

German 7,5 cm Anti-tank Gun

Pak 40

Jan Coen Wijnstok

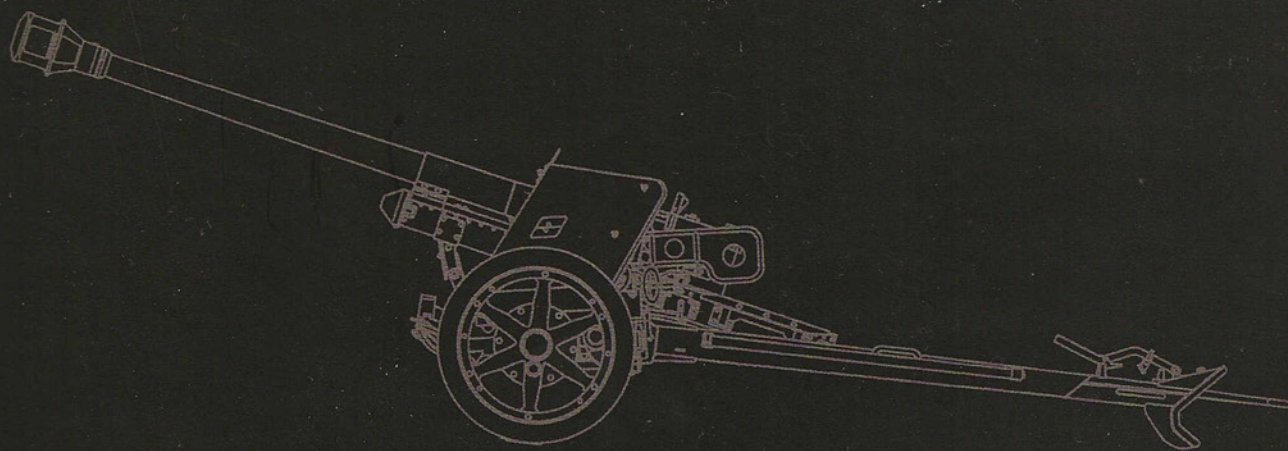


182 color photos • 31 h&w photos
15 pp scale drawings

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Model Centrum PROGRES

Armor PhotoGallery #18

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7,5 cm PaK 40



1 The PaK 40 preserved at the Panzermuseum Munster, Germany. This is probably one of the better known PaK 40s in the World. It is in pretty good condition, but has been repainted in a three-tone camouflage scheme. It appears to be a late production model.

2 The PaK 40 gun preserved in Valkenburg in the southern part of the Netherlands. This gun was left behind during Operation Market-Garden, when the Allies advanced from Belgium to capture the bridges over the Meuse and Rhine rivers. The gun was firing on the town and US troops until men of the 119th Regiment of the 30th Infantry Division put it out of action on 17 September 1944. The damage to the gun is still evident. It is presently placed near the city hall in the middle of the town. As this gun was in use in 1944, one may assume it was originally Dunkelgelb.





3 The PaK 40 gun preserved in Maaldrift, a depot of the Dutch Army Museum. It came from one of the collection points of German equipment in the Netherlands and was taken into the collection shortly after the war. It has never been on public display and is completely original, down to the Dunkelgelb paint. It is, however, coated in a layer of protective oil, which makes it appear darker.

4 The PaK 40 gun preserved in Zandvoort, near Eindhoven in the southern part of the Netherlands. This gun was also left behind during Operation Market-Garden, and has been out in the open serving as a memorial since then. The gun was recently overhauled and repainted and is situated in the square of this small village. Most likely, this gun was also originally in Dunkelgelb. Whether they were given the three-color scheme is unknown.

7,5 cm PaK 40

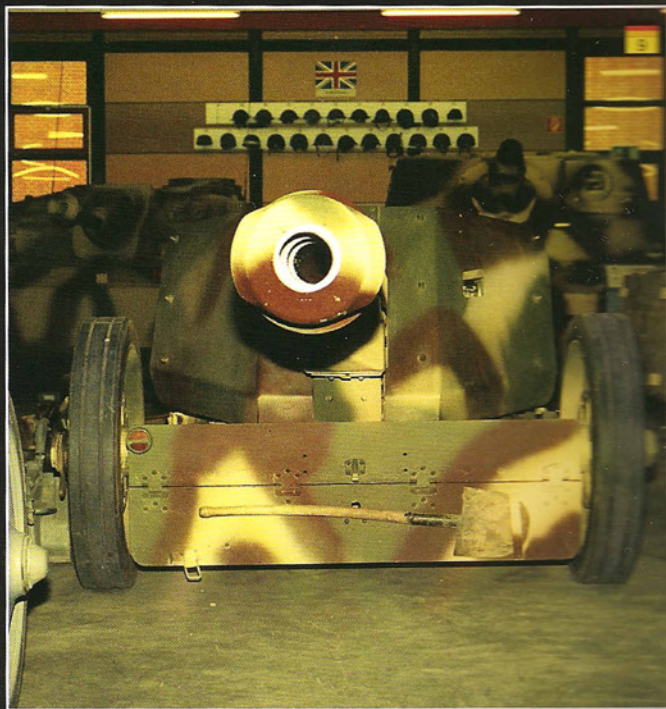
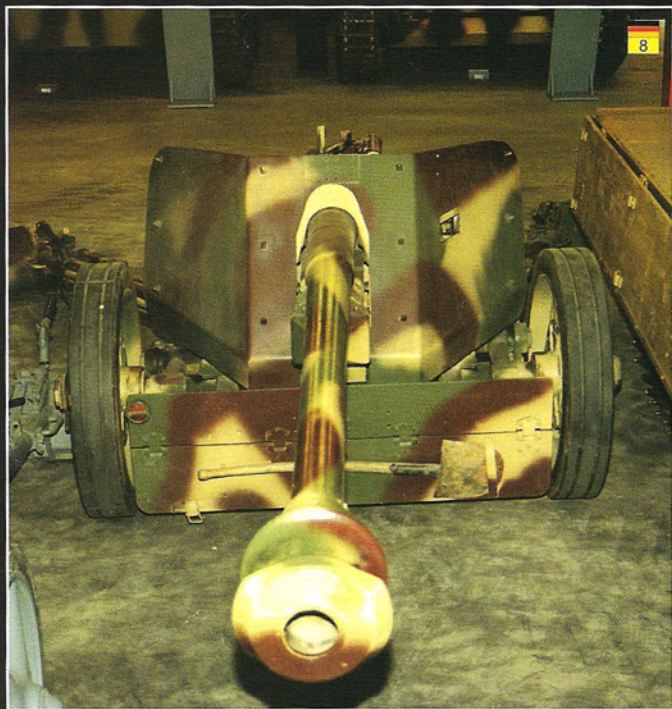
All photos of the Munster gun published in this book are marked with a small German flag  combined with the actual number of the photo.

All photos of the Valkenburg gun published in this book are marked with a small Dutch flag with a small letter "V" , combined with the actual number of the photo.

All photos of the Maaldrift gun published in this book are marked with a small Dutch flag with a small letter "M" , combined with the actual number of the photo.

All photos of the Zandoerle gun published in this book are marked with a small Dutch flag with a small letter "Z" , combined with the actual number of the photo.

In the following photo captions, "left" and "right" on the gun are defined with the viewer facing the breech looking towards the muzzle.



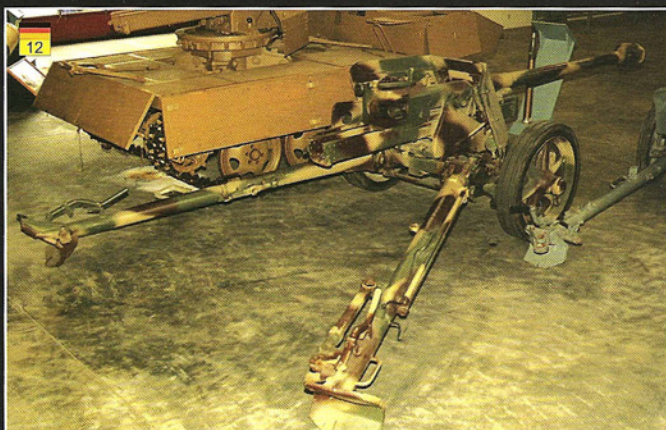
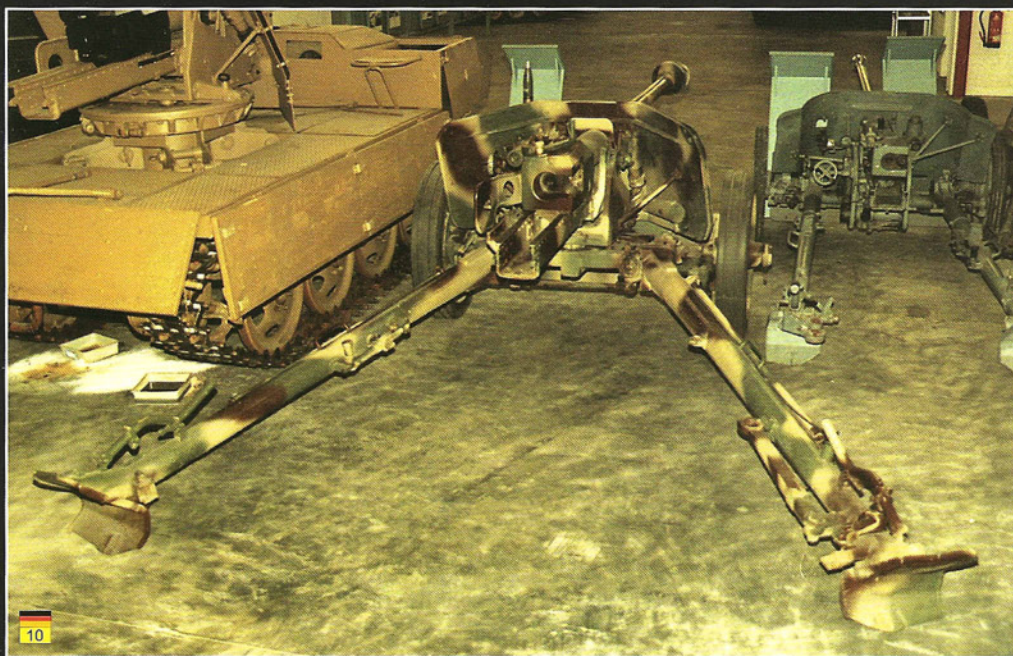


5 6 7 Several views of the PaK 40 in Munster. The 7.5 cm PaK 40/4 Sfl RSO is behind it. In front is the 5 cm PaK 38, which is quite a bit smaller than the PaK 40. Compare the angular shield of the PaK 40 with the curved one of the PaK 38. Early PaK 40s had stamped dish wheels similar to the one seen on the PaK 38 in photograph [6].

8 9 Two views of the front of the gun. The angular gun shield is evident here. The wheels of the PaK 40 had solid rubber tires.

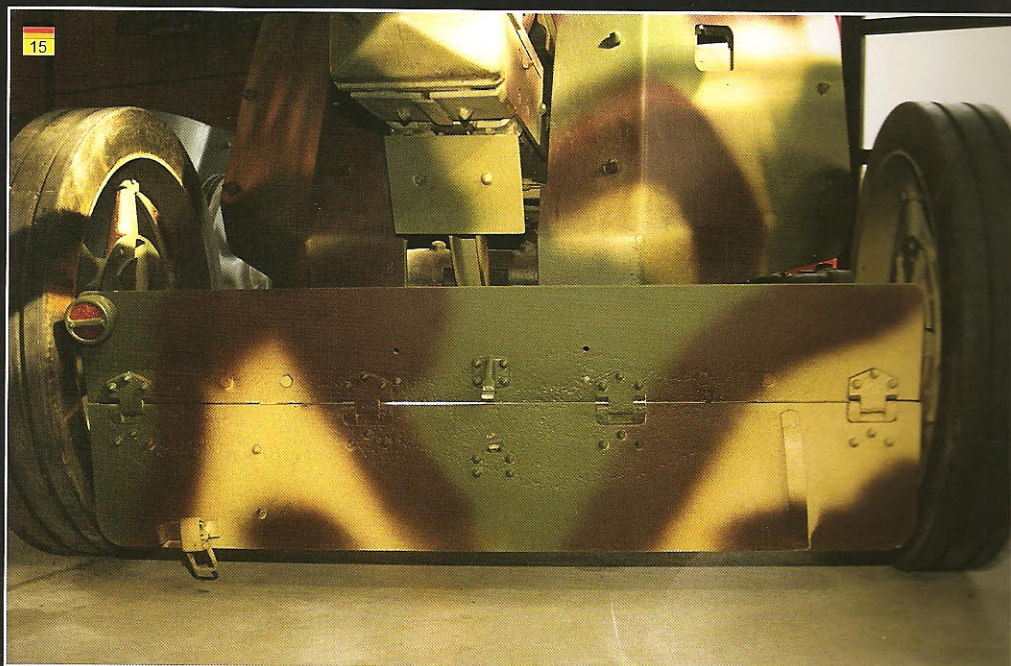
10 11 12 Several views of the rear of the gun. The left hand trail isn't completely spread. The gunner, who aimed the gun, was on the left and the loader on the right. The gun shield didn't really give them a lot of cover, as is also witnessed by some of the period photographs in the back of the book.

13 14 Two views of both sides of the breech.

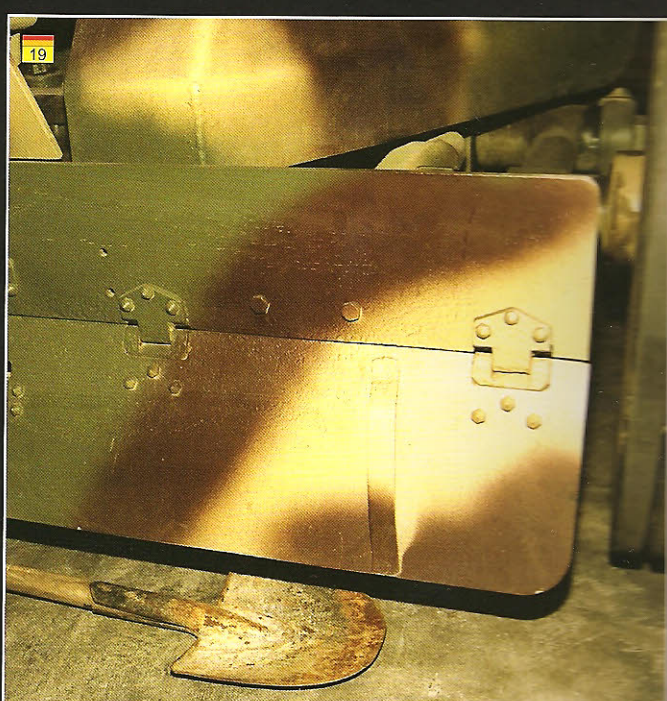
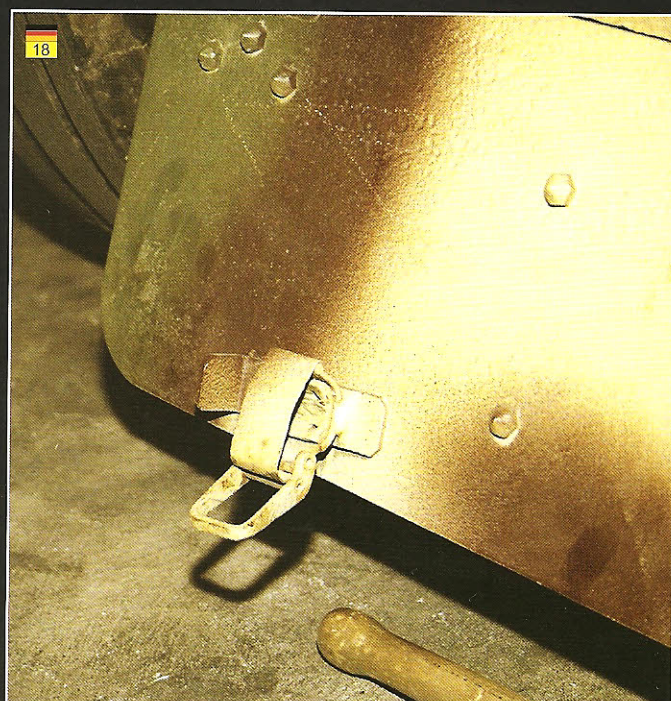
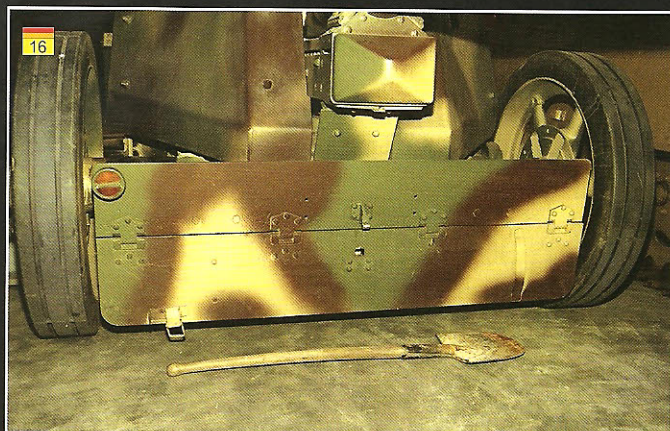


7,5 cm PaK 40

15 16 17 These pictures show the complete lower gun shield of the gun in Munster. The bottom part, or apron, is lowered in firing mode. When raised, it is held in position by the hook in the center of the top plate. There is a release mechanism on the back of the apron. Brackets for spades are on the inside and outside faces of the apron. The spade shown here is a rather warped original.



18 19 Close-ups of the brackets for the spade. The standard equipment clasp is on the left. Though the fastener is standard, the shape of the bracket varies with the type of tool it had to hold. The hinges are bolted to the outside of the top plate and the inside of the apron.





20 The hook that holds the apron is on the extreme left of the photograph. Note that the bolt-heads on the outside of the lower gun shield are conical.

21 22 The inside of the lower gun shield is shown here. The lower gun shield is attached to beams on the

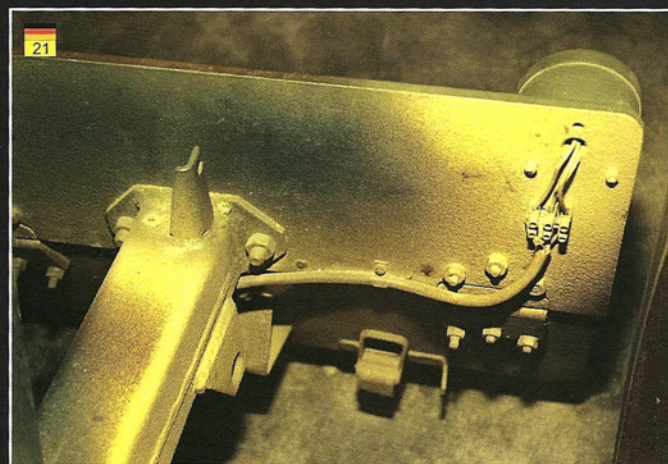
lower carriage. The undercarriage is a hollow welded construction. The welds are visible on the sides of the beams.

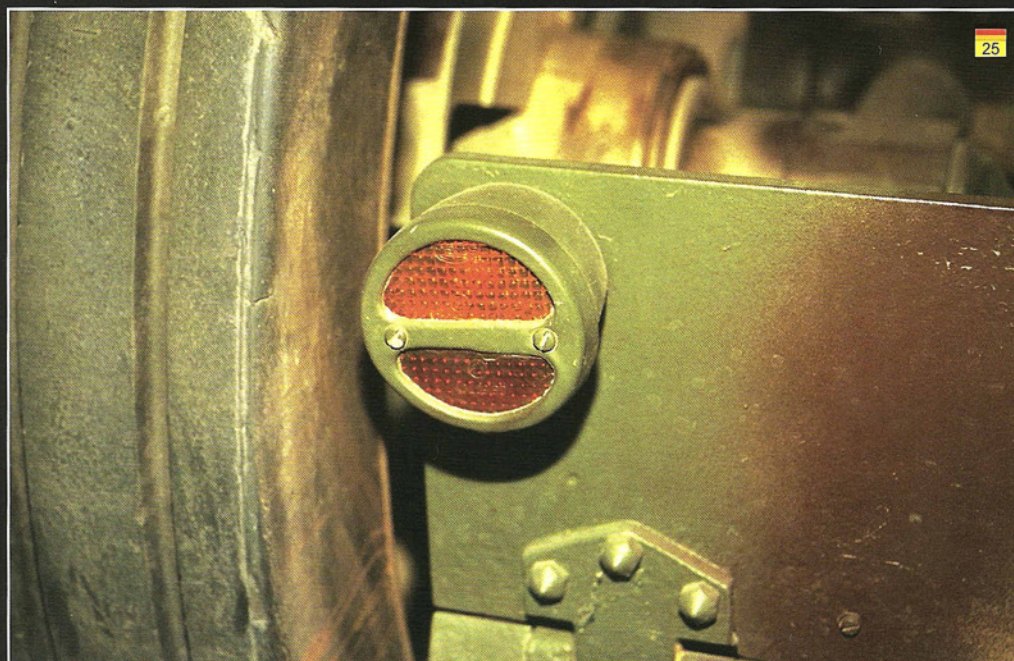
23 The auxiliary pressure tank of the pneumatic system of the Maaldrift gun is shown here. It is connected with the pneumatic system that operates the

brakes. It is used in case of pressure loss in the main system that is operated from the tow vehicle. When the gun was deployed, the pressure in the auxiliary tank was released by pulling the rod.

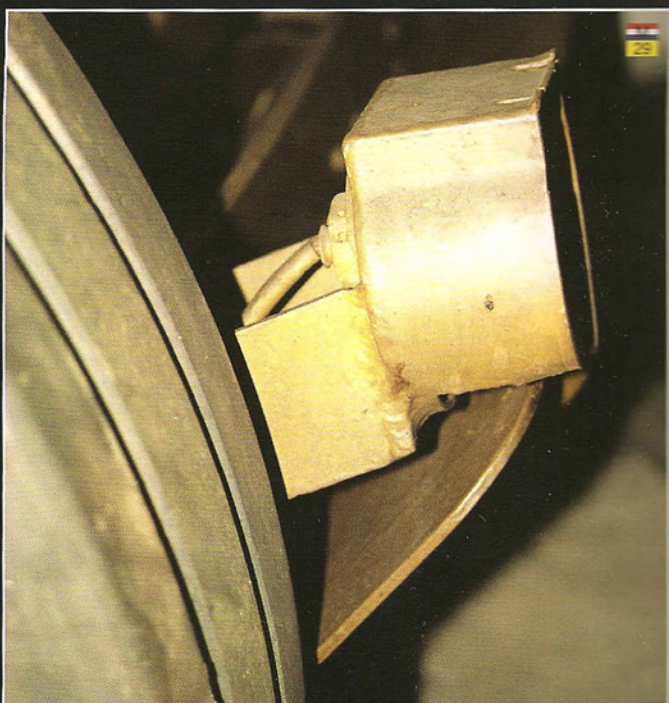
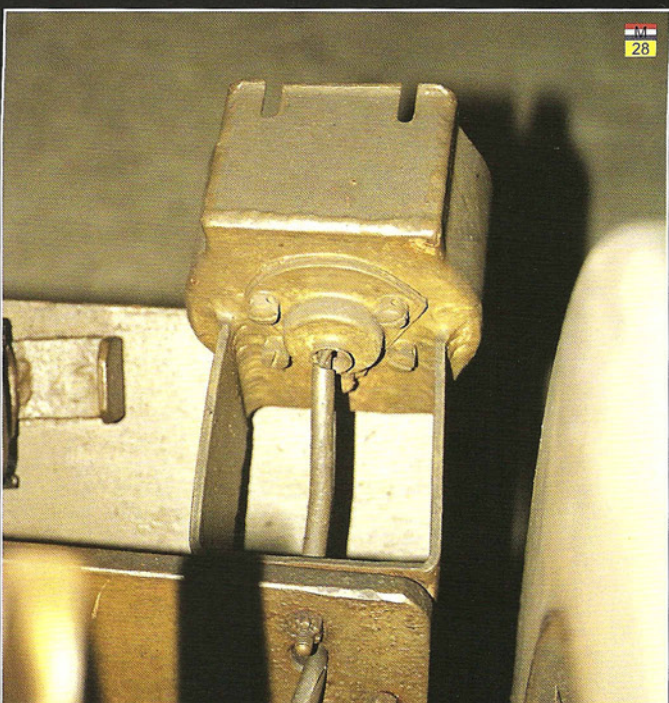
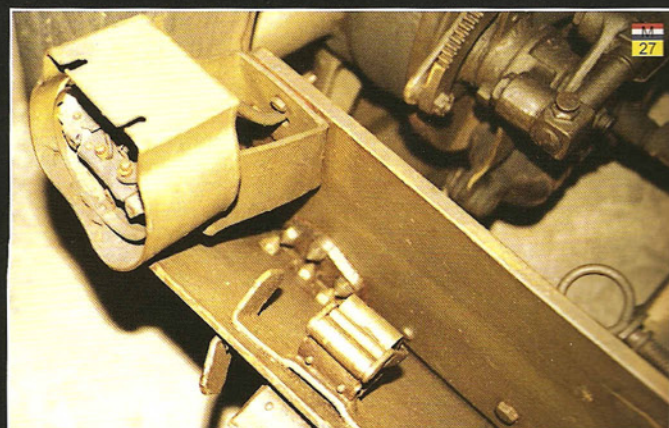
24 The same spot on the gun in Mun-

ster shows no sign of a pressure tank. Since the gun doesn't have brakes it was probably never installed. The bracket for the release rod can be seen in photograph [21] however.

