping effect.

A cushion element in accordance with Claim 4 acting between the firing pin guide and the housing assembly dampens the impact of the advancing barrel assembly or of the recoil damper arrangement when said barrel assembly or recoil damper arrangement returns to its original position. With this measure both the recoil itself as well as also the subsequent forward motion are effectively dampened. The easy operation of the weapon is significantly improved and the mechanical stresses of the movable weapon parts are reduced.

In accordance with Claim 5 the firing pin guide in the case of the recoil effect acts in such a way on a trigger device (hammer or cock) that said trigger device is brought to its cocked position. The hammer does not need to be manually cocked, but rather the weapon is already immediately ready for use again directly after reloading.

Claims 6 through 9 relate to advantageous designs of the breech block or of a breech block element which according to Claim 6 is designed as a cartridge chamber cover, which is pivotable around a swivel pin running parallel to the axis of the bore between its open and closed positions. The breech block element is thus pivoted on the breech block plane and can as a result securely and tightly seal the cartridge chamber in connection with easy to design support flanges. The pivot hinge itself does not have to absorb any firing stress. The development according to Claim 7 guarantees that the breech block in the case of properly inserted ammunition always

occupies its closed position when the barrel assembly is swiveled in to its closed position. The axial firing pin head elastically arranged in the breech block element permits the complete decoupling of the barrel assembly from the recoil damper arrangement. The interface level developed in accordance with Claim 9 improves this decoupling and ensures a largely backlash free load transfer between barrel assembly with breech block element and recoil damper arrangement and with it with the housing assembly.

The improvements in accordance with Claims 10 and 11 ensure the secure locking of the barrel assembly in the firing position, wherein in the design in accordance with Claim 11 the locking is also to be securely guaranteed when the spring action in the catch arrangement is reduced by damages or accumulation of dirt or completely broken down.

According to Claim 12 barrel assemblies of variable caliber can be accommodated. With this an inventive small arm can cover a very large spectrum of ammunition.

In accordance with Claim 13 a coupling or an interface for coupling to other weapons is provided. With this a weapon arrangement in accordance with Claim 14 is to be realized, in which case the inventive small arm is constructed as a so-called attachment and in particular as a grenade weapon.

An exemplary embodiment of the present invention will now be explained with the help of the drawings. The figures show the following:

Figure 1 shows a perspective lateral view of an inventive small arm,

Figure 2 shows a longitudinal section through the weapon represented in Figure 1,

Figure 3 shows a perspective view from the side rear of the weapons represented in Figures 1 and 2 with swing out barrel arrangement and opened cartridge chamber,

Figure 4 shows the view from Figure 3 with closed cartridge chamber,

Figure 5 shows an exploded view of important barrel components of the inventive weapon,

Figure 6 shows a view from the rear of the weapon shown in Figure 1,

Figure 7 shows locking and catching elements of an inventive weapon and,

Figure 8 shows a frame component of the inventive weapon.

The structure and base functions of an inventive weapon 1 will be described in the following with the help of Figures 1 and 2.

The weapon 1 exhibits a main frame 2 as essential housing assembly, said main frame exhibiting several interfaces 4a through d, which serve the purpose of fastening the weapon 1 to a further weapon (not shown). The weapon 1 can for example be hooked to the interface 4d and then connected via a cotter pin to a corresponding receptacle on the carrier weapon (for example on the gas port). On the main frame additionally a housing element

6 with grip 8, trigger region 10 and the cartridge ejection mechanism is arranged. The connection of the housing assembly 6 takes place likewise via corresponding cotter pins 14. A Picatinny rail 16 is constructed at the underside of the main frame.

The main frame 2 forms the backbone of the weapon and accommodates the barrel assembly 20 and the recoil damper arrangement 50 in its interior (Figure 2). On the right side the frame is closed by a wall 18 (see Figure 7) and on its front end it exhibits a swivel mount 19, in which the mounting sleeve 22 is pivotably accommodated via hinge pins 24. On the left side on the barrel assembly 20 an electronic unit 26 is provided as a cover, said electronic unit being able to be swiveled in and out together with the barrel assembly 20 (compare also Figures 3 and 4). On its rear abutting surface this electronic unit exhibits display and control elements 26a, said elements serving the purpose of providing programmable ammunition 5 located in the barrel 21 with corresponding function and/or target data.

The barrel 21 is guided into the mounting sleeve 22 mounting sleeve via its muzzle end. A guide sleeve 23 screwed on the muzzle guides the barrel, said guide sleeve attaching on the one recoil spring 25, which is supported on a shoulder 27 and thus presses the barrel 21 to the front into the mounting sleeve 22 and against a buffer ring 28 provided there. A pivot spring 30 acts engages on the barrel 21, said pivot spring supporting itself on the main frame 2 and laterally pivoting swiveling out the barrel assembly 20 around the hinge pin 24 (see Figures 3 and 4) when the lock of the barrel assembly 20 to the main frame 2 is released. On its rear end the barrel 21 is screwed to a breech assembly 40 (see also Figure 5) in the cartridge chamber region 32. The breech assembly 40 comprises a breech block 42, in which a hinged floor plate 44 is arranged, said hinged floor plate being pivotable around a swivel pin/axis 45 running parallel to

the axis of the bore 3 from the breech block 42 when the barrel assembly 20 is in swivel out position (Figure 3 and Figure 4). In swivel out position the hinged floor plate 44 uncovers the cartridge chamber, so that ammunition can be introduced into the barrel. This position is represented in Figure 3. In its closed position, the hinged floor plate 44 with its inner surface serves as a breech block, which is fixed in the direction of the axis of the bore in the peripheral region 46 by a corresponding retaining flange 47 in the breech block. In the hinged floor plate 44 the firing pin head 49 is axially held via a leaf spring 48.