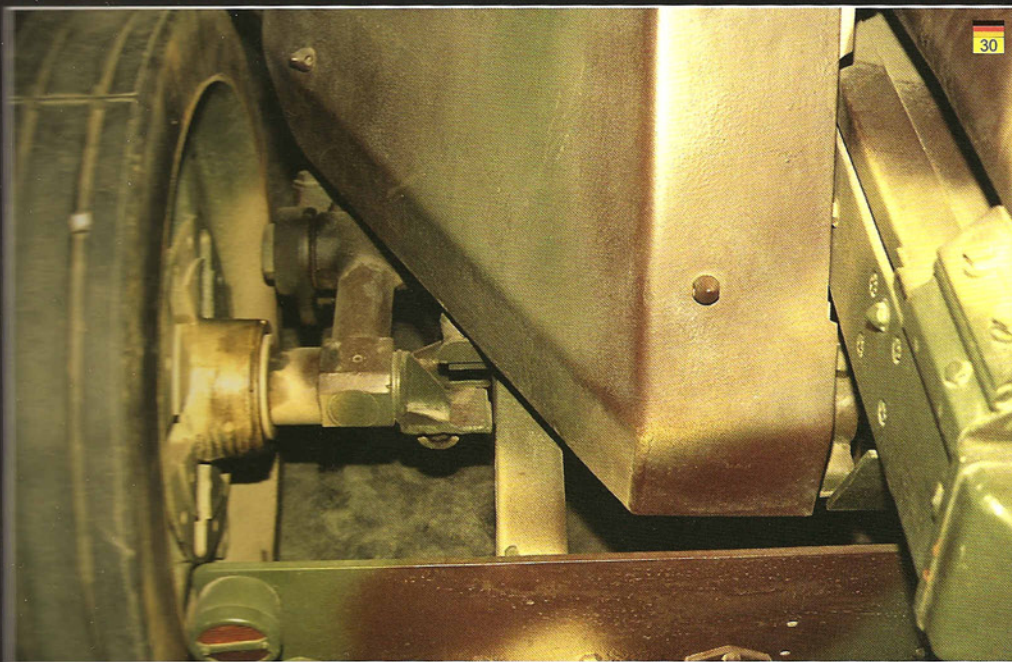
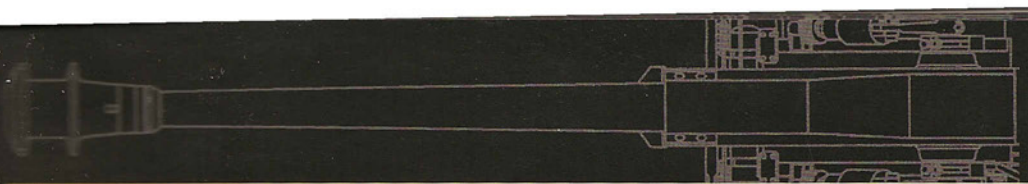




25 The rear light of the gun in Munster seems to be an original item, but it lacks the bracket and housing shown below. The rear light wasn't originally installed on this gun.

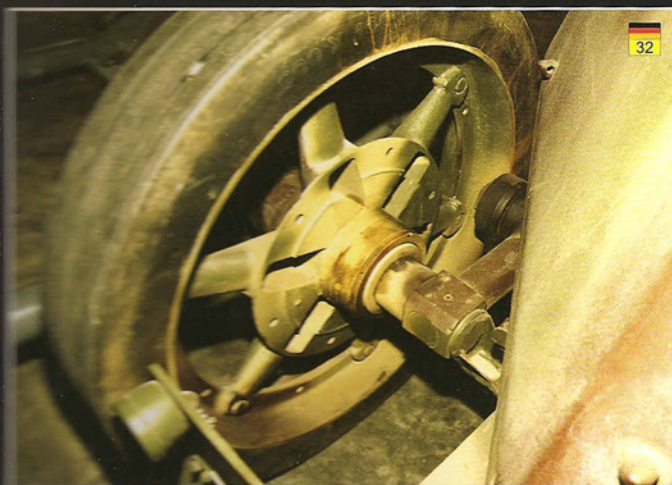
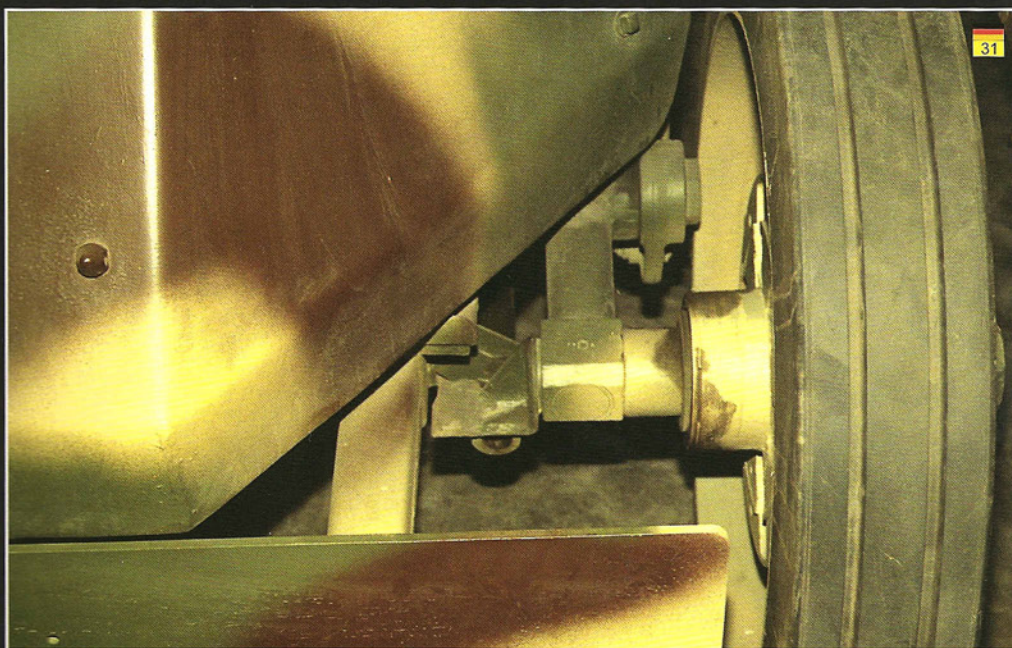


26 27 28 29 Four views of the rear light of the Maaldrift gun are shown here. This is the original bracket and housing found in factory drawings dated 1943 and in period photographs. The front of the light itself is missing. The slots in the top of the housing may be to attach a cover to protect the light from the muzzle blast when the gun is fired. The rear light is at a slight angle to the lower gun shield, which makes it horizontal when the gun is towed.



30 31 The PaK 40 has torsion bar suspension. The swing-arms and stub axles for the wheels are shown here. The extensions on the inside of the axles engage with stops on the undercarriage to limit upward travel. When the trails are spread, a rod goes through the eye on the bottom of the extension to lock the suspension.

32 33 The inner faces of the wheels reveal their secrets here. Note that the spokes have solid ends but are hollow where the attachment plate for the brake drum is. This is done to save weight. Brakes were not installed on the Munster gun. Neither the socket for the electrical system, nor the pneumatic coupling was installed on the right hand trail. The gun in Valkenburg has the same configuration. This may be a simplification to speed up production, as there were never enough PaK 40s to satisfy demand.



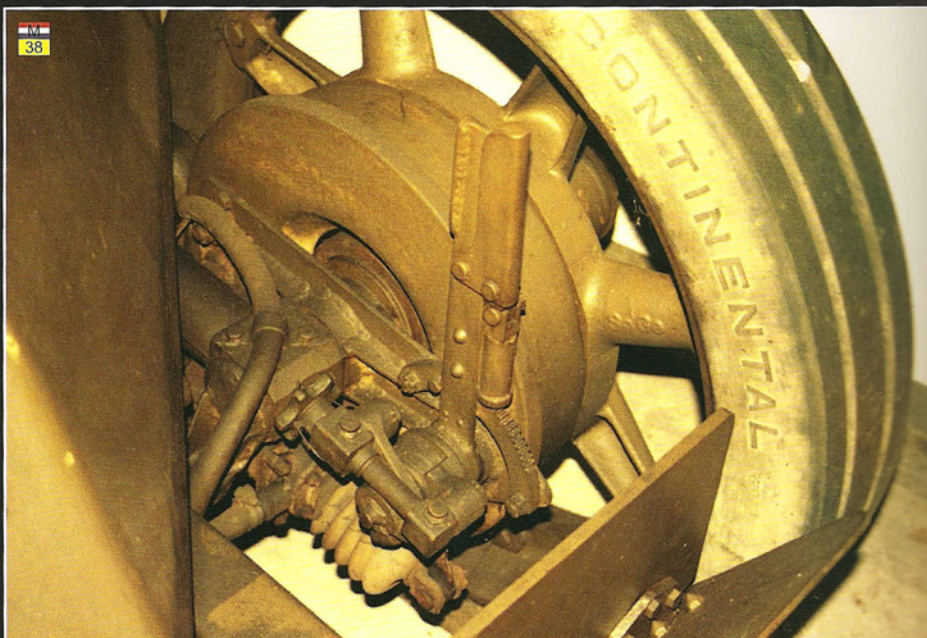
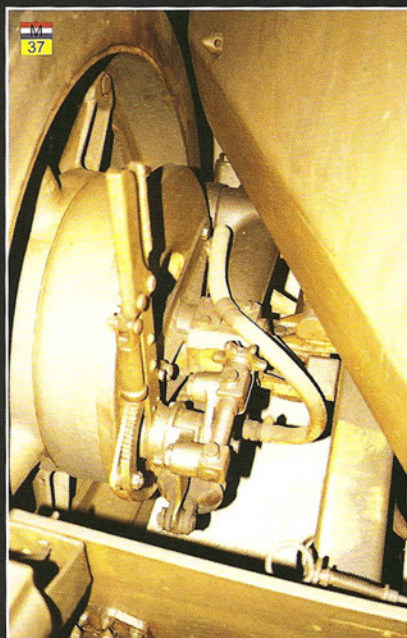
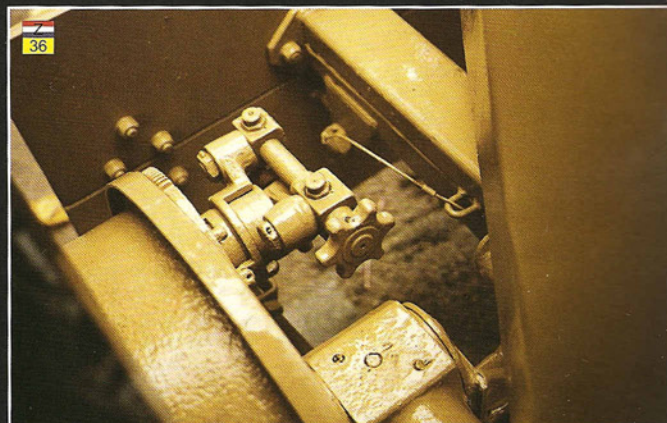
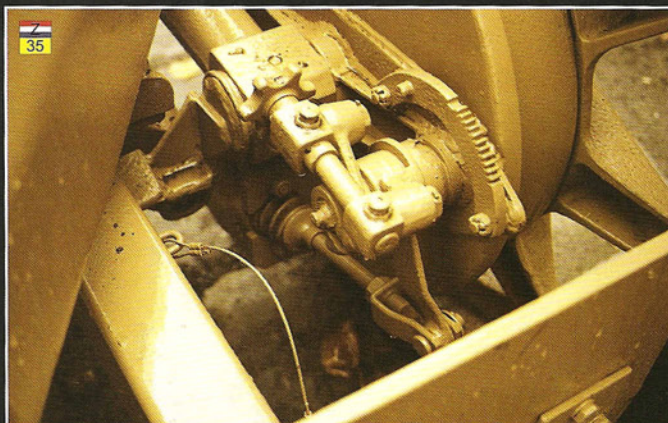
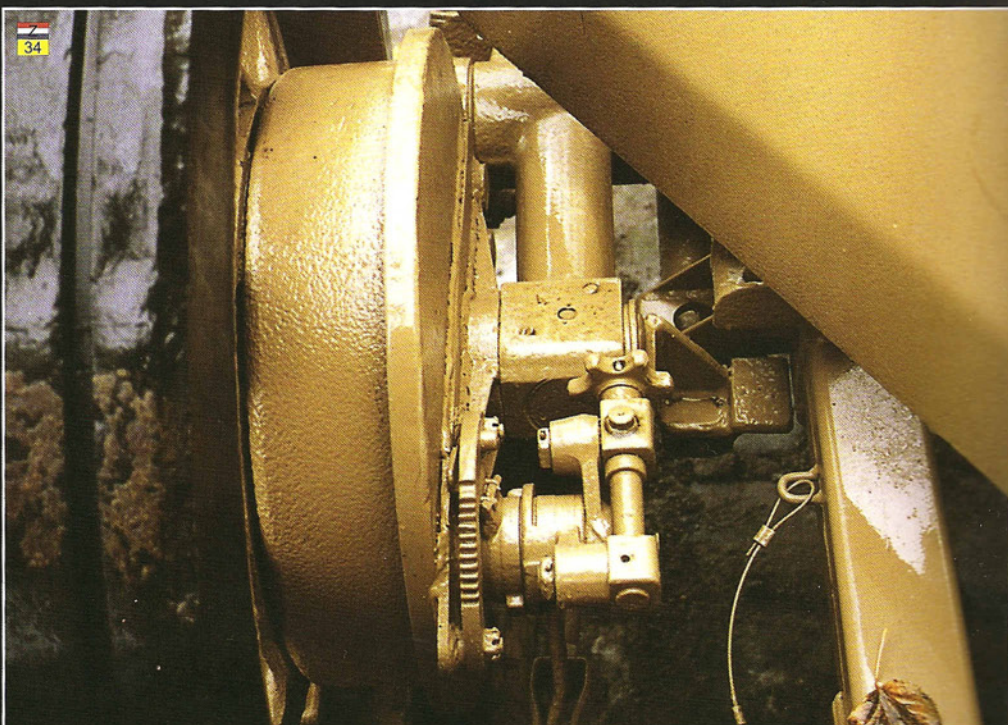
7,5 cm PaK 40

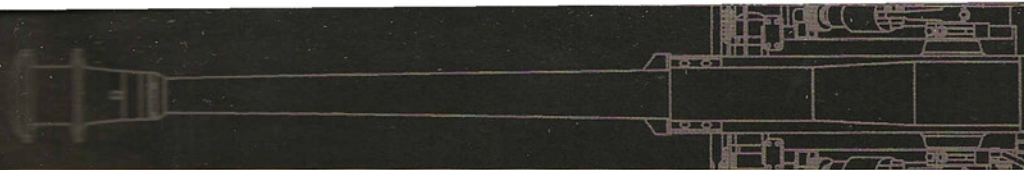
34 The gun in Zandoerle did have brakes installed. The complete set consists of pneumatic brakes and hand brakes. The handles of the hand brakes are missing, but their cams still remain. The surface structure on the brake drums is the result of rusting.

35 The adjustment screw for the brakes is seen here over the rod that connects the hand brake to the brake cylinder. A protective sleeve normally covered this rod.

36 The adjustment screw for the brake is seen from the other side here. The steel cables between the lower gun shield and the undercarriage prevent dismantling of the gun; they are not an original feature.

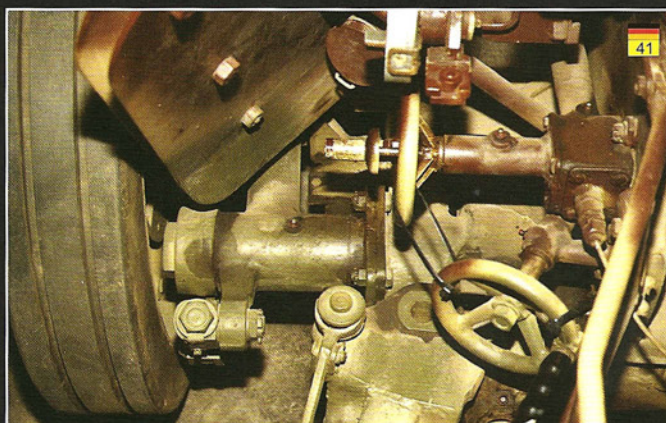
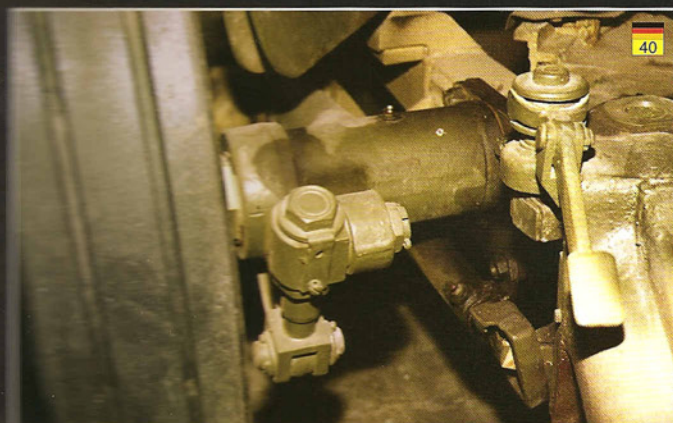
37 38 The brakes of the Maaldrift gun are complete, even the pneumatic conduits are still there. They are connected to the side of the brake cylinder. Pneumatic conduits run between the brake cylinder and the auxiliary pressure tank as well. The rubber sleeve that covers the connecting rod between the hand brake and brake cylinder is visible in photograph [38].





39 The wheel and swing-arm of the gun in Munster seen from the rear. The rod and eye beneath the swing-arm connect to a hook on the head of the trail. When the trail is spread, the rod is pushed forwards into an eye on the underside of the extension of the axle (see photographs [30] and [31] as well), which locks the suspension to provide a stable firing platform.

40 41 42 43 The swing-arm of the PaK 40's suspension consists of a sleeve that goes over the torsion bar and the proper arm that extends to the front and has a stub axle on the front end. This sleeve is rigidly connected to the torsion bar by means of the structure seen in photograph [42]. There is a bent arm at the back of it that is attached to the torsion bar itself (see pages 12 and 13 for views from the side). When the wheel goes up, the sleeve rotates around the torsion bar and pushes down on the connector, which in turn is pushed back by the torsion bar. This action provides the spring in the suspension. Note the grease nipple on top of the sleeve.

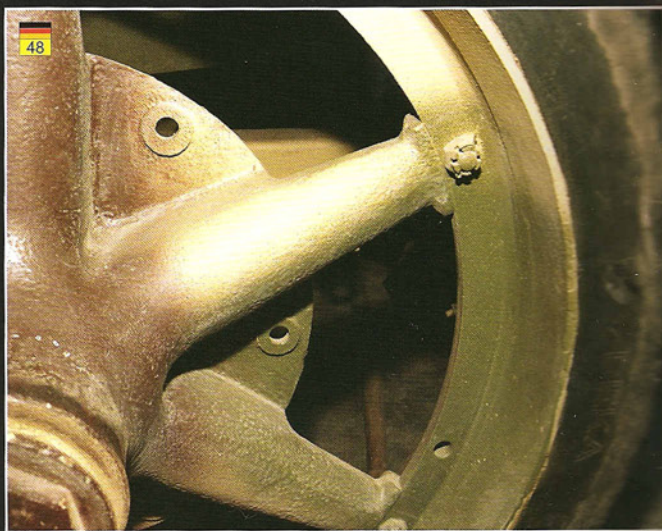
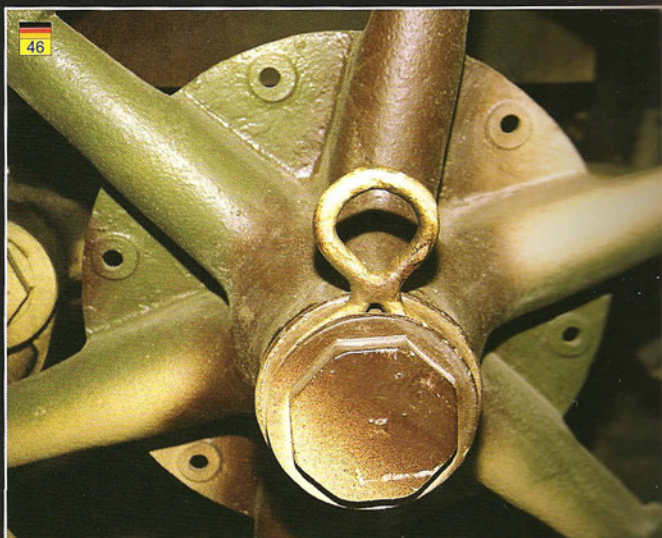
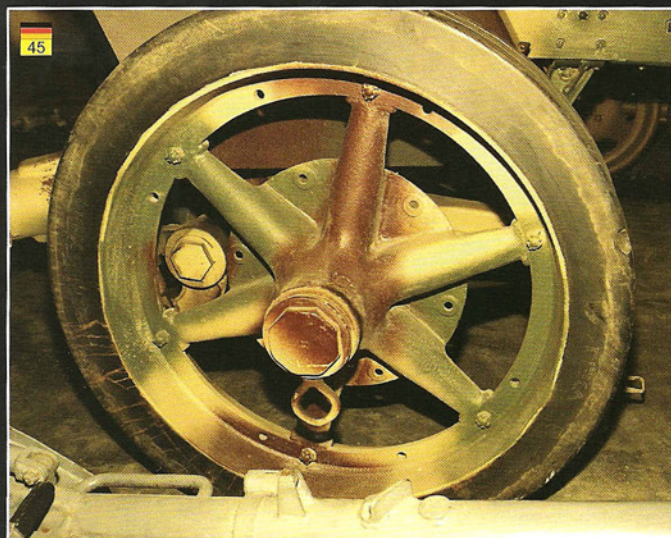
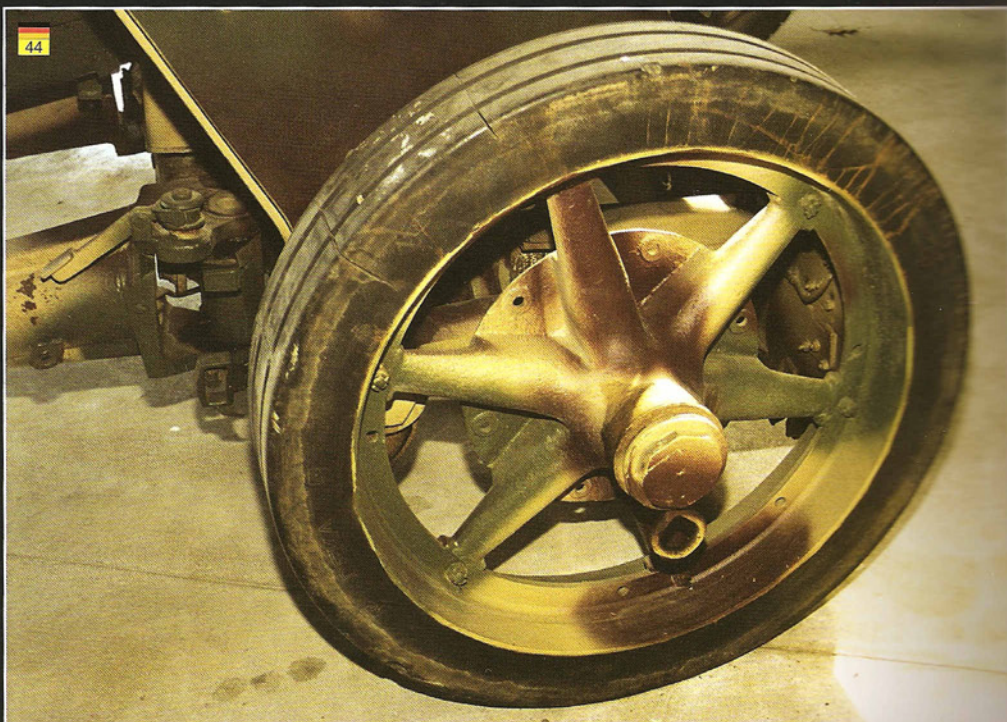


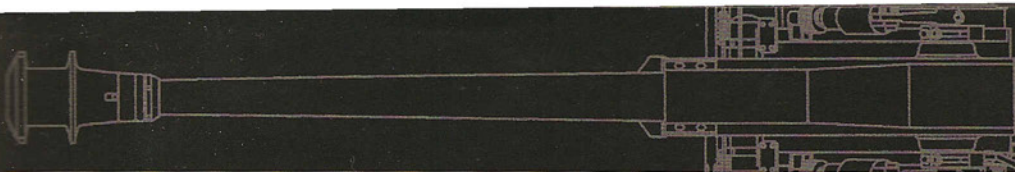
7,5 cm PaK 40

44 45 46 The Munster gun has the type of wheel with six spokes. This is a standard wheel type with an attachment plate for the brake drum, even though brakes aren't installed. The tow eye goes over the axle and is retained by the hubcap. The wheel rim has bolt holes for six and eight spokes.

47 The wheel of the Maaldrift gun has eight spokes, which are alternately convex and concave. The rim has only eight bolt holes; it can only be used with wheels with eight spokes. The shape of the tow eye is slightly different from the one on the gun in Munster, but the hubcaps are similar.

48 This close-up of an original nut shows that it is retained with a Cotter pin. The Cotter pin is held in place by the recesses on the nut. This prevents the nut from loosening through vibration.

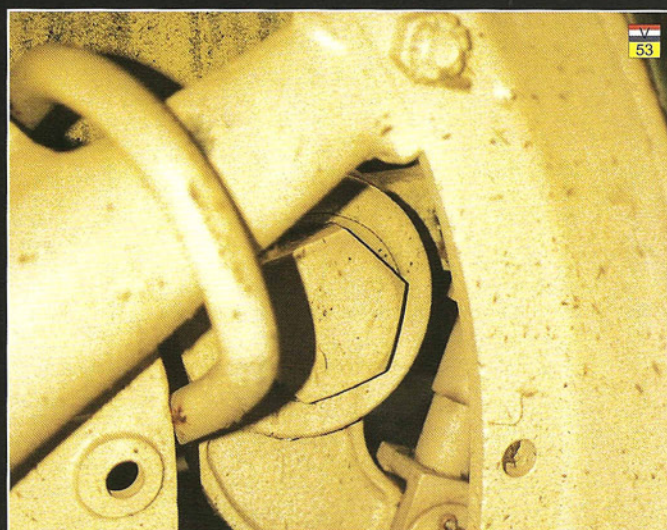


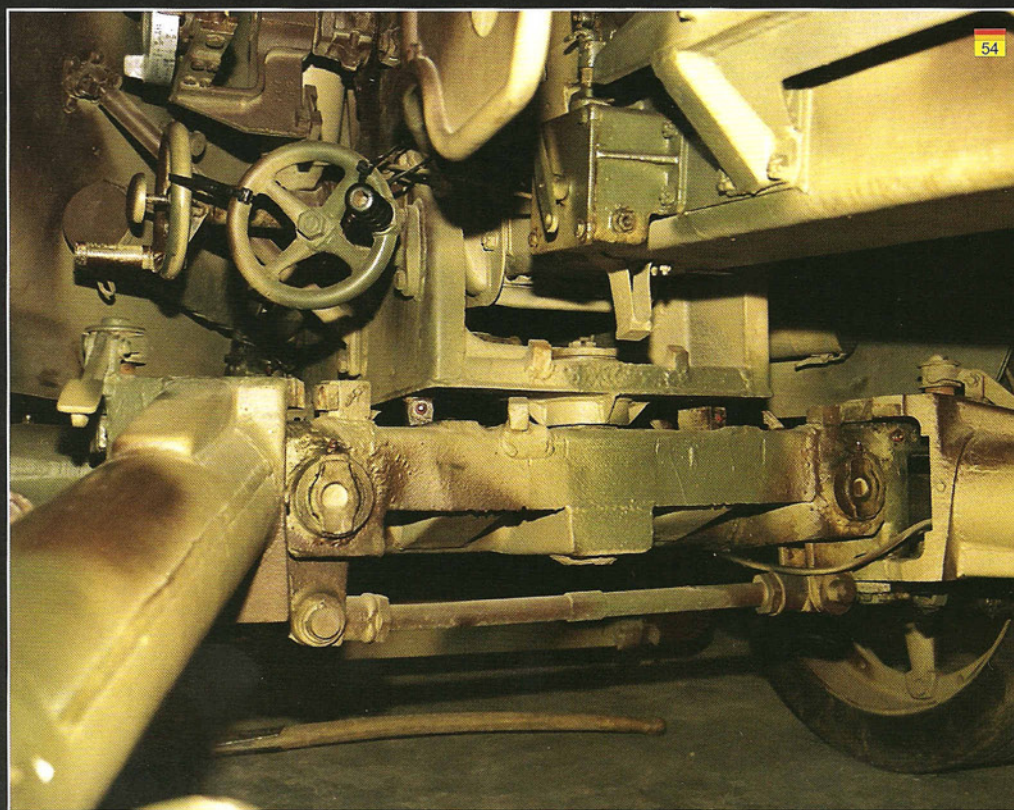


49 50 The gun in Zandoerle has another pattern of wheel with eight spokes. In this case they are all convex. The tow eye differs from those on the other guns as well. It is on the end of the hubcap. All the bolts have been replaced during restoration. Normally the nuts would show on the outside of the wheel rim.



51 52 53 The gun in Valkenburg has the same type of wheel as the gun in Munster. The tire in photograph [51] has probably loosened over time as it is held on with bolts through the wheel rim. Photograph [53] shows how the swing-arm is connected to the torsion bar.

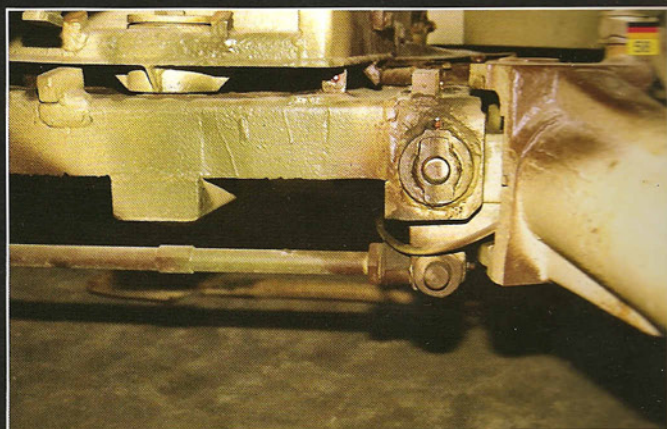
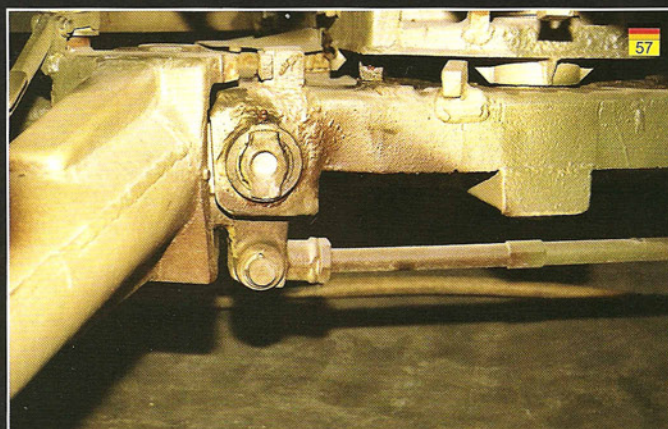
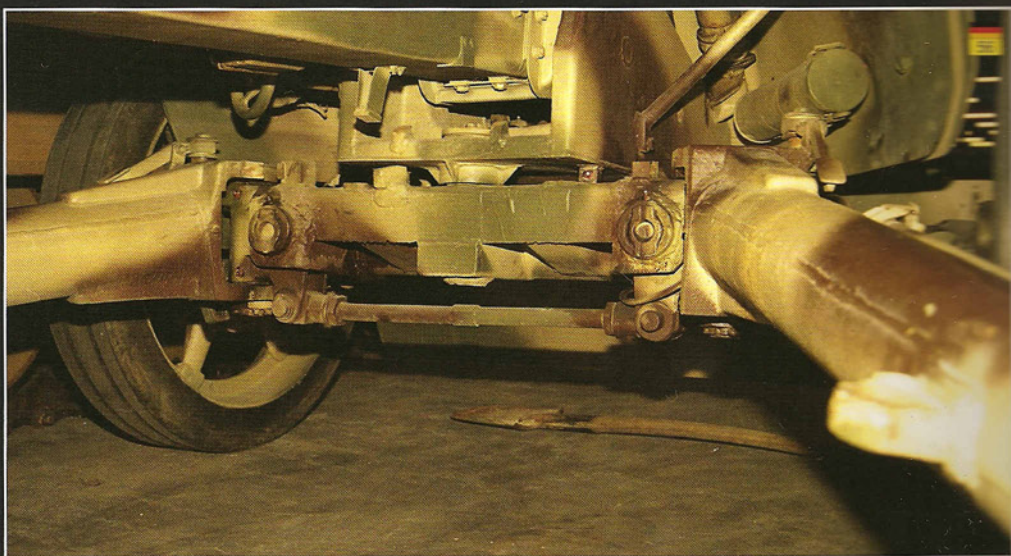
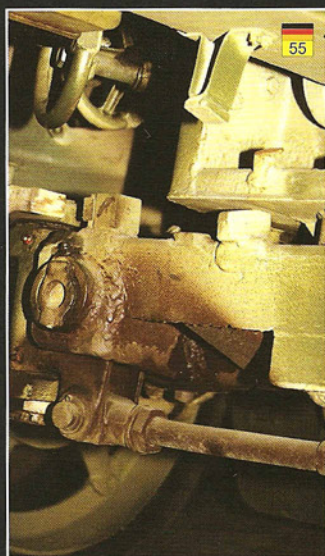


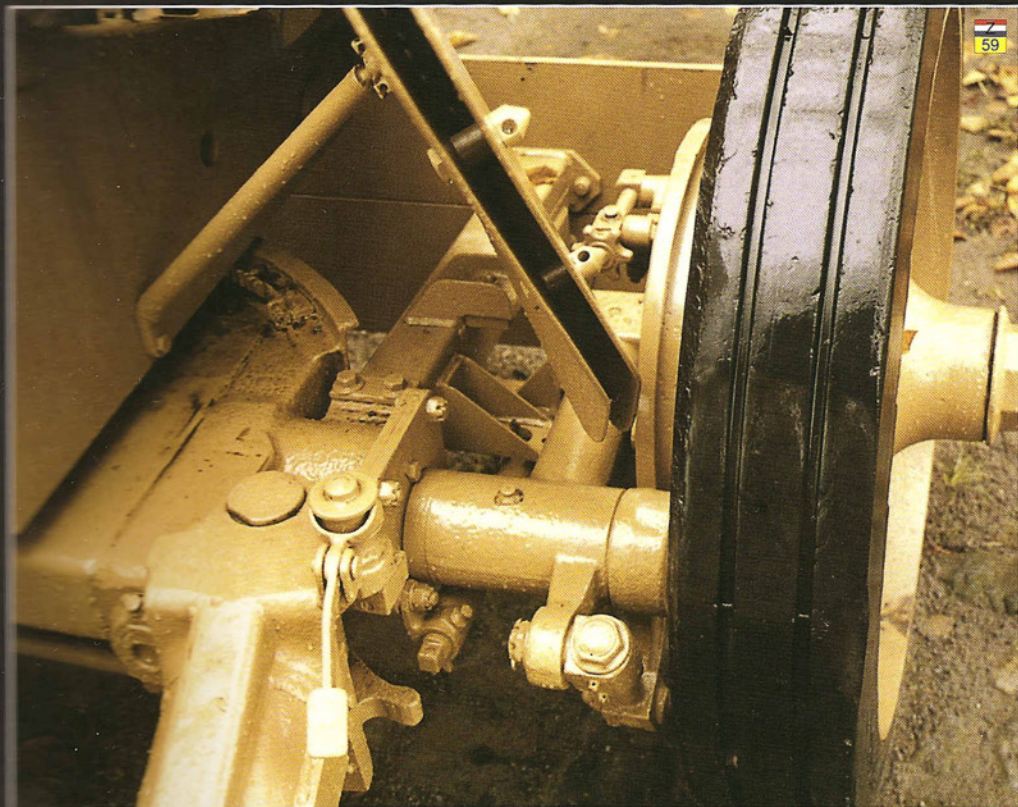
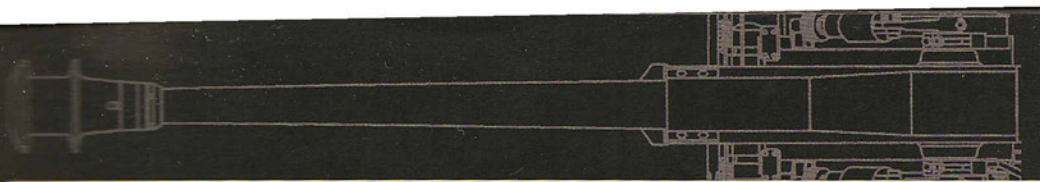


54 This overall view of the rear end of the undercarriage shows the way the trails are connected to it on the corners. The connector is attached to the undercarriage with a horizontal rod, which allows the trails to move up or down. The tie-rod that connects them keeps the trails perpendicular; when one spade goes up, the other has to come down. This mechanism allows the gun to be positioned securely on uneven ground. The trails rotate around vertical rods through the connectors for spreading and closing.

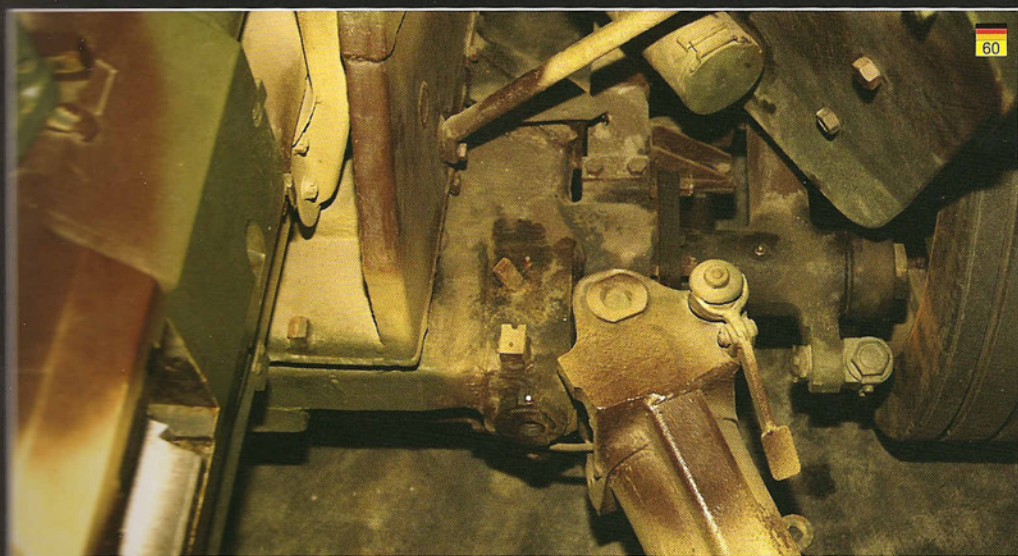
55 56 These photographs show the way the tie-rod is connected to the trail connector. The construction on the underside of the cradle may be a means to limit the elevation of the gun. A similar construction is found on the gun in Maaldrift. If the gun is elevated too far, the breech will hit the ground in full recoil, resulting in damage.

57 58 Close-ups show the trail connectors once more. Note the shape of the rotating point on the upper carriage. The function of various blocks welded to the edges of the upper and undercarriage is unknown to the author.

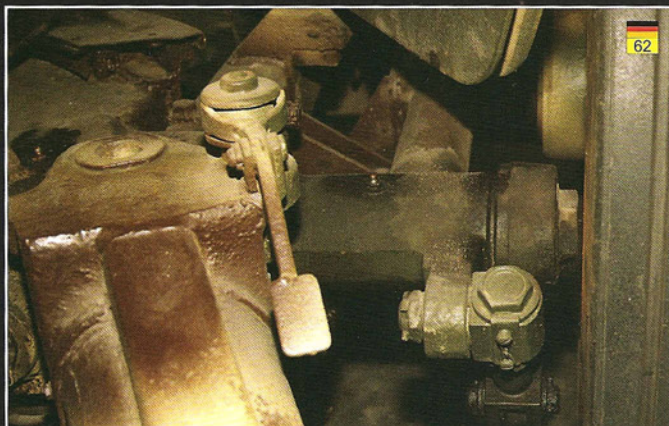




59 60 The trail swivels on a vertical rod through the connector for spreading and closing. The locking mechanism with the foot pedal is situated on the outside of the trail. A spring inside keeps it in the down position. It locks the trail in place when fully spread. The foot pedal is depressed to unlock it. A small block welded to the undercarriage next to the trailhead keeps it from rotating too far inward. The gun in Zandoerle, seen in the top photograph, has lost this feature as well as the protective cover for the traversing arc on the front of the undercarriage. It can be seen in photograph [60].

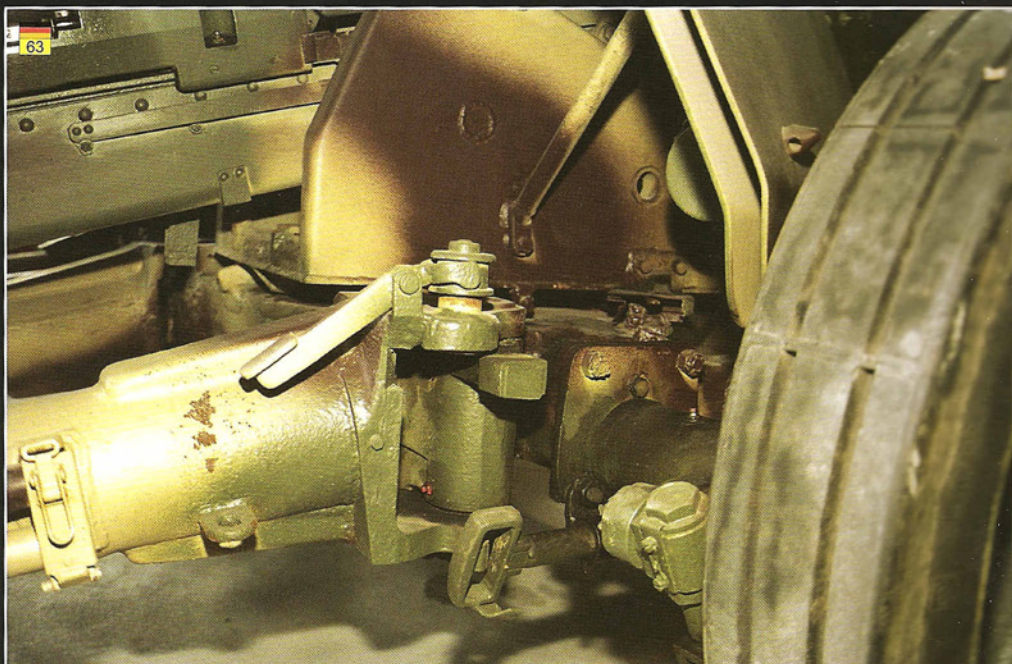


61 62 Two more views of the locking mechanism's foot pedal.

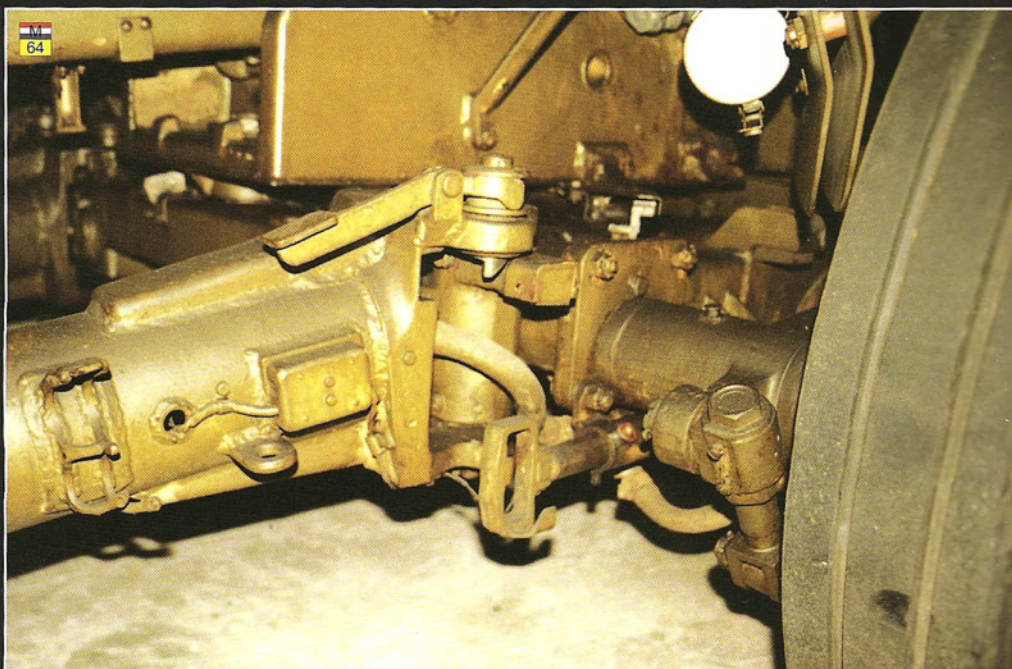


7,5 cm PaK 40

63 The locking mechanism on the gun in Munster is in the up position. Normally it should be kept in the down position by an internal spring. The clamp for the cleaning rods is to the left on the trail. Two sections of the cleaning rod are stored on the right hand trail and one on the left hand trail. A towrope can be hooked to the eye on the trail.

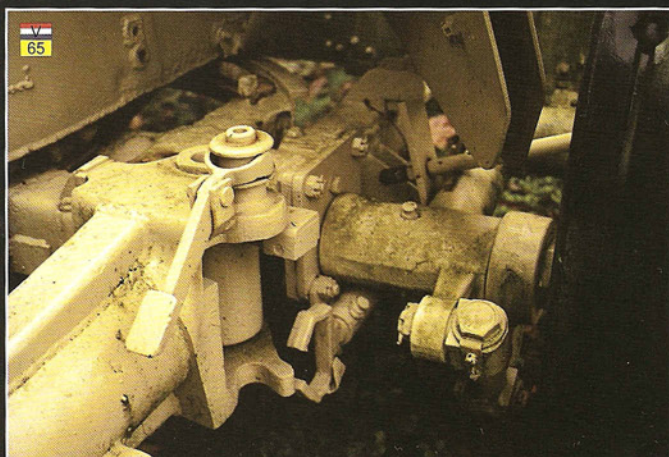


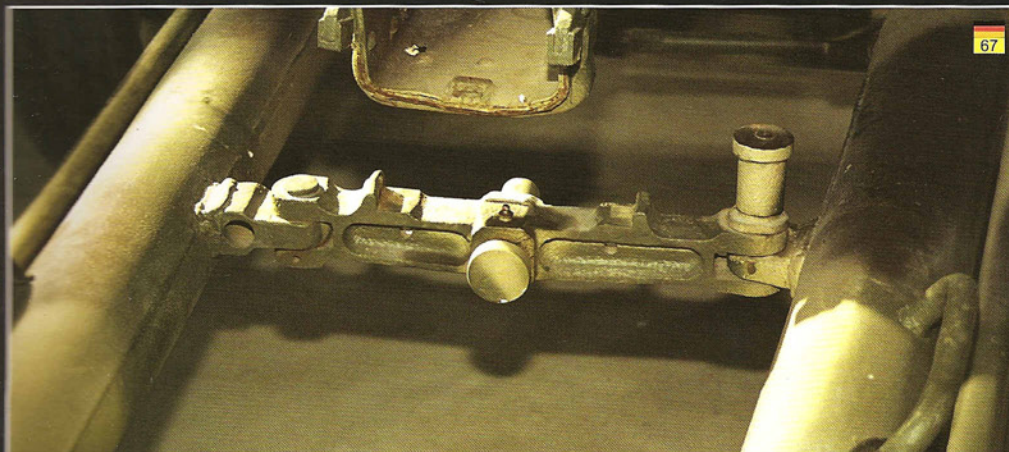
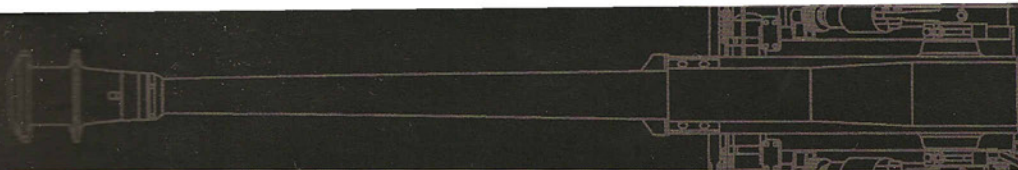
64 The trails on the Maaldrift gun are closed. The locking mechanism is in the down position and the claw that hooks behind the stub on the outside of the connector is visible. This claw is lifted by the action of spreading the trail and then drops behind the stub when the trail is completely spread. The gun in Maaldrift still has all the provisions for the pneumatic and electric systems. The electric lead emerges from the side of the trail and then goes through the box before being led along the underside of the undercarriage to the rear light on the lower gun shield. The pneumatic lead emerges from the end of the trail and curves around the connector to a T-junction on the underside of the undercarriage and from there to the brake cylinders on both sides of the gun. Note the shape of the bracket for the cleaning rods; the clamp and fastener are missing.