The breech block 42, hinged floor plate 44 and firing pin head 49 each adjoin with their rear free abutting surfaces on a plane 50 the recoil damper arrangement 60, which is coupled in swiveled in position of the barrel assembly to the breech block 42, and with it to the mounted barrel 21.

The recoil damper arrangement 60 comprises a butt plate 62, from which a guide sleeve 64 extends to the rear. The guide sleeve 64 in its interior accommodates the firing pin guide 65, which is sealed at the rear end with an adjusting head 66, which is screwed into the guide sleeve 64. The firing pin 68 is fixed in spring-loaded manner between firing pin guide 65 and adjusting head 66, so that its front end on the plane 50 adjoins an opening in the butt plate 62 pushing on the firing pin head 49. The rear end of the firing pin 68 protrudes from a corresponding bore hole in the adjusting head 66.

Between the rear side area of the butt plate 62 and a support region 5 likewise constructed on the main frame 2 the recoil spring 70 runs, said recoil spring surrounding the guide sleeve 64. The recoil spring 70 is constructed as an elastomer spring which

exhibits alternately arranged, annular guide 71 and dampening elements 72. The guide elements 71 are made of metal or plastic and the dampening elements 72 are made of an elastomer material, in particular of a PU foam material.

The cartridge ejection mechanism 12 acts in known manner with its spring-loaded hammer 13 on the rear end of the firing pin 68, said hammer being actuated by the trigger 11. The actuated hammer 13 drives the firing pin 68 to the front, which with its front end meets/hits the firing pin head 49 through the butt plate 62, said firing pin head thus with its ignition tip through the hinged floor plate 44 igniting the ammunition located in the barrel 21. The propellant charge catapults the projectile out of the barrel 21 - hopefully in the direction of the target.

The recoil effect pushes the cartridge base to the rear against the inner surface of the hinged floor plate 44, said hinged floor plate acting on the breech block 42 through the side safety 46, 47. The breech assembly 40 moves/pushes the recoil damper arrangement 60 on the plane 50 over the butt plate 62 to the rear against the support region 5 on the main frame 2. In the process the dampening elements 72 of the recoil spring 70 are compressed and the annular guide elements 71 glide along the outer surface of the guide sleeve 64 through the hysteresis effect of the dampening elements 72. The deformation of the recoil spring 70 dampens the recoil elastically. An additional dampening effect takes place if necessary through the friction of the dampening elements 72 on the outer surface of the guide sleeve 64.

In the case of the recoil movement the barrel 21, the breech assembly 40 and the recoil damper arrangement 60 move to the rear in the main frame 2. In the process the rear end

of the guide sleeve 64 moves through the opening in the support region 5 to the rear and presses via the adjusting head 66 against the hammer 13, which is thus brought back to its cocked position. In this position a safety shaft 15 can be twisted via a safety catch in such a way that the if necessary unlocked hammer 13 can no longer hit the rear end of the firing pin 68.

After the adjusting head 66 has reached its rear returning point, the recoil spring 70 pushes on the butt plate 62, moving the breech assembly 40 and the barrel 21 back to the front in the original position. In the process the annular spring element 74 dampens the impact of the adjusting head 66 against the support region 5 and the buffer ring 28 dampens the impact of the guide sleeve 23 on the front end of the attachment sleeve 22 in the muzzle region.

For reloading the barrel assembly 20 is unlocked and swiveled out laterally (Figures 3 and 4). In the process the spring 25 holds the barrel 21 in the original position and the pivot spring 30 holds the barrel 21 in the swivel out position.

For reloading the hinged floor plate 44 is swiveled out downward from the retaining flange 47 of the breech block 42, so that the cartridge chamber region 32 is accessible. The empty cartridge case is removed and a new cartridge is reloaded. Prior to the swiveling in the hinged floor plate 44 can either be manually closed and the barrel assembly 20 can then be swiveled in again. However, it is also sufficient to swivel in only the barrel assembly 20. In the process, the bottom rim 44a of the hinged floor plate 44 borders on an edge 2a of the main frame 2. In the case of the swiveling in of the barrel assembly 20 the edge 2a simultaneously brings about the swiveling in of the hinged floor plate 44 to its closed position. Thus it is ensured in simple manner that the hinged floor plate 44 in the case of swiveled in

barrel assembly 20 always occupies its properly closed position, subject to the condition that the ammunition is properly inserted into the cartridge chamber 32 or the cartridge chamber 32 is empty (see Figure 4).