65 The gun in Valkenburg has the same configuration as the one in Munster. Neither the pneumatic nor the electric systems are installed.

66 The parts for the electric system are missing from the gun in Zandoerle, but the base for the box and the exit hole for the electric lead are visible. Many of the openings on this gun are welded shut to prevent water from lodging in the gun and causing more damage.

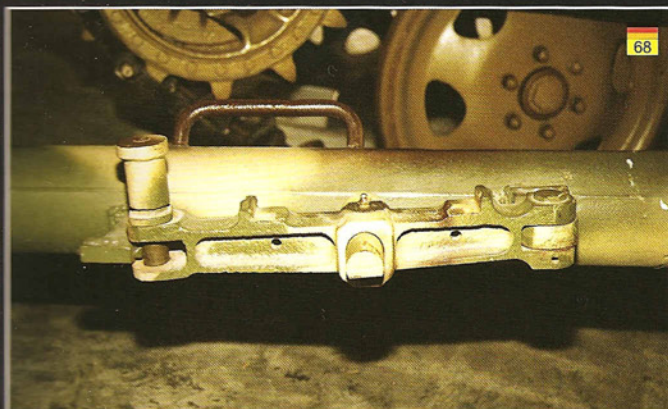




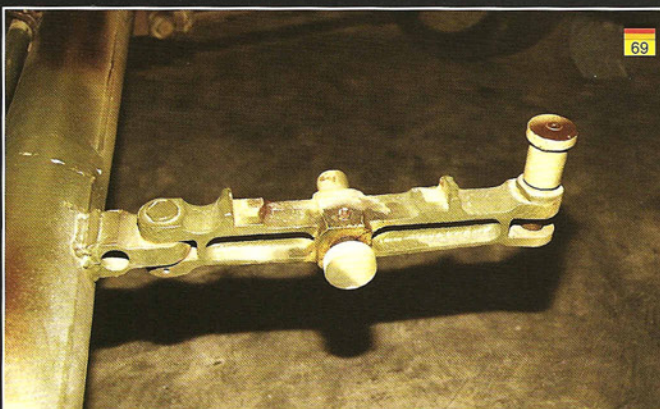
67

67 68 69 The cradle lock of the PaK 40 is situated between the trails. The protrusions on the end of the cradle come to rest on the bridge and the lock itself grips the bottom of the cradle. The lock on the gun in Munster may not be original. Photograph [67] shows the cradle lock in travel position. The handle on the right is internally sprung and has to be lifted to release the bridge and swivel it back to rest along the trail.

70 The bridge of the travel lock on the gun in Zandoerle is in firing position. It should be further back towards the trail to be properly fastened. Lifting the handle will free it again. The cradle lock itself is missing.



68



69



70

71 This is the complete cradle lock of the gun in Maaldrift. It is shown in travel position. The manual states that the handle should be turned from left to right and vice versa to either engage or release the lock. The pins protruding from the bridge limit the movement of the travel lock's handle. They are not present on the other guns, though their location holes are.

72 This protrusion on the inside of the left hand trail retains the bridge of the cradle lock, when in firing position.



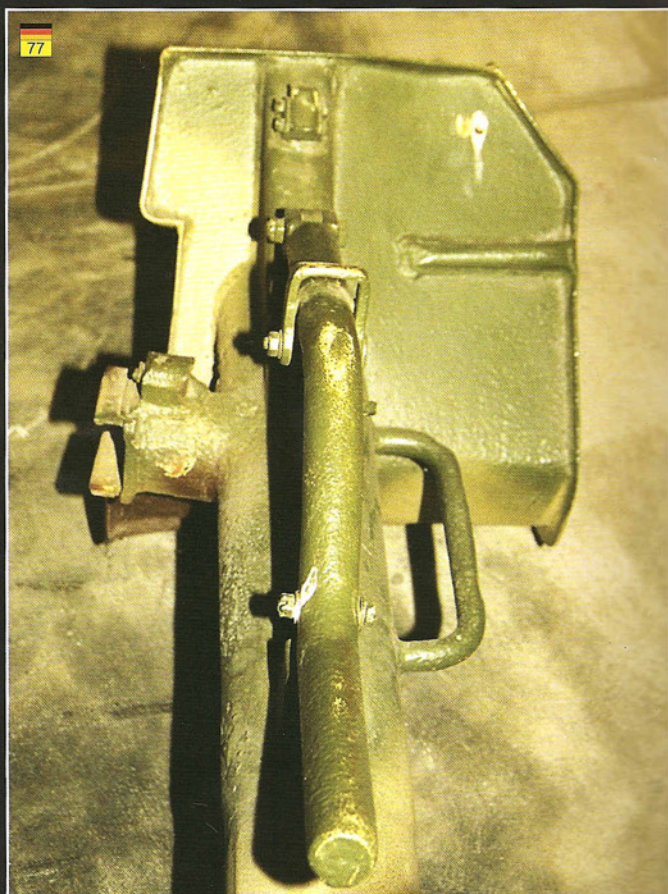
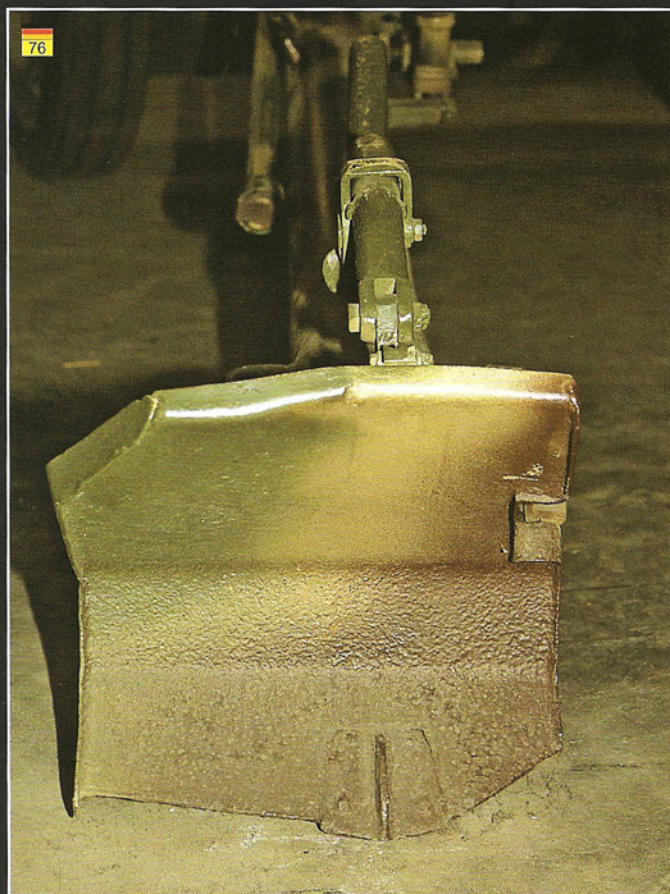
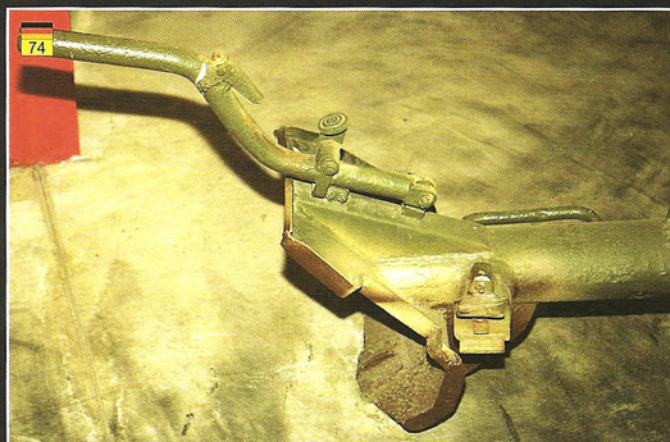
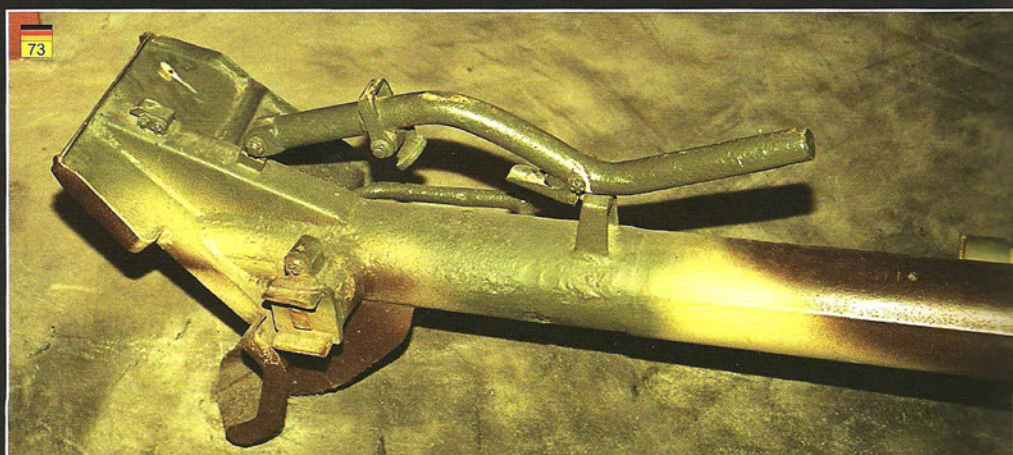
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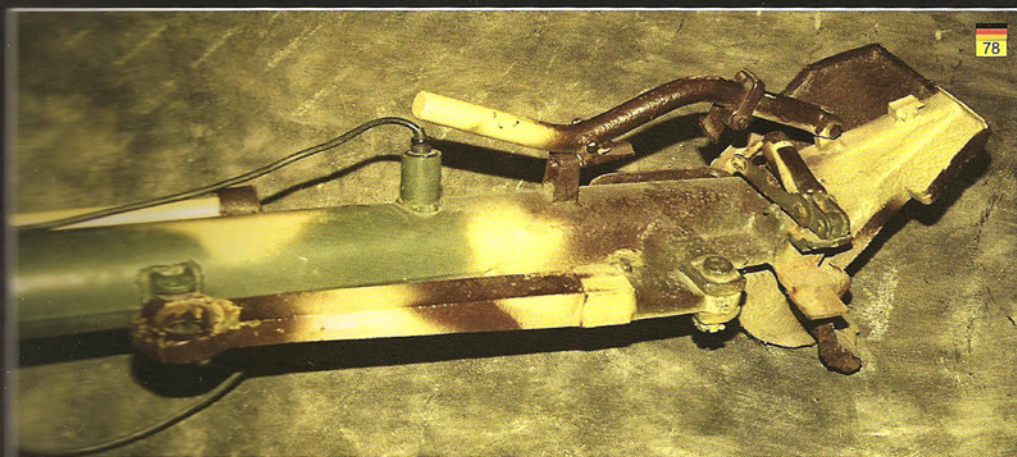


72

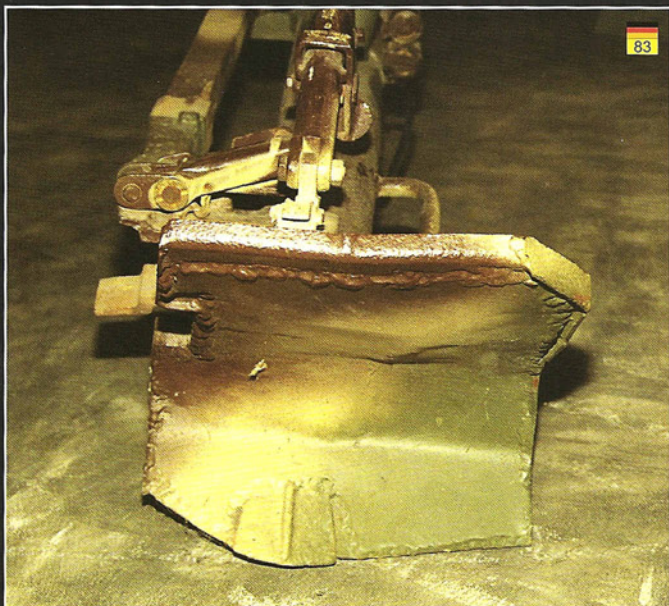
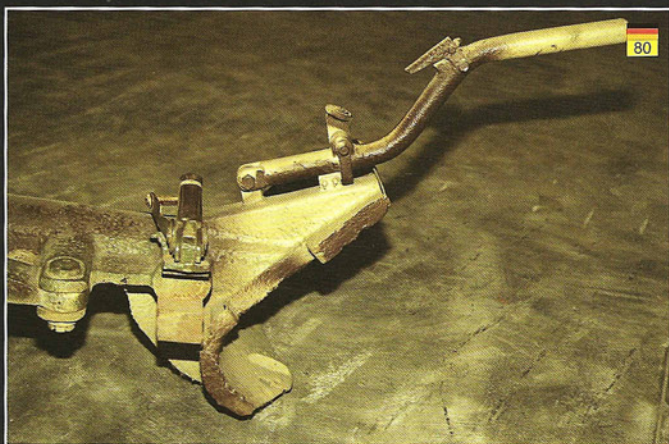
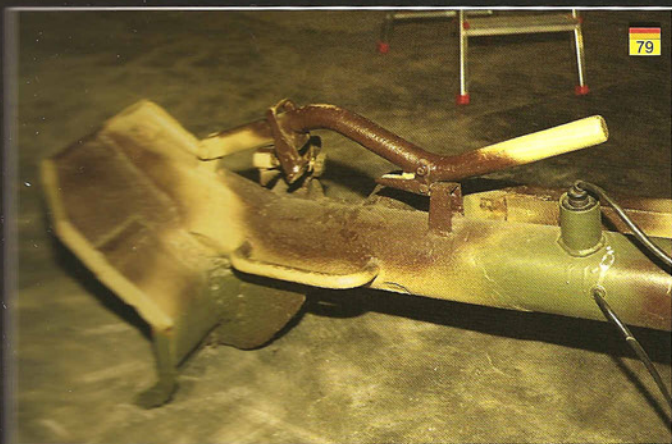
7,5 cm PaK 40

73 74 75 76 77 The rear of the left-hand trail of the gun in Munster is shown here. The folding handle is shown in travel position except in photograph [74]. These handles were used to swivel the whole gun in order to fire in another direction. Handles on the sides of the trails, one near the spade and one about halfway up the trail, are used to manhandle the gun and spread the trails. The trail itself tapers toward the spade. It has a weld along the inside of it. The spade is mounted on a sleeve that is welded on the outside.



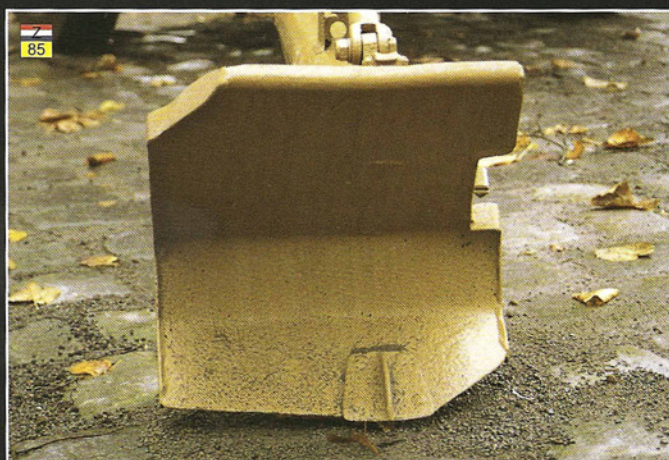


78 79 80 81 82 83 The rear of the right hand trail of the gun in Munster is shown here. The spades are made of thin steel plate. The tow bar is stowed in firing position. It is held in place by the device shown in photograph [82]. The socket for the electric lead is not original (see pages 22 and 23 for the original). The trail lock is on the inside of the right hand trail. Photograph [80] shows the folding handle in the up position. The fastener is sprung and simply pushing the circular top releases it.

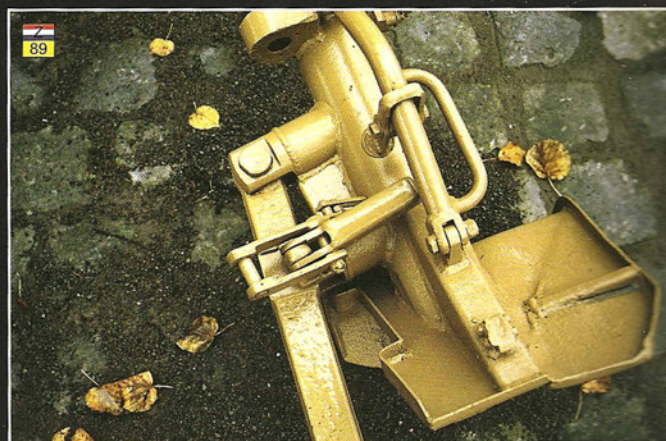


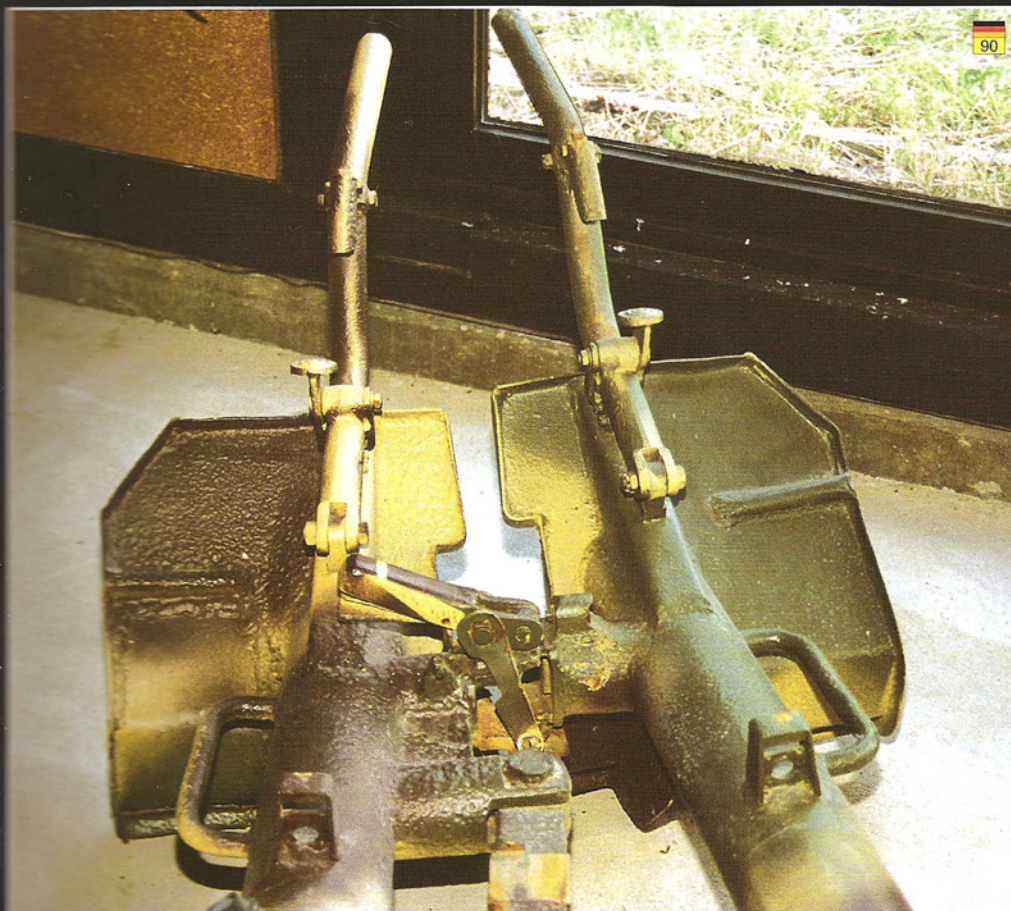
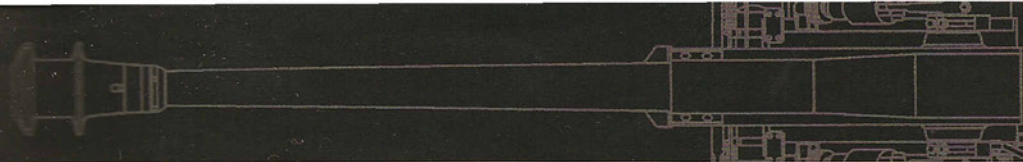
7,5 cm PaK 40

84 85 86 The left hand trail of the gun in Zandoerle shows that sixty-odd years in the open have taken its toll. Quite a few small parts, such as the fastenings that hold the folding handles in travel position, are missing. The welding on the trail shows up well in these photographs.

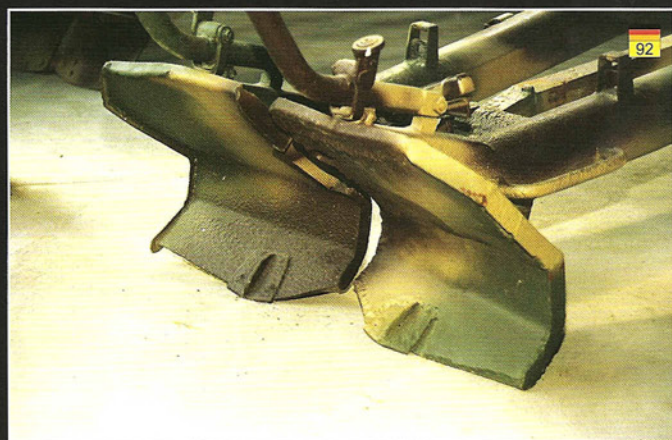


87 88 89 The right hand trail has the tow-bar and the trail lock attached to it. The tow-bar is shown in travel position here, even though the trails are spread. The spades would be dug in to about the upper bend when in firing position. The tow-bar has to be out of the way to achieve this. The housing for the electric socket is on the inside of the trail and the pneumatic coupling on the outside.





90 91 92 The trails of the gun in Munster are in travel position here. Officially, the tow-bar should point to the rear and the handles should be folded down. The trail lock is not engaged either.



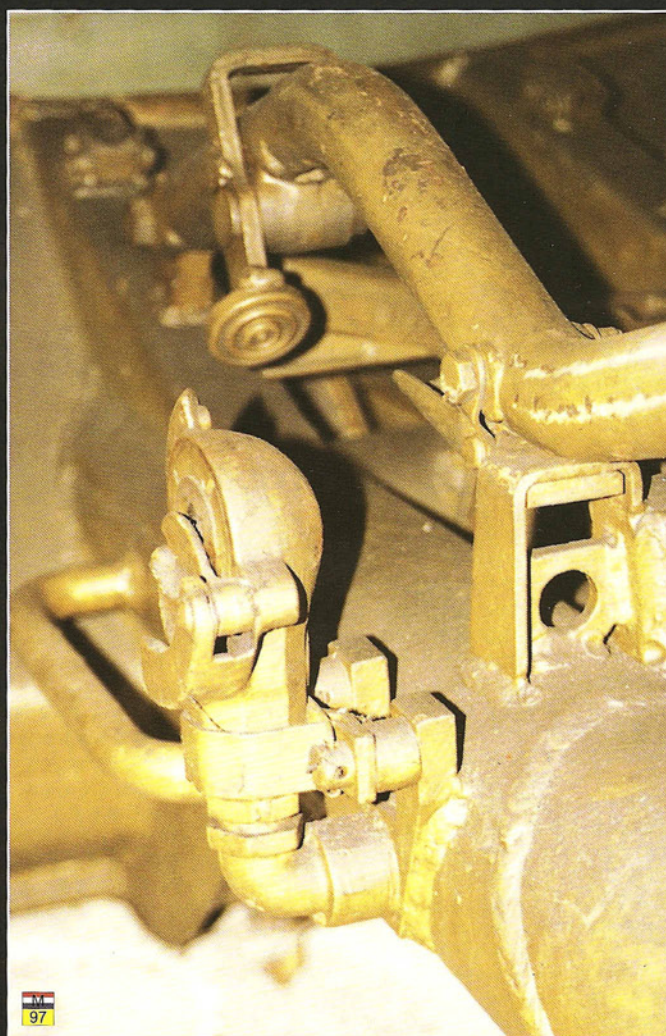
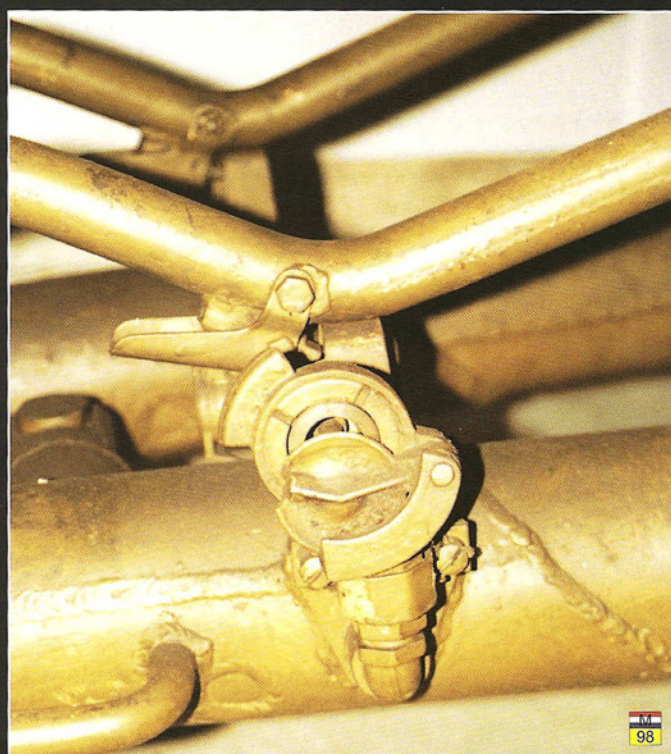
93 94 The trails of the gun in Valkenburg are in travel position as well. The trail lock is partly engaged; the handle should be pushed down to fully lock the trails. The clamp hooks behind a stub on the left-hand part of the lock. The hook on the handle engages the small stub on the right-hand part to lock everything down. Pushing on the rib in the handle releases the hook and allows one to open the trail lock. The tow-bar is also held in place by the trail lock.

7,5 cm PaK 40

95 The trails of the gun in Maaldrift are in the proper travel configuration. The handles are folded and the tow-bar points to the rear, ready to be hooked onto the tow vehicle.

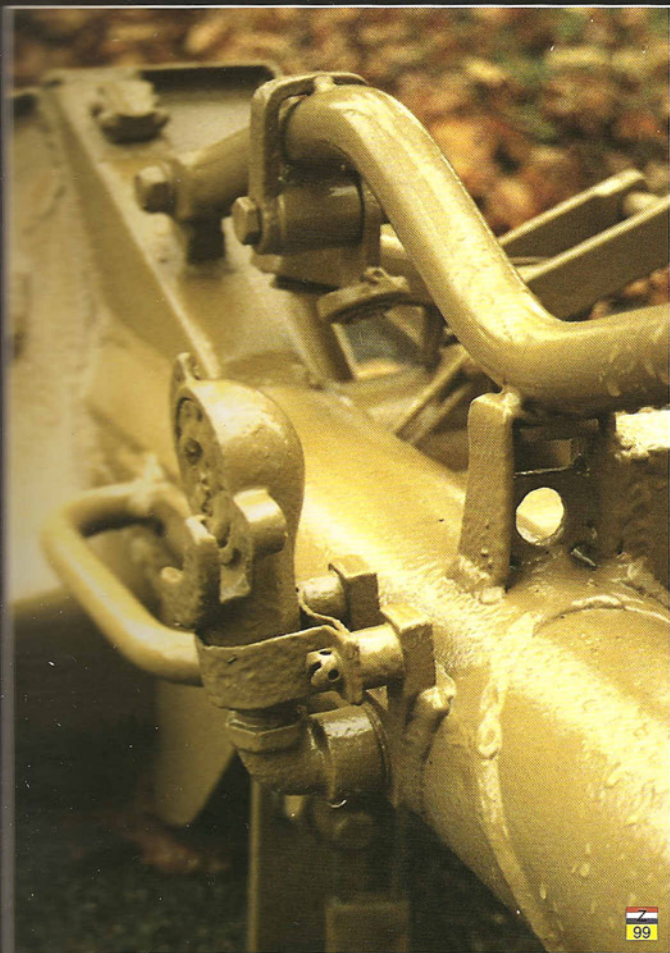
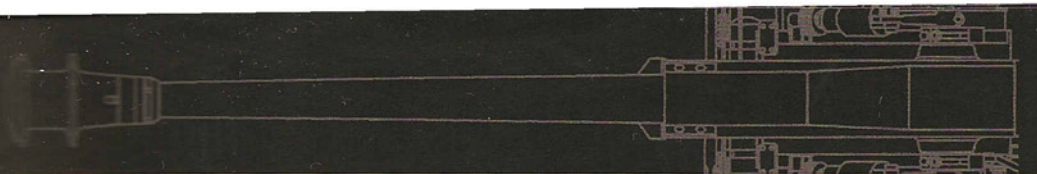


96 Here you see the complete socket for the electric system. A cable with plugs on both ends is used to connect it to the socket on the tow vehicle. Note the protective cover over the socket itself.

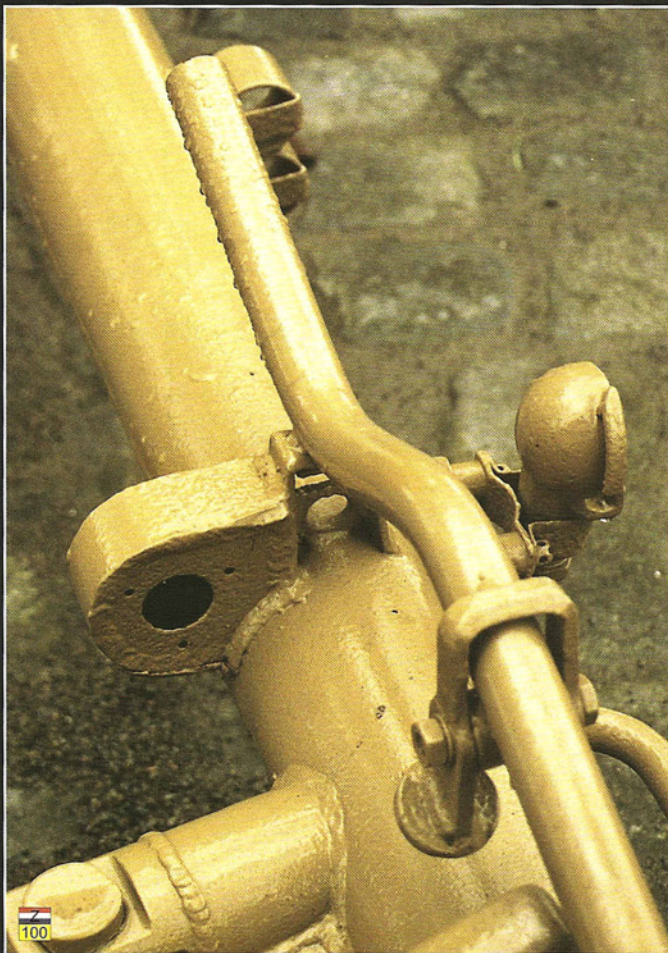


97 98 The coupling for the pneumatic system is shown here. The protective cover is a bit too far down; it should cover the hole in the coupling. It can be swiveled to the right to open the coupling. The connecting hose has

a similar coupling on the end. The two couplings are put together and turned to let their cams and gutters engage. The fasteners that retain the folding handles can be seen clearly in these photographs.



99



100



101

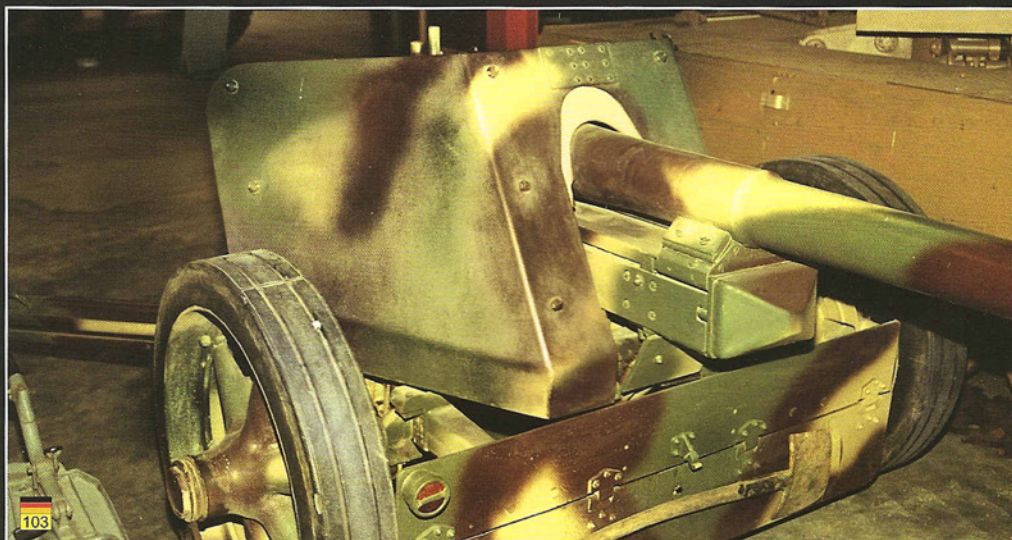
99 100 101 102 The protective cover of the pneumatic coupling on the gun in Zandoerle is missing, but the rest is basically there. It has survived sixty-odd years of exposure to the elements. If the guns in Munster and Valkenburg

had it installed, some of it would be left. The housing for the electric socket is still present, but the socket and protective cover have gone. The double rear bracket for the cleaning rods is visibly in the top of the photograph [100].



102

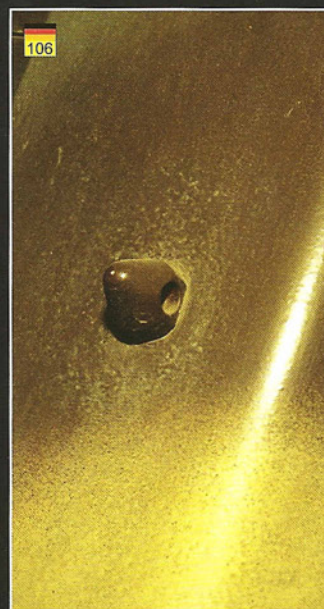
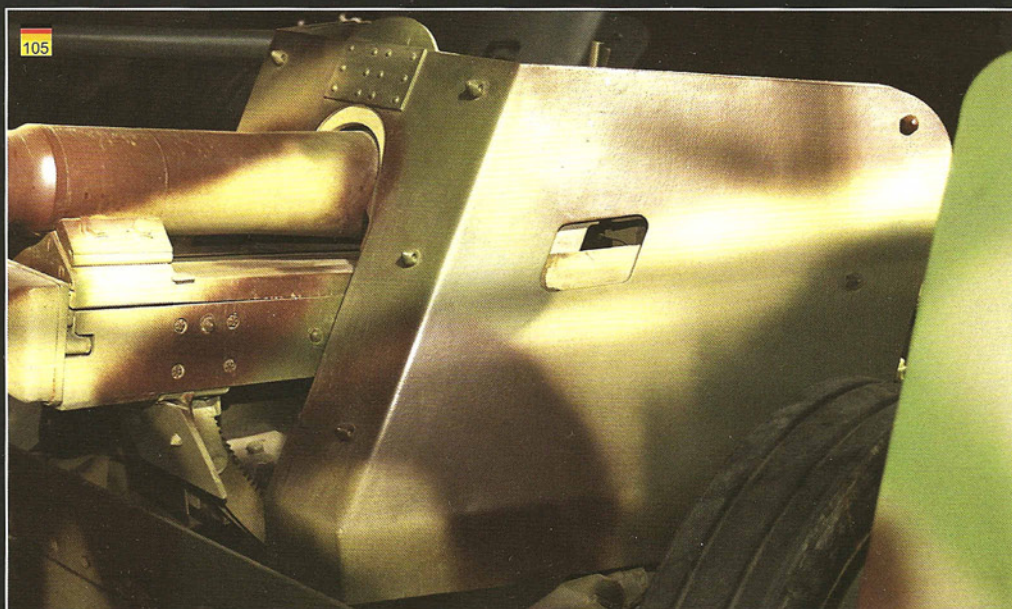
7,5 cm PaK 40

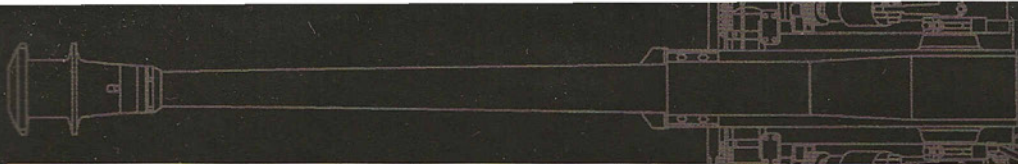


103 104 105 The gun shield of the PaK 40 consists of two layers with space between them. The opening for the barrel is closed with an armored plate that can slide between the layers of the gun shield. It is attached to the cradle of the gun, so it will follow the vertical movement of the barrel. Each half of the gun shield is formed from a single plate. The two halves are joined over the barrel opening. This also applies to the inner shield. The aperture for the sight is in the left hand side of the shield. It has its own sliding armor. One part slides upward the other down.

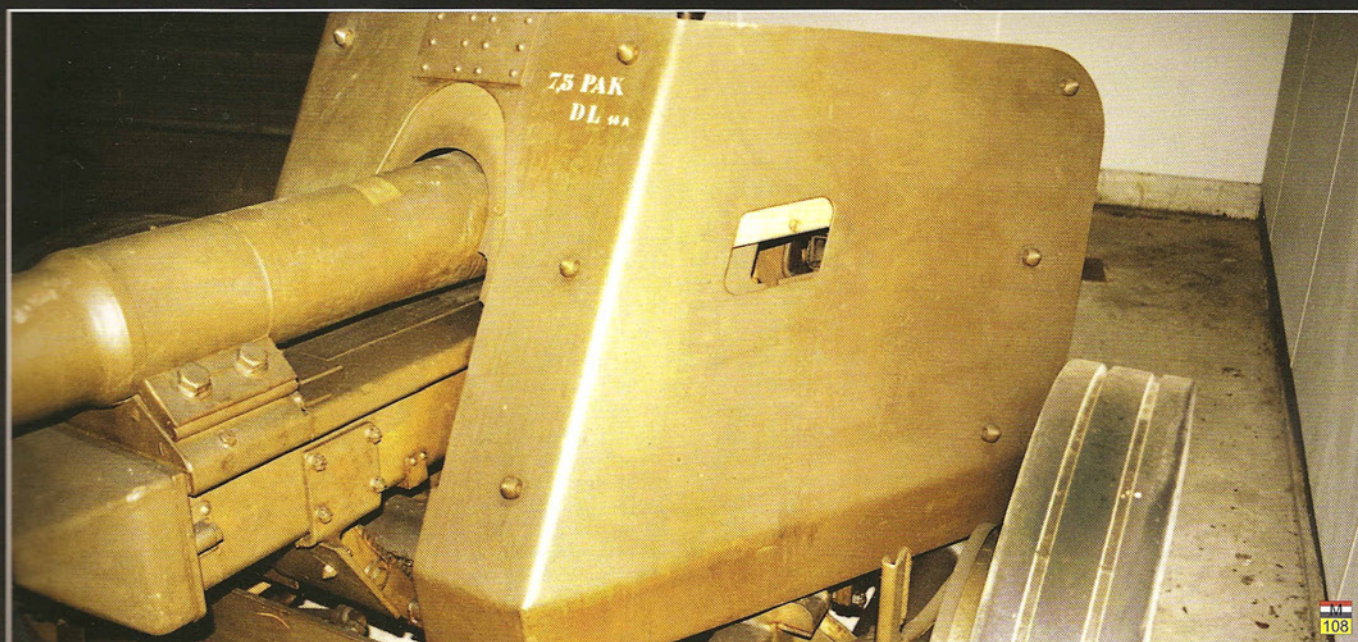


106 One of the bolt heads on the gun shield. The hole is probably there to hold the bolt while the nut is screwed on, but they proved equally handy for threading wire through to hold foliage and the like.

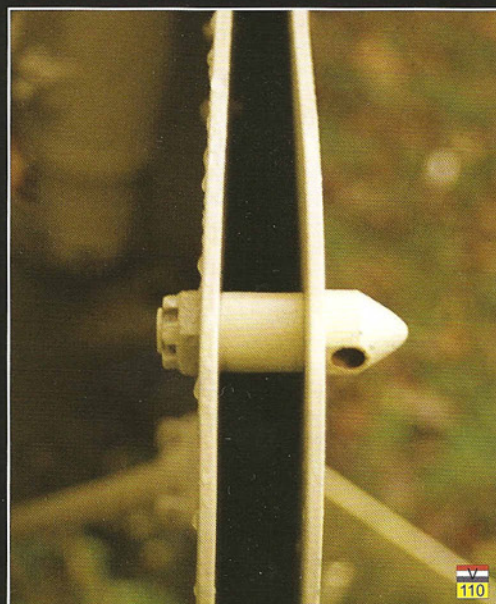
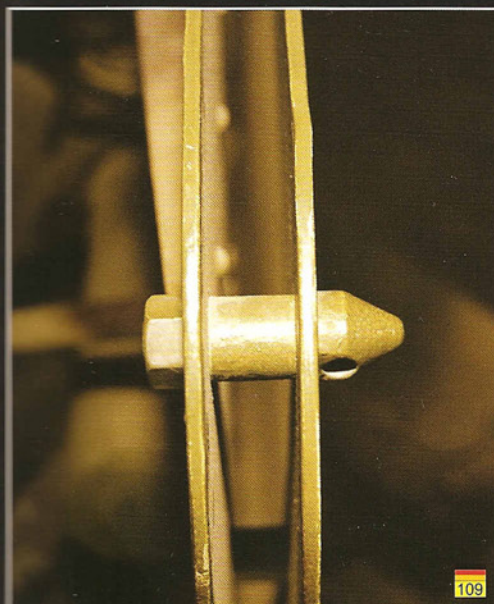




107 The gun in Zandoerle is fully elevated; the top of the sliding armour emerges from the top of the gun shield. The lower gun shield is not original. This one has only two hinges, whereas the original has four.



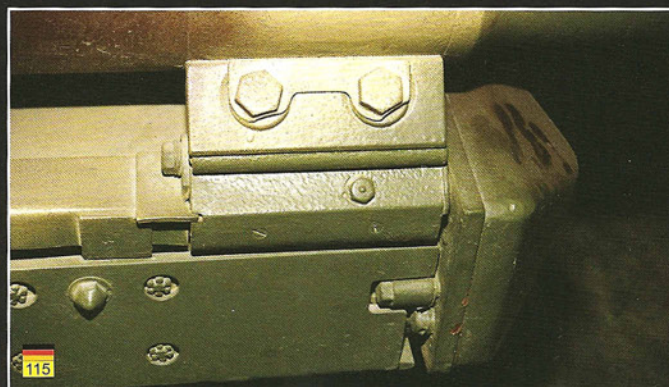
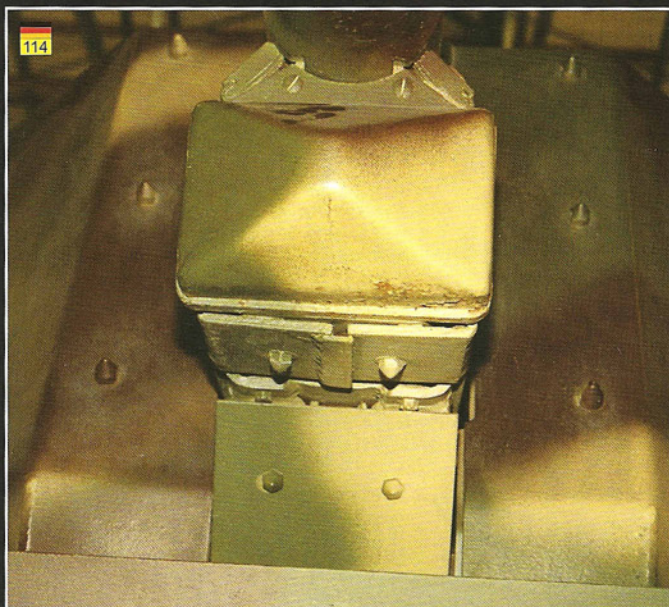
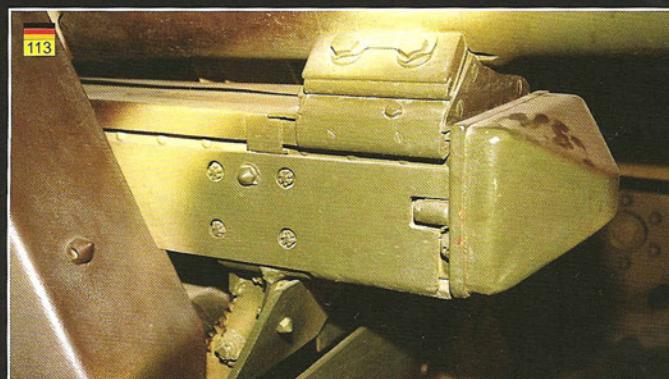
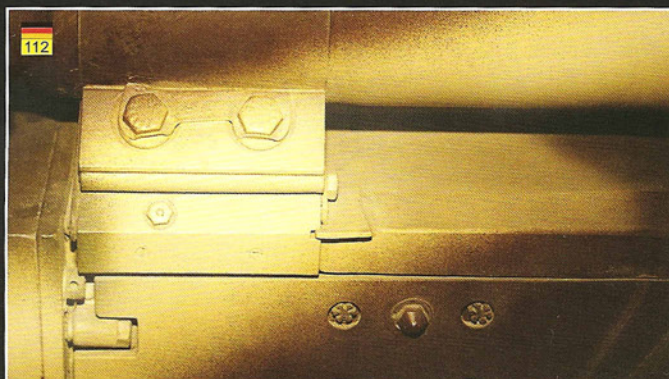
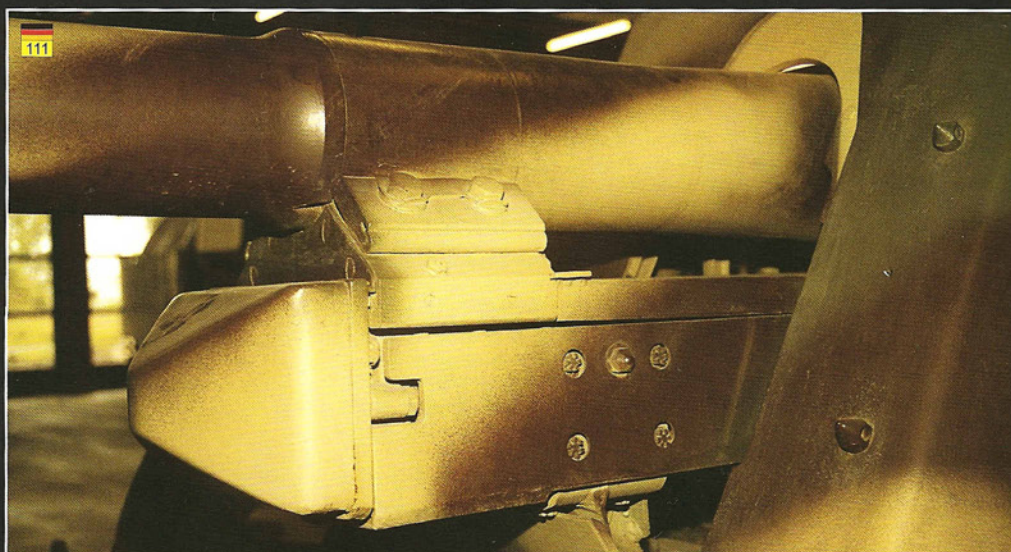
108 The left side of the gun shield of the gun in Maaldrift shows the original paint to advantage. The lettering was applied by the museum.