The locking of the barrel assembly 20 takes place via a spring-loaded catch 80 accommodated in the breech block, said catch locking in a corresponding detent recess in the main frame 2 in the case of the swiveling in of the barrel assembly. In case the spring action of the detent spring 82 is not sufficient for a proper locking, the catch can be moved to its locked position from the outside via the slide lock 84 (see Figures 5, 6, 7 and 8) via the bolt 86 (Figure 5). In the process a locking nose 88 protrudes inward from the side wall 18 of the main frame 2 and presses on the bolt 86 (see Figures 3, 4 and 5) protruding upward from the breech block 42. The position of the slide lock 84 also indicates to the marksman whether the weapon is properly locked (Figure 6).

The pivot lever 90 (Figure 7) serves the purpose of unlocking, said pivot lever acting on the catch 80 from below and being arranged pivotable around the pin 92 perpendicular to the axis of the bore 3 in the main frame 2. The button 94 serves the purpose of actuation, said button protruding downward into the trigger region 10 and being able to be actuated there with the trigger finger for unlocking. In the case of unlocking the release latch 96 on the release lever 90 acts on the catch 80 and moves it upward out of its catch.

The stop 100 serves the purpose of limiting the swivel path of the unlocked barrel assembly 20, said stop likewise being accommodated rotatable in the main frame 2 perpendicular to the axis of the bore 3. In its first rotating position the projecting rim 101 of the head 102 protrudes into the swivel path of the barrel assembly 20. On the opposing end the stop 100 holds a spring catch 104

in this position. For complete disassembly of the barrel the stop 100 can be twisted by 180° so that the flat side 106 then releases the swivel path of the barrel assembly 20.

The main frame 2 is dimensioned in such a way that it can accommodate different barrel assemblies. For example barrel assemblies for 25 mm or 40 mm caliber can be used alternately. The interfaces of the different breech assemblies to the recoil damper arrangement are in the process likewise identically designed. If necessary the recoil spring 70 can be exchanged according to the momentum of the ammunition used.

The weapon 1 can be used separately. The attachment interfaces 4a-d can for example serve the purpose of mounting an additional shoulder support and if necessary also an additional sighting device on the weapon 1. It 1 can however also be used together with a conventional (not shown) rapid fire weapon to which it is then coupled via interfaces 4a-d. The inventive weapon is also part of a very flexible weapons system and is versatile in use.

The person skilled in the art infers gathers additional advantages and designs from the following claims.

Claims

1. A small arm (1), in particular a grenade weapon, with a barrel assembly (20) mounted in a housing assembly (2) and a recoil damper arrangement (60) which acts between the housing assembly (2) and the barrel assembly (20) and is axially arranged between a breech block region (42, 44) and a support region (5) of the frame unit (2), wherein
the recoil damper arrangement (60) is pushed through by a firing pin guide (64).

2. The small arm (1) according to Claim 1, in which the barrel assembly (20) is movably arranged in a receptacle (22) which can be pivoted around a swivel pin running perpendicular to the axis of the bore (3) between a reloading position and a firing position.

3. The small arm (1) according to Claim 1 or 2, in which the recoil damper arrangement (60) comprises an elastomer spring arrangement (70).

4. The small arm (1) according to any one of the preceding claims, in which a cushion element (74) acting axially opposed to the recoil damper arrangement (60) is arranged between the firing pin guide (64, 66) and the frame unit (2).

5. The small arm (1) according to any one of the preceding claims, in which the firing pin guide (64, 66) is constructed and arranged in such a way that under the recoil effect it brings trigger device (12, 13) to its cocked position.

6. The small arm (1) according to any one of the preceding claims, in which on the barrel assembly (20) a breech block element (44) is designed as a cartridge chamber cover which is pivotable around a swivel pin running parallel to the axis of the bore between an open position and a closed position.

7. The small arm (1) according to Claim 5, in which the cartridge chamber cover (44) is designed and arranged in such a way that it is brought from its open to its closing position when the barrel assembly (20) is swiveled in.

8. The small arm (1) according to any one of the preceding claims, in which the cartridge chamber cover (44) exhibits an axial elastically pivoted firing pin head (49).

9. The small arm (1) according to Claim 7, in which the breech block element (44) and firing pin head (49) in firing position in an interface level adjoin the recoil damper arrangement (60, 62).

10. The small arm (1) according to any one of the preceding claims, in which a spring-loaded catch arrangement (80, 82, 86) is provided which detachably locks the barrel assembly in its firing position.

11. The small arm (1) according to Claim 9, in which the catch arrangement (80, 82, 86) is coupled to an adjusting element (84, 86) via which it can be manually brought to its locked position.

12. The small arm (1) according to any one of the preceding claims, in which the frame unit 2 is designed in such a way that it can accommodate barrel assemblies (20) of variable caliber.

13. The small arm (1) according to any one of the preceding claims which is provided with a coupling device (4a-d) via which it can be coupled to other weapons.

14. A weapon arrangement with a plurality of small arms which comprises a first small arm 1 in accordance with any one of the preceding claims which is designed as an attachment, in particular as a grenade.