109 110 The two layers of the gun shield are kept apart with spacers. The photograph on the right shows the original crenellated nut.

7,5 cm PaK 40

111 112 113 Both sides of the front of the cradle of the PaK 40 in Munster are shown. This is the only surviving gun I know of that has additional armor plates on the front of the cradle. It consists of two halves that are bolted to the sides and bottom of the cradle. This type of additional armor is shown on a factory drawing dated 15 September 1944, which makes it a late war development. This then is entirely consistent with my surmise that the gun in Munster is a late production model. The recoil brake and recuperator are housed in the cradle and serviced from the front. The armored cover on the front of the cradle protects their fill openings and adjustment screws.

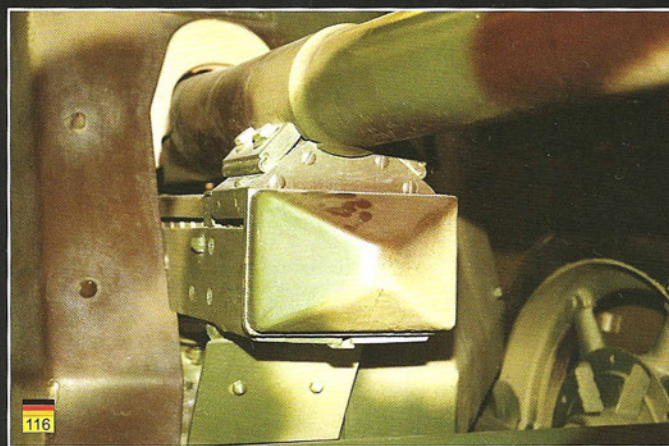


114 The additional armor is bolted to the bottom of the cradle. Note the strip welded to one side as an overlap. Armor plate is bolted to the front of the elevating arc to protect it and close the opening in the gun shield below the cradle.

115 The PaK 40's barrel is bolted to a sleigh that grips the rails on top of

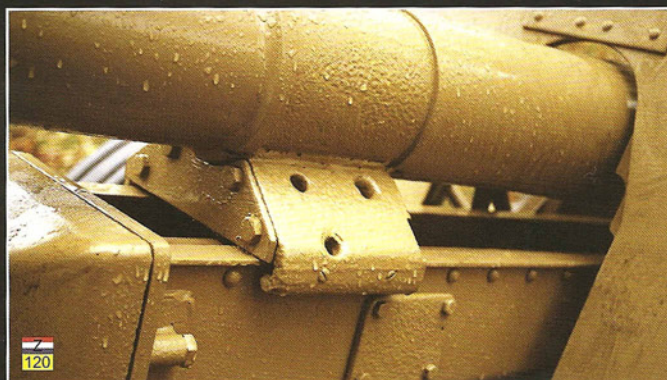
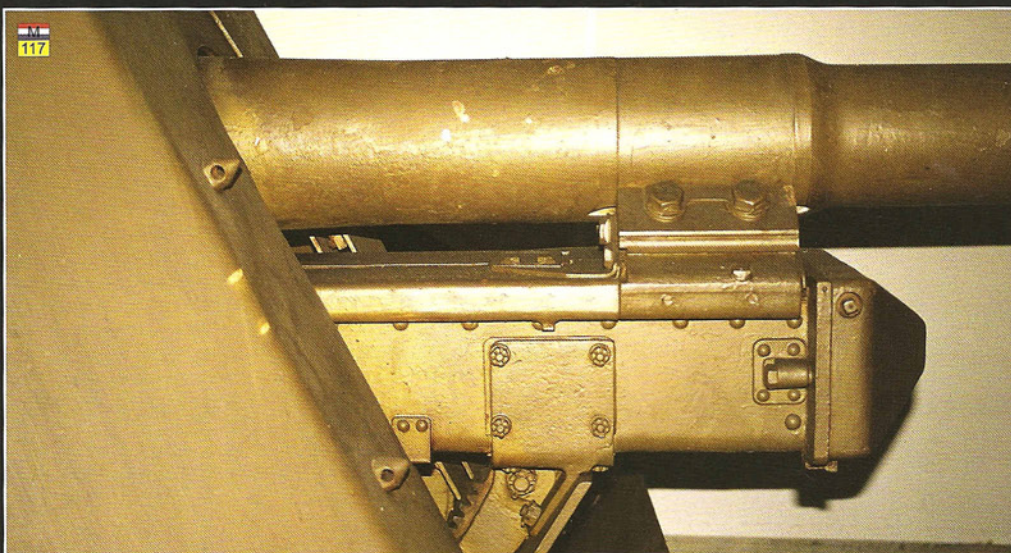
the cradle. A metal cover closes the gap between the front sleigh and the breech. This whole assembly will slide backwards in recoil. Note the grease nipple on the sleigh.

116 The cradle, seen from the front. The front plate of the sleigh is screwed on. There aren't any visible hinges on the armored front cover.





117 118 119 The front of the cradle of the gun in Maaldrift is shown here. The screw to secure the armored front cover is visible on the side. There are hinges on the underside of the armored cover. In photograph [119], the release mechanism on the apron of the lower gun shield is visible. It is pulled upward to lower the apron. A hook on the top plate engages this mechanism through a square opening when the apron is raised (see pages 6 and 7 as well).

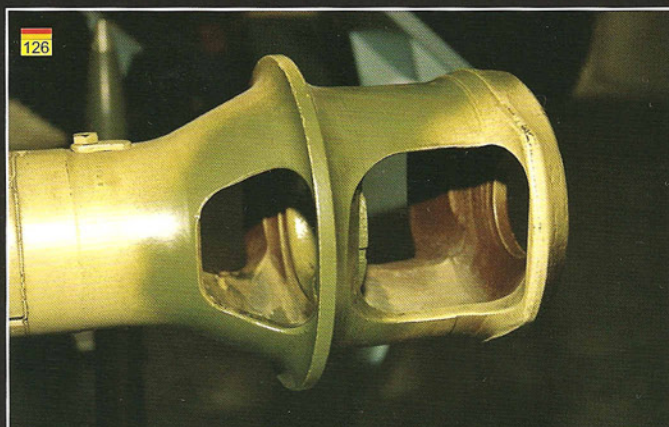
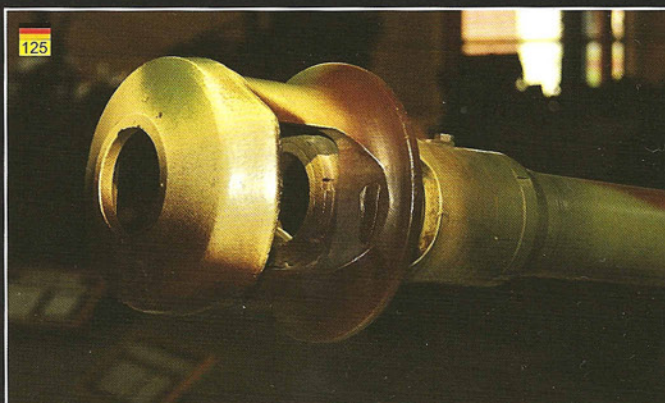
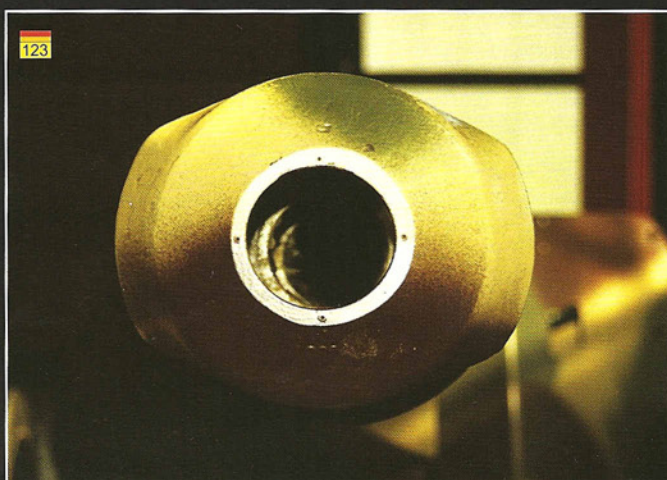


120 The cheeks on the barrel that bolt onto the sleigh are missing from the Pak 40 in Zandoerle. The bolt holes are the ones on top, the single one is for the grease nipple. The barrel has slid back a little, which gives a good view of the way the sleigh grips the rails on

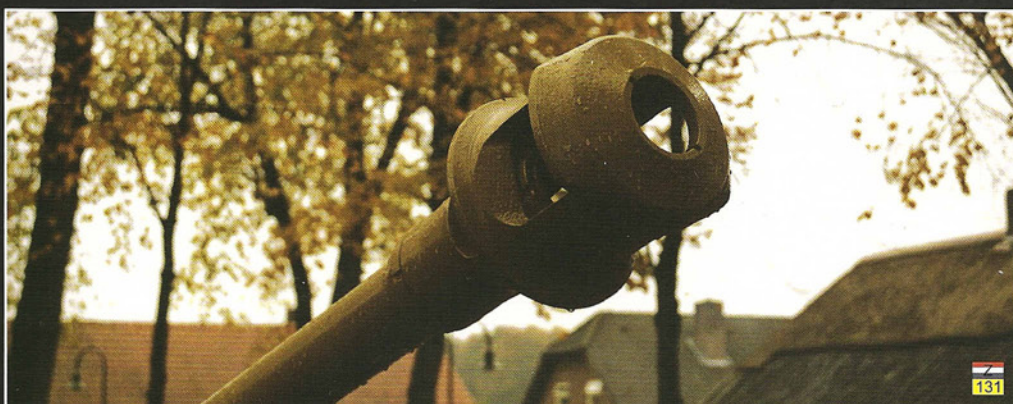
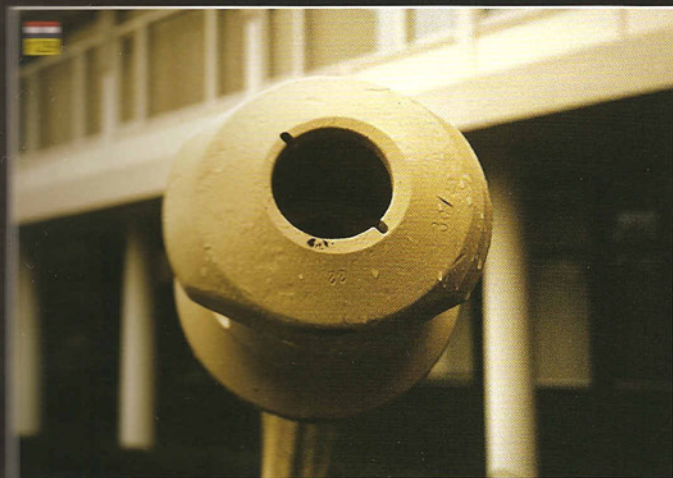
top of the cradle. The cover between the sleigh and the breech is missing. **121** This photograph shows the way the elevating arc is attached to the cradle. An armored plate is bolted to the front of the arc.

7,5 cm PaK 40

122 123 124 125 126 127 Six views of the muzzle brake of the gun in Munster illustrate its shape. This is called a double baffle muzzle brake. The baffles are plates in the muzzle brake with a hole for the projectile to pass through. They extend to the outside of the muzzle brake. In this case, the rear one is a complete circle, whereas the front one had its top and bottom machined so it has a roughly oval shape. This is the most common shape for the PaK 40's muzzle brake. When the gun is fired, at the moment the projectile is passing the baffle, it acts as a plug forcing the propellant gasses out of the baffles. This reduces the amount of recoil. If the baffles are also designed to angle the diverted gasses to the rear, this reduces the recoil even further. The manual clearly states that the PaK 40 should not be fired without the muzzle brake to avoid damage to the gun. The muzzle brake is about 47 cm long. It is screwed onto the barrel and secured with a lock nut, which is the tapered ring on the back.



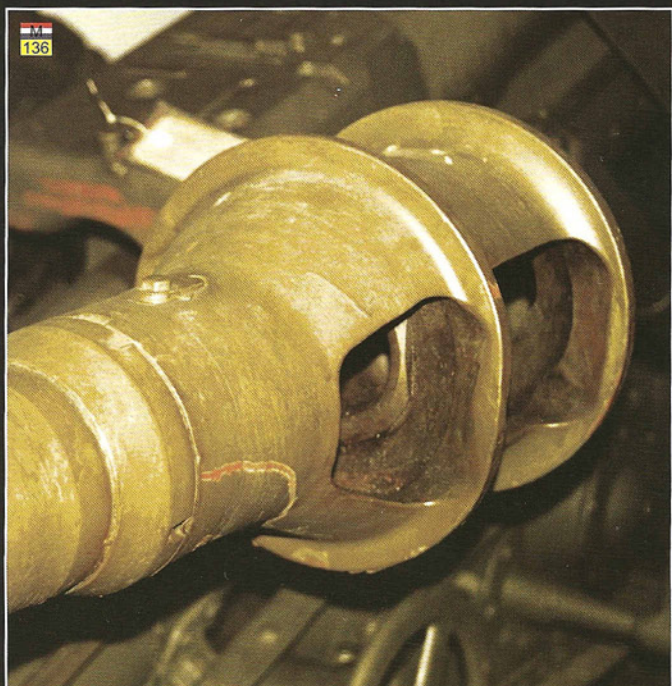
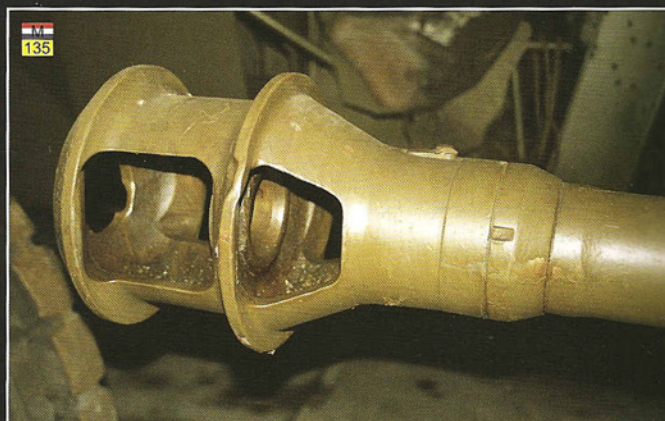
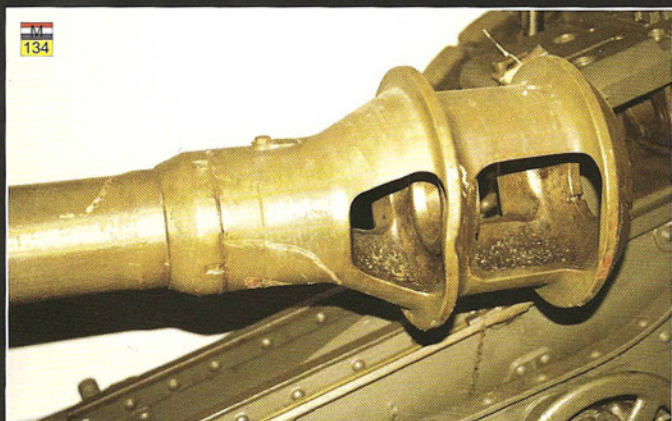
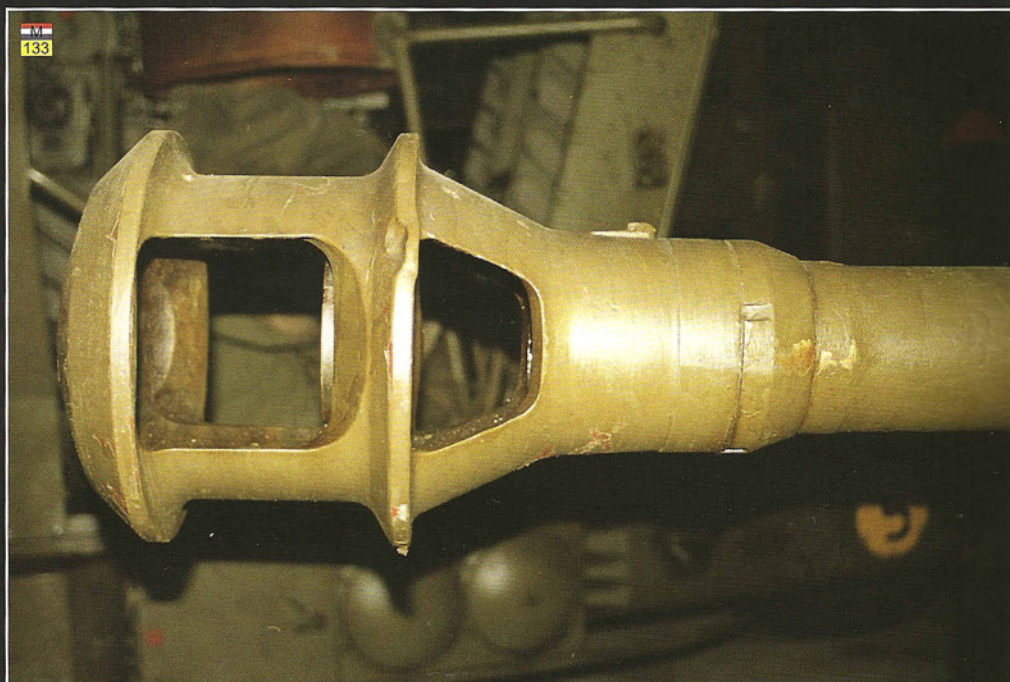
125 126 127 The gun in Valkenburg has the same type of muzzle brake as the one in Munster. There are notches in the front opening of the muzzle brake. Their purpose isn't clear. They may have been used to centre the muzzle brake when it is machined. The muzzle brake was cast and then machined to the required specifications. Photograph **[125]** shows that the Munster gun has four shallow indentations that serve the same purpose, or these indentations may have been used to boresight the gun. Many allied guns have small stamped indentations at the muzzle for that purpose. The small plate bolted to the top of the muzzle brake may just be there to indicate top center.

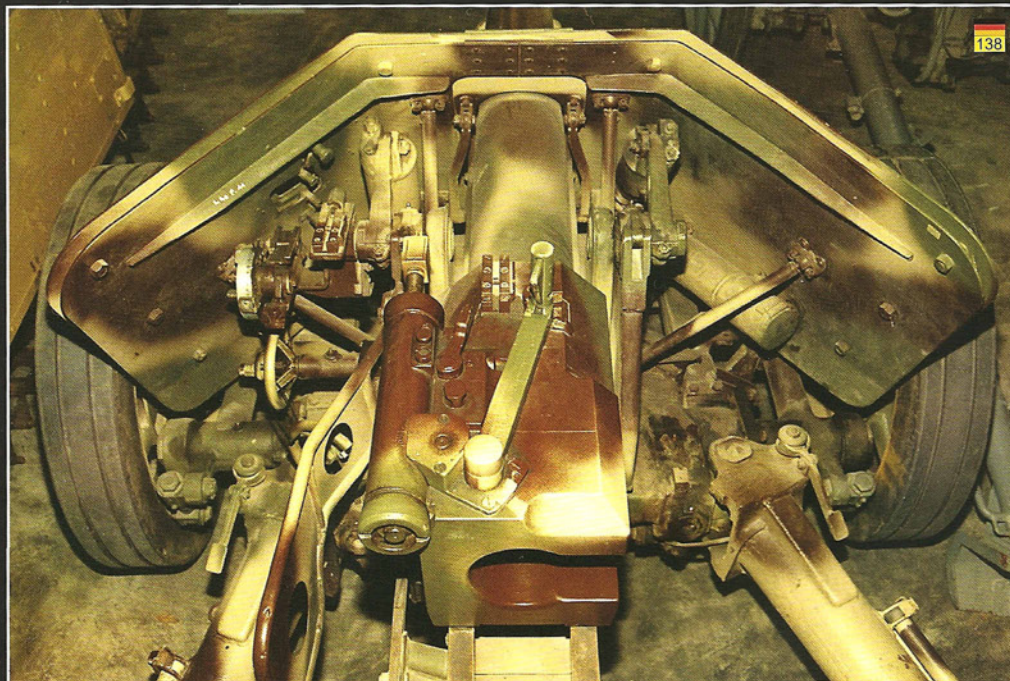
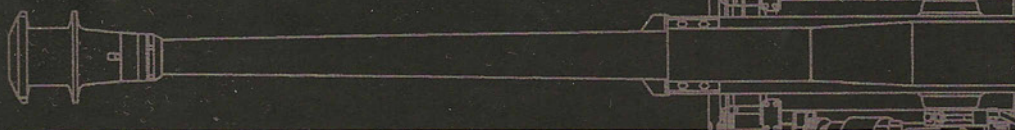


131 132 The PaK 40 in Zandoerle has the same type of muzzle brake as the previous guns. It really is the most common.

7,5 cm PaK 40

133 134 135 136 137 The Maaldrift gun's muzzle brake is of a different type. Both baffles are circular. This simply means that the front baffle has not been ground down to an oval shape. Note the fact that this gun has been primed with red oxide primer, and then painted in a single layer of Dunkelgelb. Even after sixty-odd years there is very little evidence of chipped paint.





138

138 The layout of the breech and inside of the gun shield is shown.

139 140 The gunner's position is on the left, where the operating hand wheels and sight are situated. The loaders position is on the right side of the gun. The shoulder guard is the plate on the left side of the gun. It protects the gunner from the recoiling gun. The gunner can speed up traversing by leaning against the shoulder guard or pulling on the cradle.

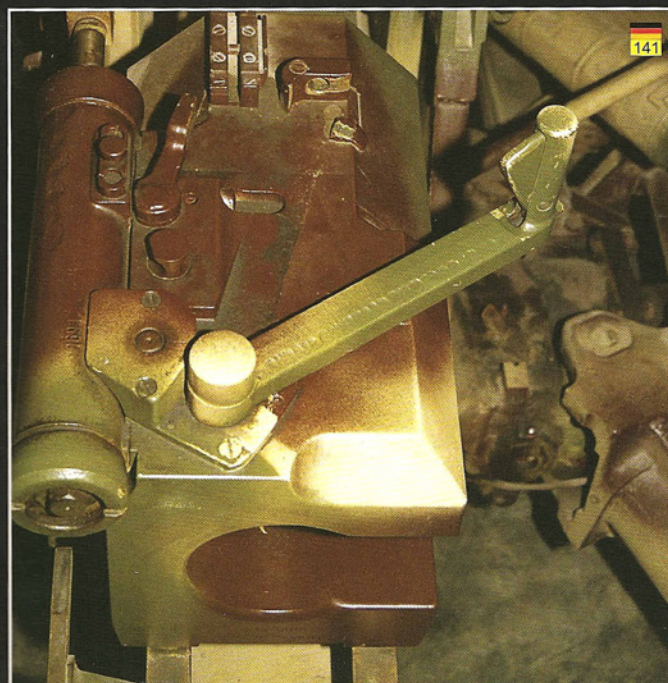
141 142 Close-ups of the top of the breech of the Munster gun on the left, and the Zandoerle gun on the right show the breechblock operating handle and the cylinder of the opening mechanism for the breechblock. The breechblock operating handle is pulled completely back and to the right to open the breech and cock the gun before loading the first round.



139



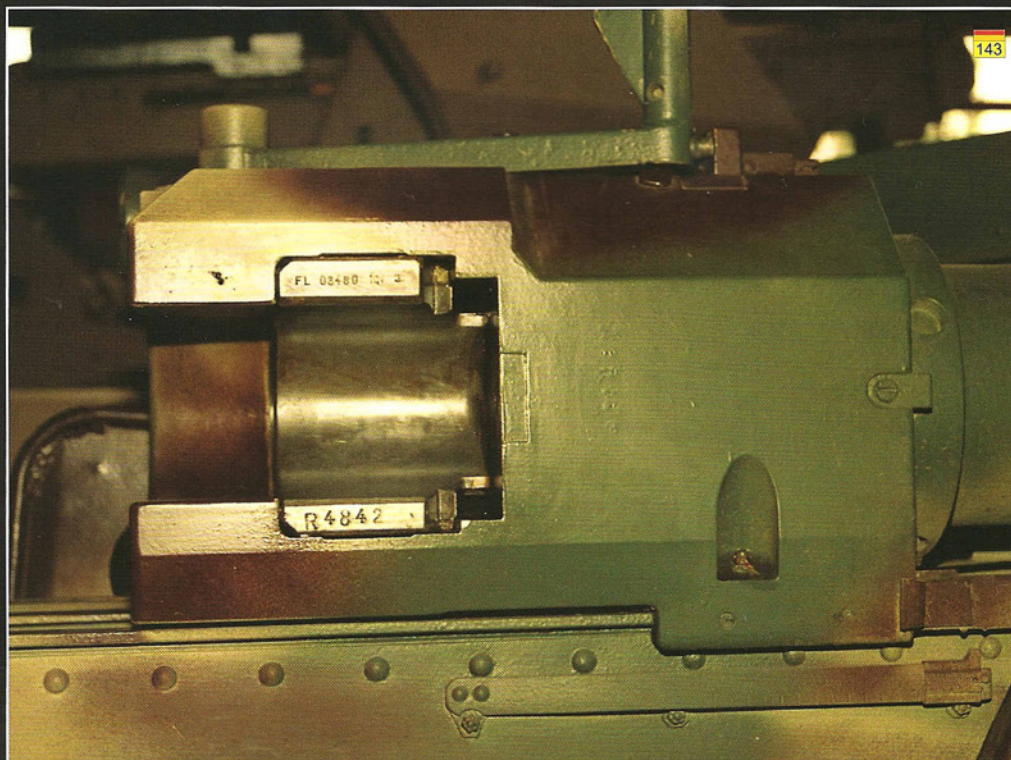
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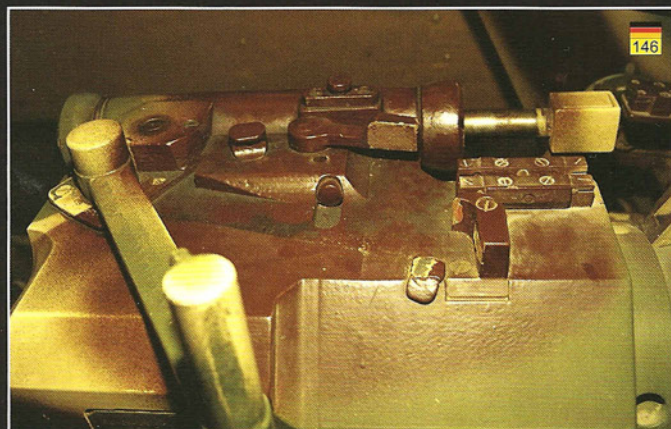
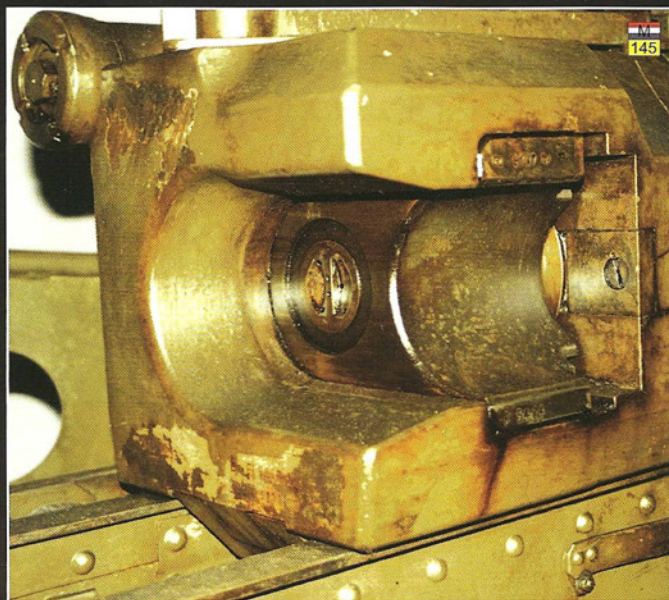
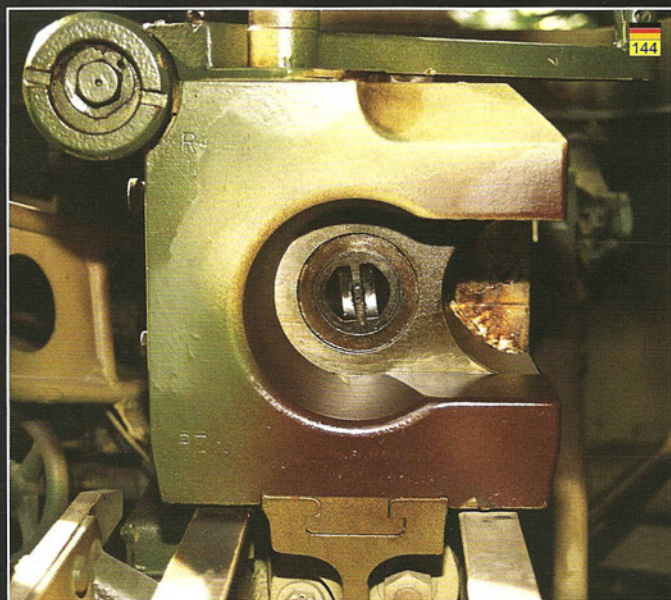


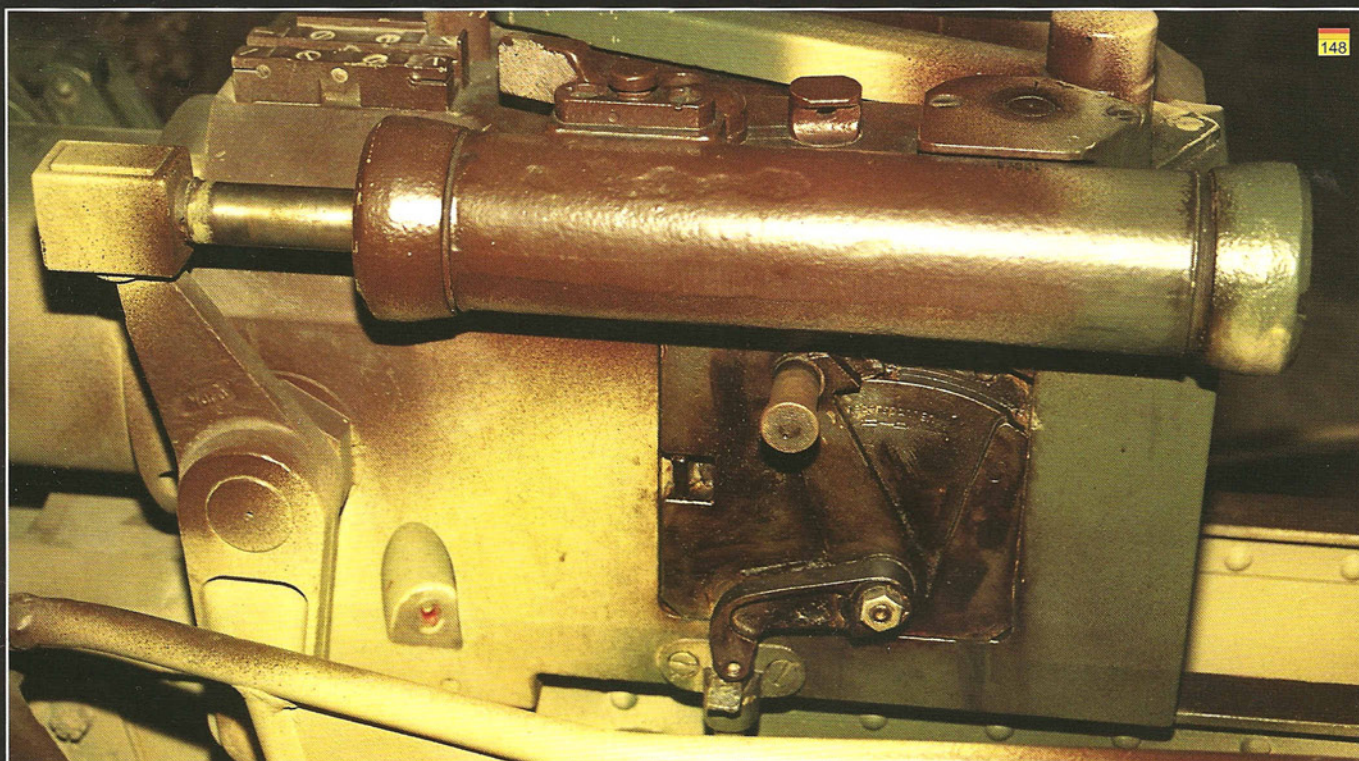
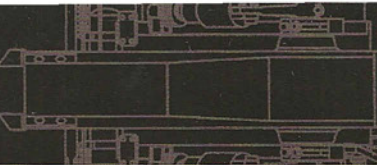
142



143 The right side of the breechblock is rather bare. Manufacturers codes and weapon number, R4842, are stamped on the sliding breechblock. Cheeks on the front of the breech grip the rails on top of the cradle. Together with the sleigh on the barrel, they hold the gun to the cradle. A grease nipple is in the recess on the breech. The strip mounted on the cradle below the breech is used to measure the recoil.

144 145 The firing pin is situated behind the circular plate in the breechblock. The firing pin is operated by a spring. A spare firing pin and spring are stored in the box over the barrel. Paint has been scraped from the breech of the gun in Maaldrift to expose the date of production, weapon number and manufacturer's code. The gun in Maaldrift was produced in 1943 and its weapon number is R5464. The manufacturer's code is hhg, which denotes Rheinmetall-Borsig's plant in Tegel, a district of Berlin. There are manufacturers' codes for every factory that produced materiel for the German Army. A list published by Karl Pawlas runs to over 800 pages. Some of them have not been identified to date. The



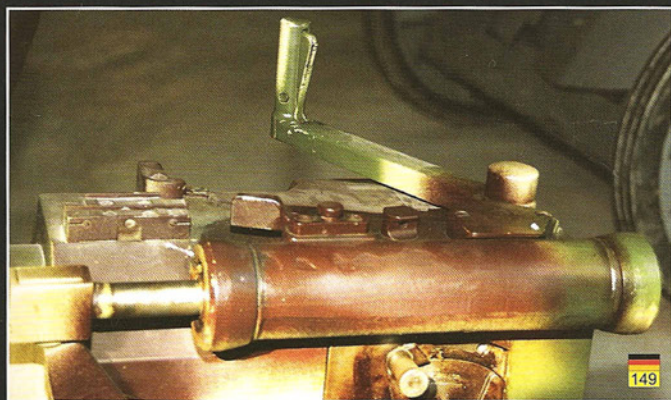


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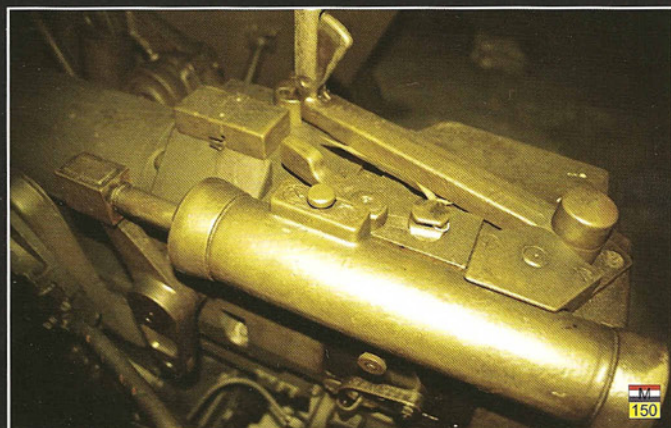
information on the other guns cannot be deciphered. The breechblock is kept open until a round is loaded. When it closes, the loader's hand is pushed to the left through the opening in that side of the breech.

146 147 Two more photographs that

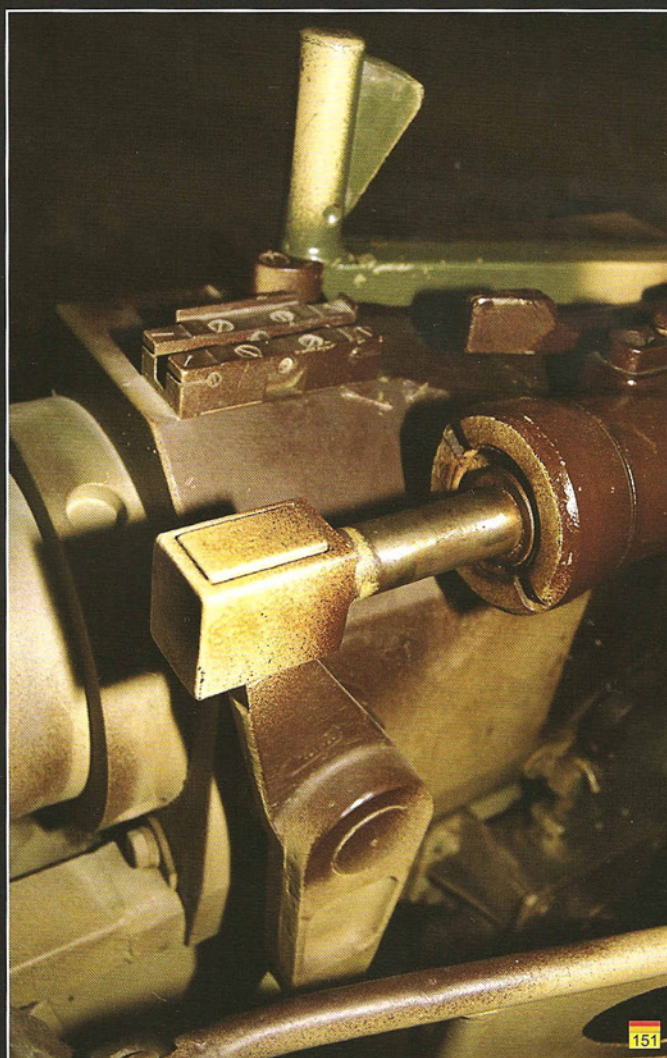
show the top of the breech of the guns in Munster (left) and Maaldrift. The small handle in the left centre of the breech is used for manual operation of the extractor. This is the mechanism that pushes the cartridge out of the chamber.



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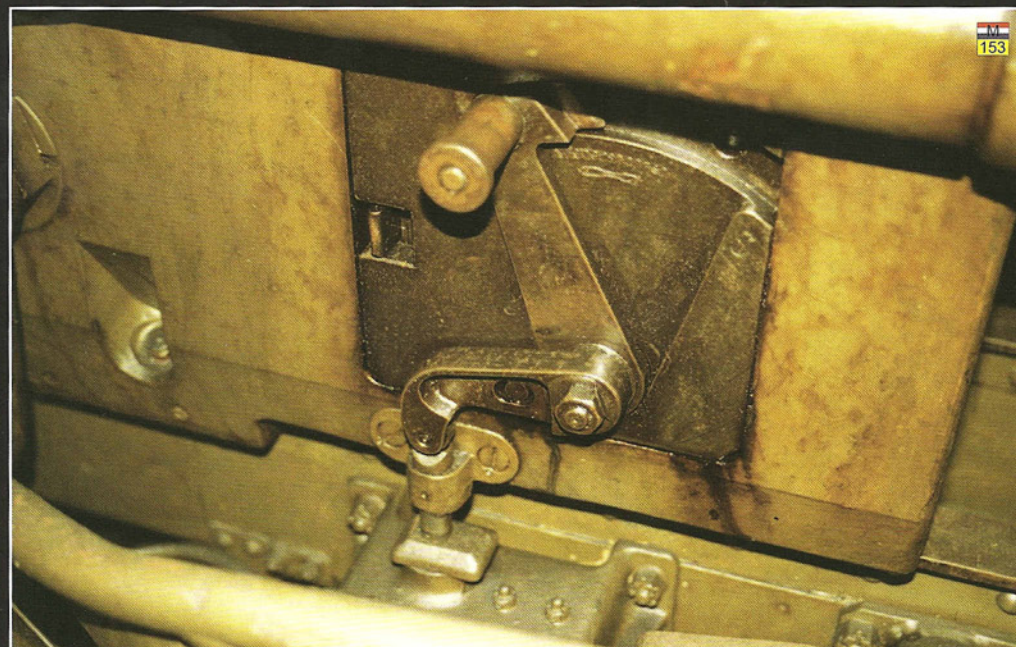
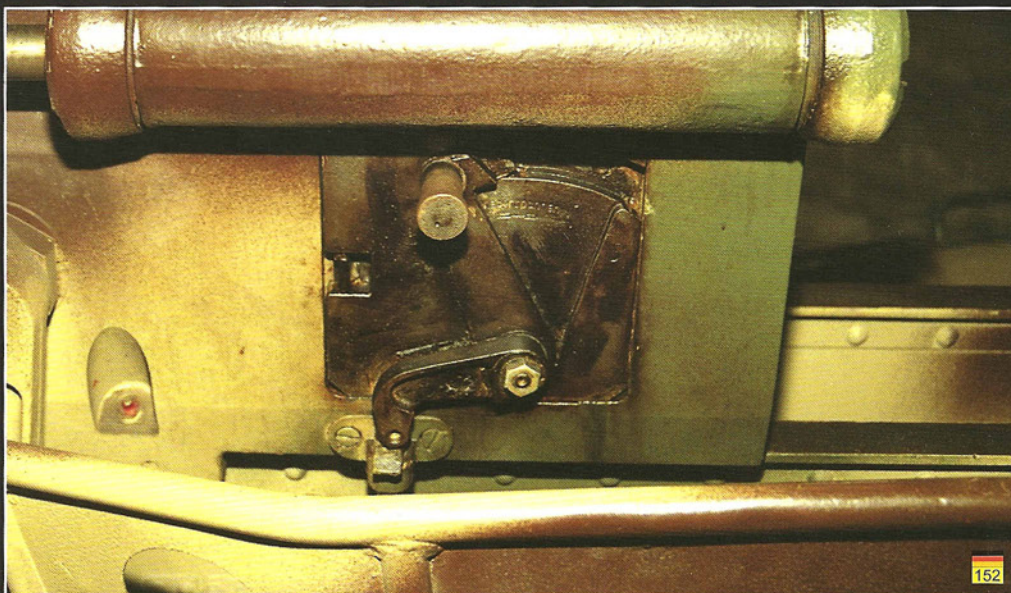
151

7,5 cm PaK 40

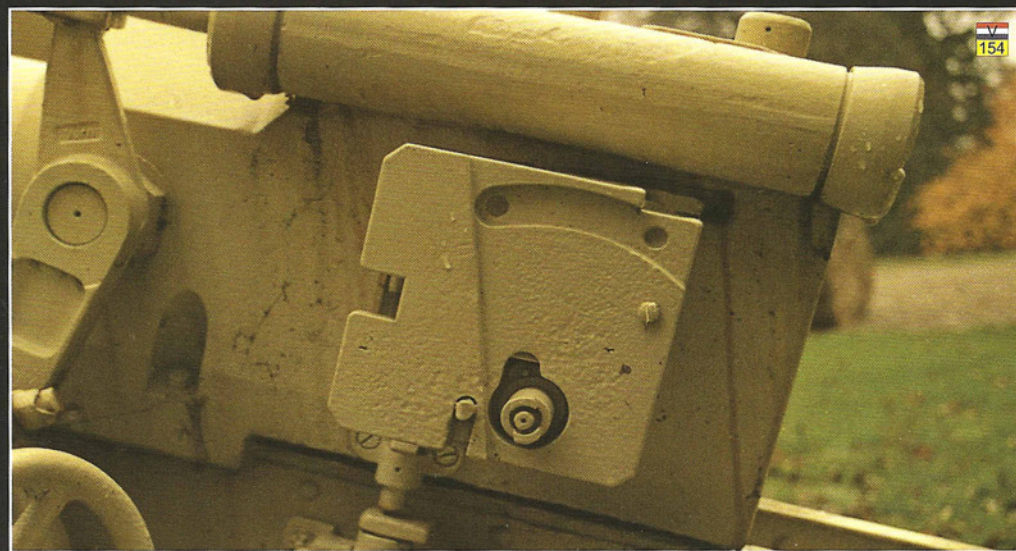
[Previous page]

148 149 150 The left side of the breech is much more cluttered than the right side. The operating arm and cylinder of the opening mechanism for the breechblock are on this side. Part of the firing mechanism is on the side of the breechblock.

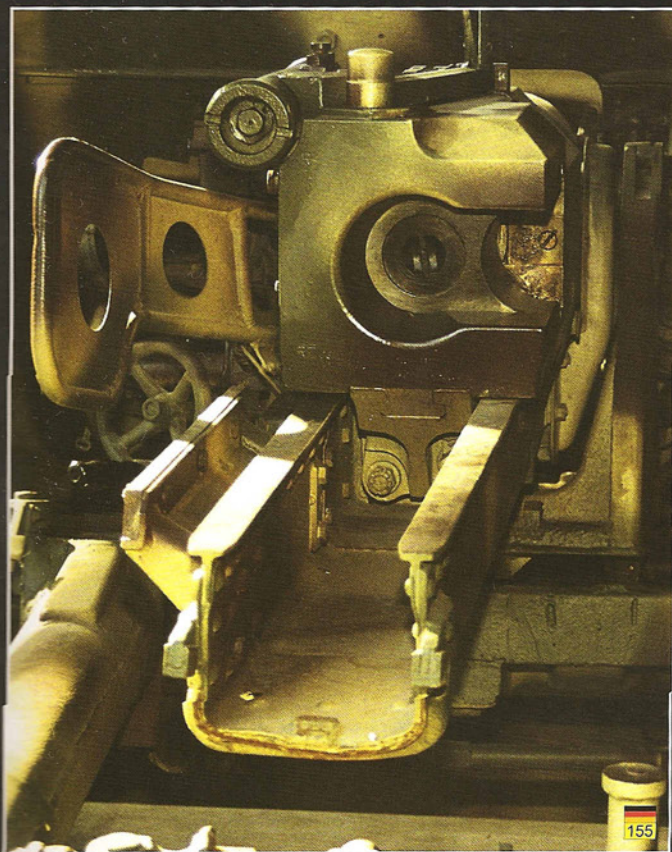
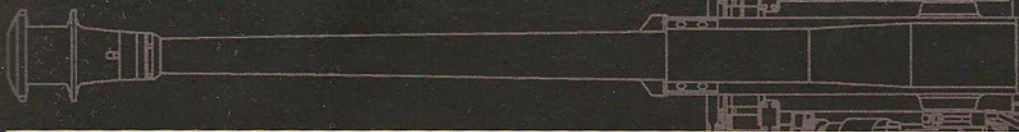
151 The arm and rod of the breechblock opening mechanism are shown in close-up. The sprung rod operates cams that open the breech and cock the gun. On top of the breech is the mounting block for an auxiliary artillery sight used to give indirect fire. Another mounting block for it is on the sight mount itself. The protective cover is in place on the Maaldrift gun, as can be seen in photograph [150]



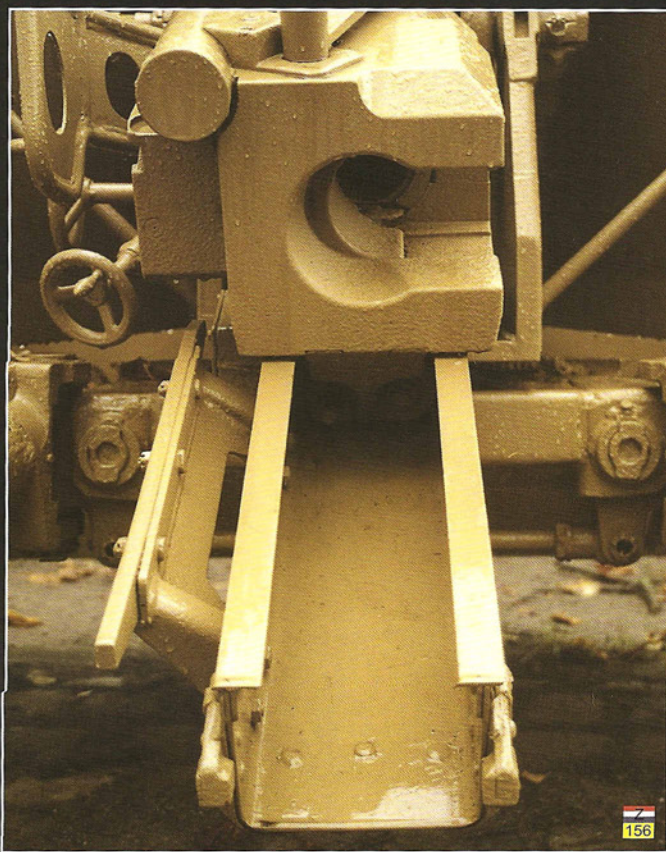
152 153 The firing lever is on the left side of the breechblock. The vertical arm is the safety catch. The sprung handle is pulled to move the arm into firing or safe mode; it locks into the holes in the breechblock. The position shown here is firing mode. An engraved S for „Sicher“, safe, is next to the rear position. The lettering with the arrow reads „Widerspannhebel“ or re-cocking lever.



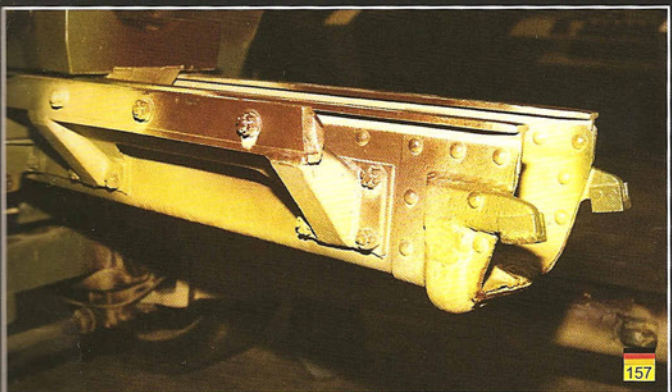
154 The gun in Valkenburg no longer has the shoulder guard, so the box for the firing mechanism is clearly visible on the side of the cradle. It is operated by a wire, running through a flexible shaft, which is connected with the firing button on the front hand wheel (see photographs [162] and [170] as well). If this mechanism fails, the gun can be fired by pulling the lever on the face of the firing mechanism's box. A lanyard can be hooked to the hole in the lever to fire the gun from a distance. When the gun is fired, the breech and barrel assembly slide backwards on the cradle. This causes the roller on the arm of the breechblock's opening mechanism to run up the rail mounted on the left rear of the cradle. This forces the arm up and the rod into the cylinder, which in turn operates the cams that open the breech, eject the cartridge and cock the gun. The breech is kept open until the next round is loaded.



155



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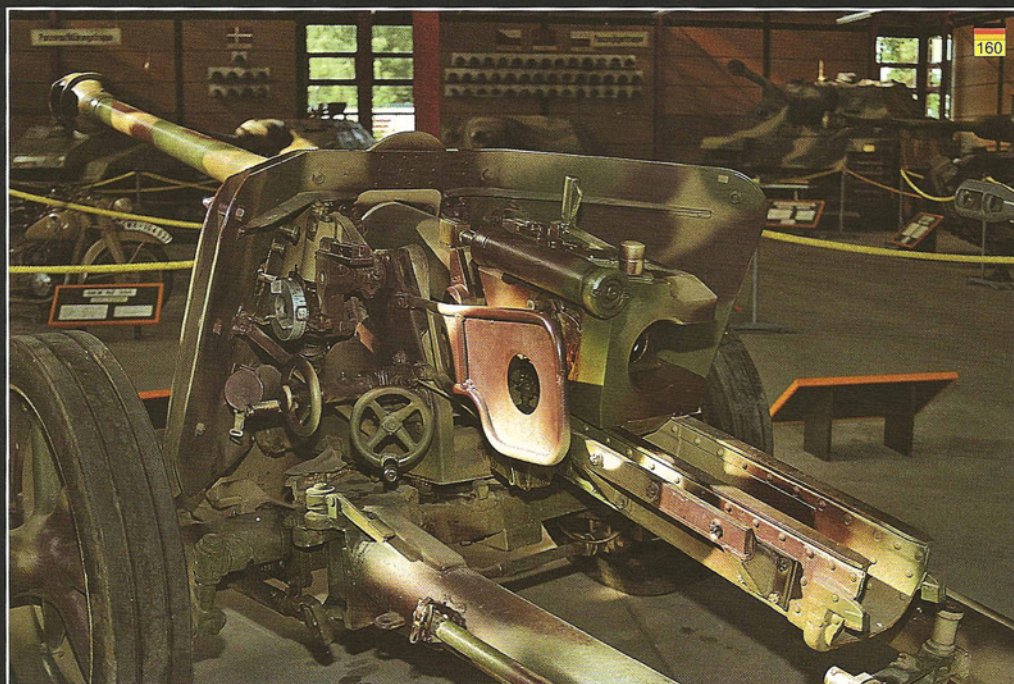
159

155 156 The bracket for the rail on the side of the cradle is quite a sturdy affair. The rails on top of the cradle are riveted to the inside of the cradle.

157 158 The left side of the cradle of the guns in Munster, on the left, and Maaldrift. The protrusions on the rear of the cradle rest on the bridge of the cradle lock when in travel mode.

159 The pistons of the recoil brake and recuperator are attached to the bottom of the breech. More stamped codes can be seen in this picture of the gun in Munster.

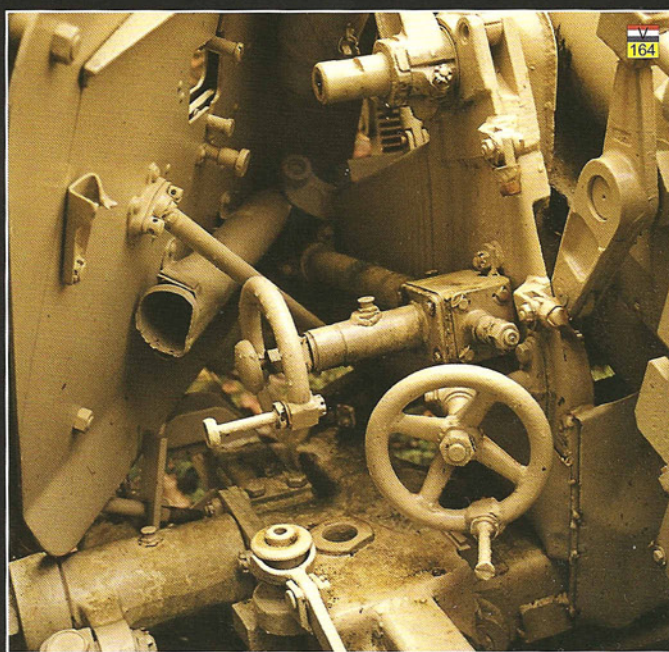
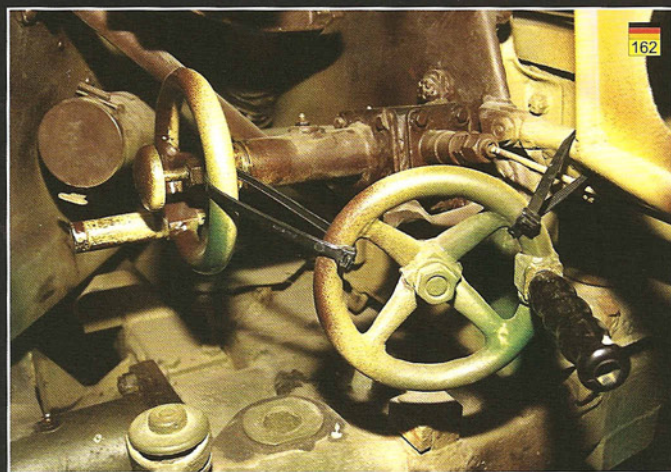
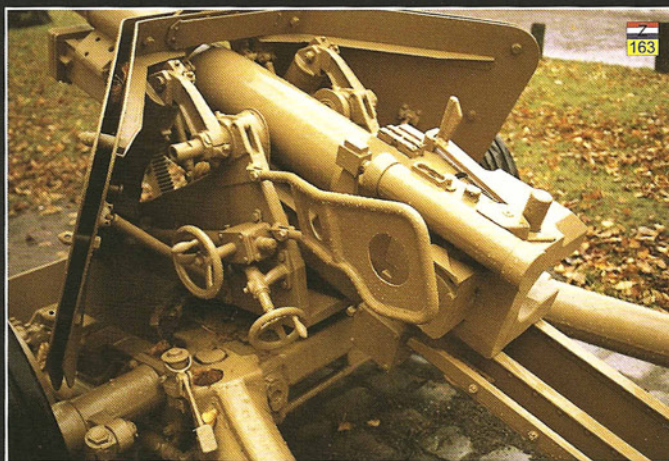
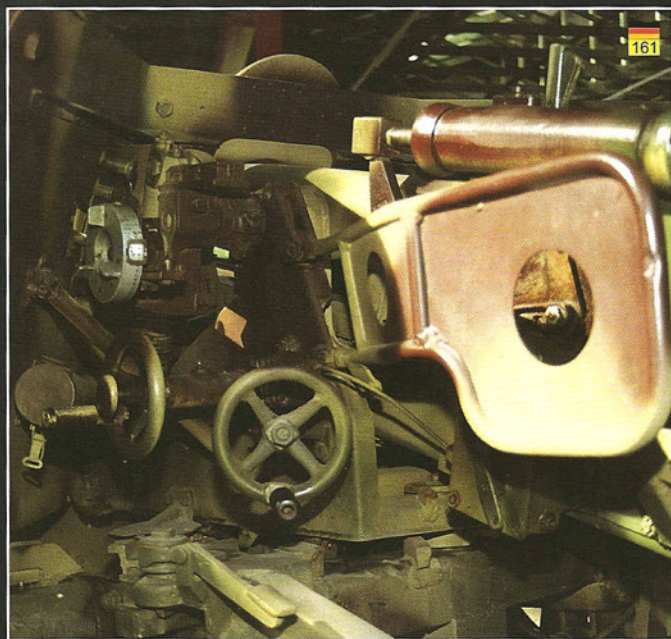
7,5 cm PaK 40



160 161 162 The sight mount and operating hand wheels of the gun in Munster are shown here. The handle on the nearest hand wheel isn't original, that on the farthest is. The nearest hand wheel operates the traverse; the other operates elevation. The firing button is situated in the center of the elevating hand wheel. A rod that passes through the hand wheel's mount pulls the wire running to the firing mechanism on the side of the cradle. This is a mechanical system; the wire pulls on a set of sprung levers that push on the arm on the side of the breechblock.

163 The sight mount is missing from the gun in Zandoerle. The handles on the hand wheels are recent replacements.

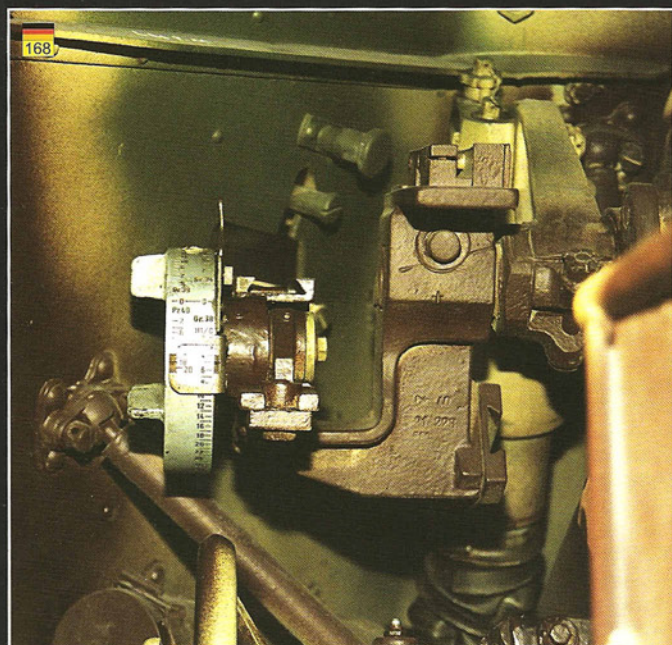
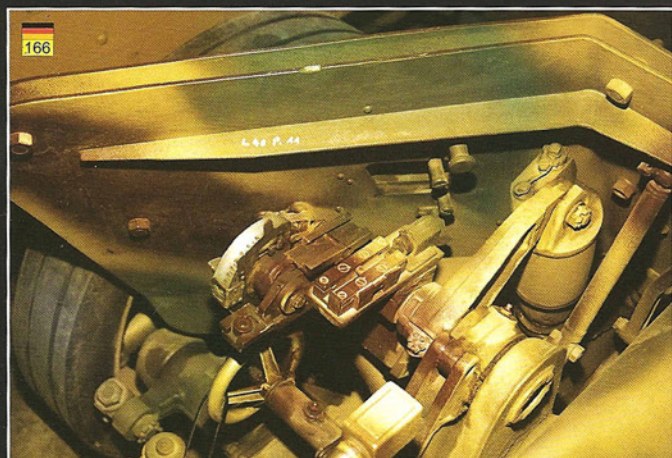
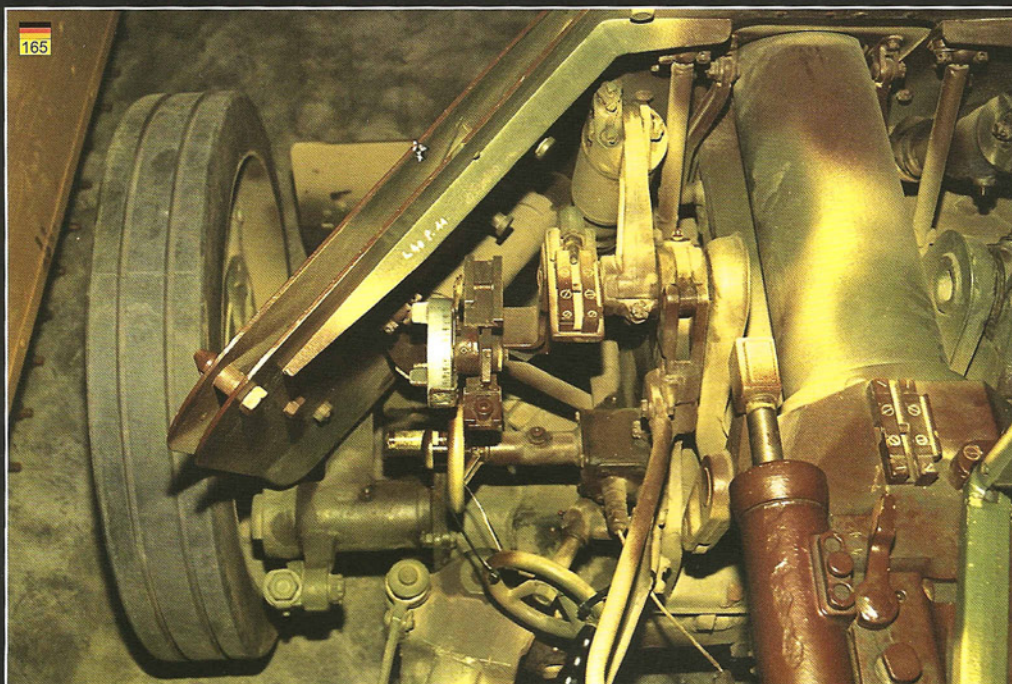
164 The gun in Valkenburg is also missing its sight mount, giving a clear view of the mounting stub. The equilibrator is missing on this side. Its lower, socket mount is on the front left side of the upper carriage. Note the screw fastener for the sight apertures shutter below its handle. The container on the inside of the gun shield is used



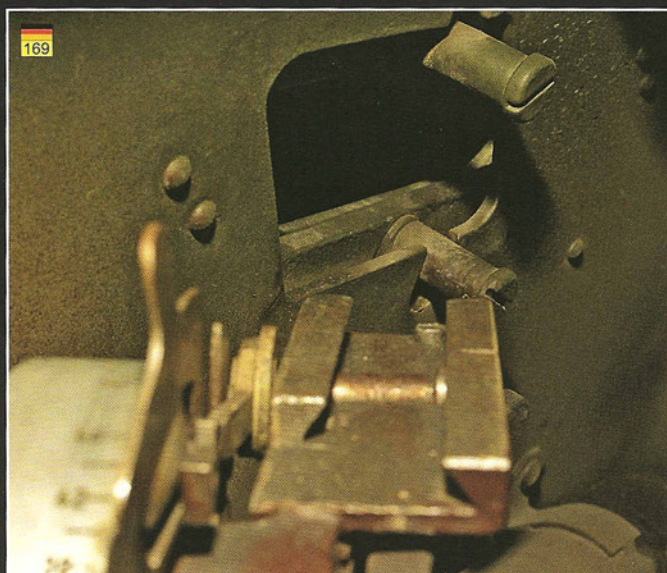


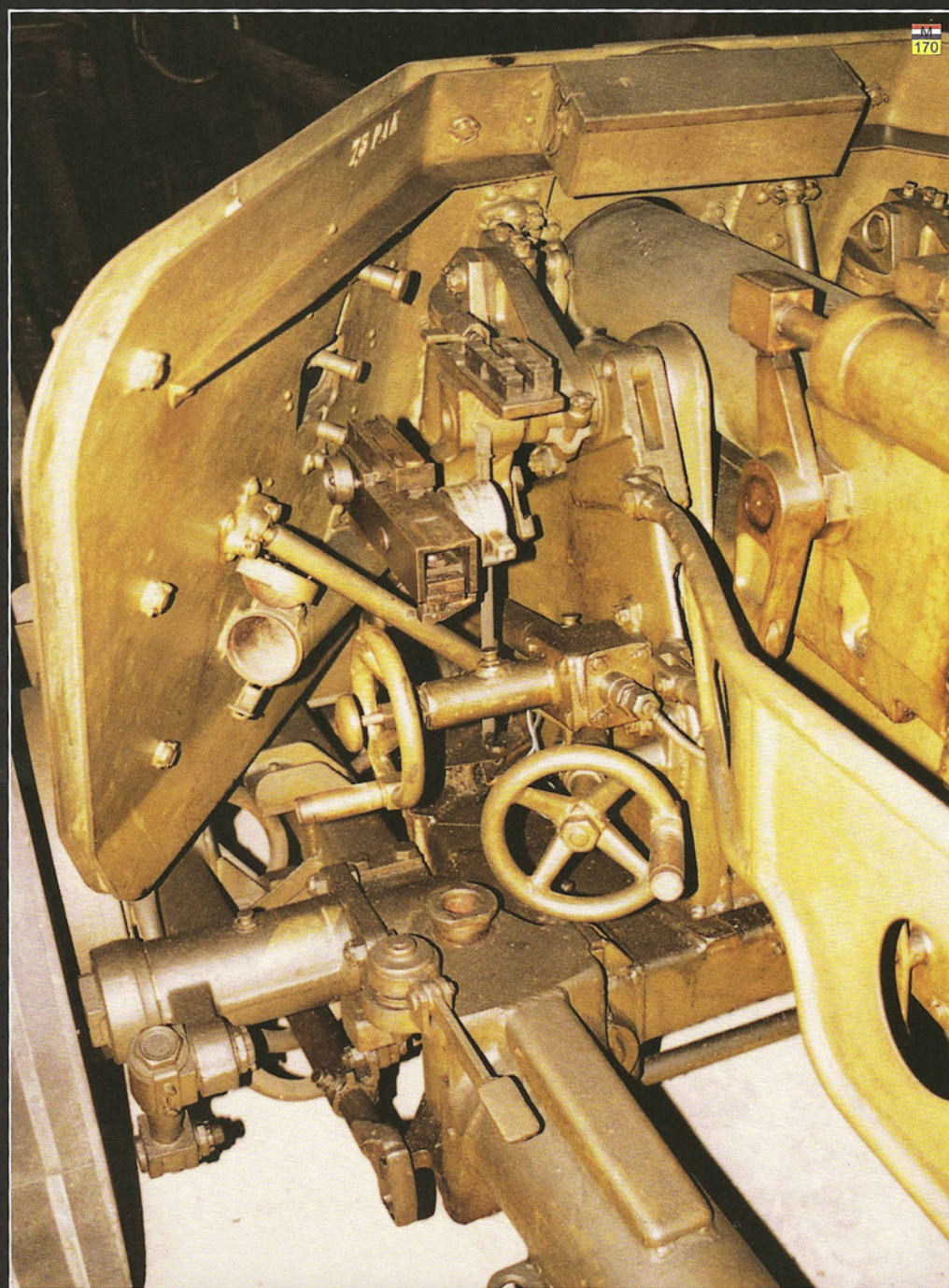
to stow the sight. The remains of the vertical bracket used to hold the container for the Sprengpatrone Z72, which is an explosive charge used to destroy the gun in case it had to be abandoned.

165 166 167 168 Multiple views of the sight mount of the Munster gun show one of the types of direct sight mount found on PaK 40s. The difference is in the drum used to select the type of ammunition and the range. A large drum is situated on the left side of the direct sight mount. It has separate range scales for the different types of ammunition. These scales are color coded: Pz 39 is red, Pz 40 is green, Gr 34 is yellow and Gr 38 H/C is black. Pz 39 and 40 are armor-piercing rounds, Gr 34 is a high-explosive round and Gr 38 H/C is a hollow charge round. The direct sight used with PaK 40 is a 3 x 8 degrees telescope. The mount for the auxiliary artillery sight is to the right and above the telescope mount. It should have a cover as shown in photograph [150].



169 The shutters for the sight aperture and their handles are seen here behind the telescope mount. Note the dovetail of the sight mount.





170 171 172 The gun in Maaldrift has another type of telescope mount. The selector drum, which is on the right side of the telescope mount, has a fixed inner ring with the range scale and an outer one with a handle that is used to set the range. The range scales are color coded for the type of ammunition: red for the Panzergranate 39, green for the Panzergranate 40 and black for the Sprenggranate 34. The Panzergranate is the armor-piercing round and the Sprenggranate the high-explosive round. Range is set for the armor-piercing rounds by turning the handle from top to bottom and the other way for the high-explosive round. The emergency open sight is installed in the telescope mount. The top is flipped forwards to reveal the notch and bead. The emergency sight is installed in order to protect the mount, when the telescope is stored. Note the rubber dome in the lid of the container for the telescope. There are screw fasteners above and below the sight aperture to secure them in the open position.

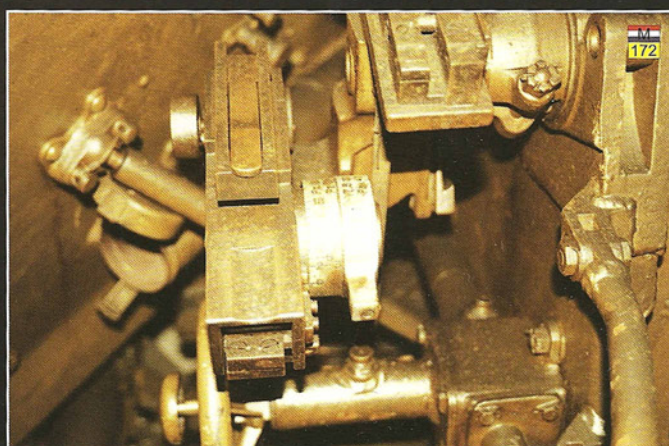
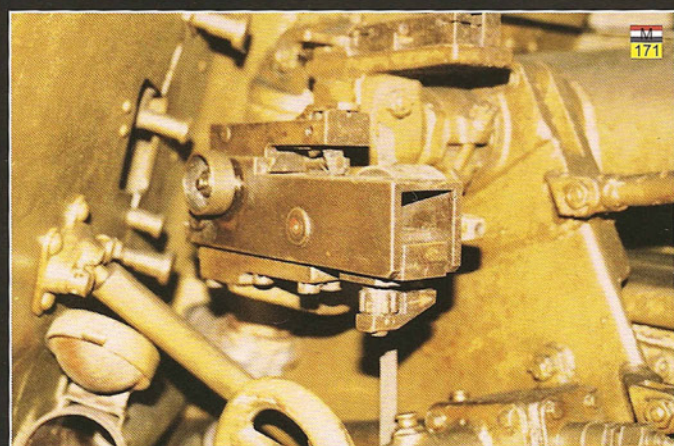
173 The gun shield is bolted to the front of the top carriage and supported by four rods, two on the front and two on the sides of the shield. They have rigid mounts on the carriage and socket and ball mounts on the shield. The container for the bore brush is on this side. A protective sleeve covers the lower part of the equilibrator. The equilibrator balances the gun and cradle.

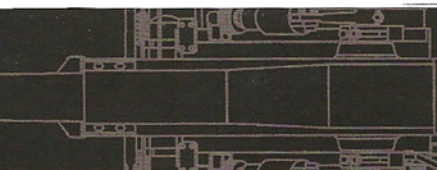
174 175 The container for the bore brush shown with closed and open lid. The bore brush is attached to the three-piece cleaning rod for use.

176 Two stops are welded to the undercarriage. The top stop limits the traverse to 32.5 degrees to either side. The bottom one limits the inward travel of the trail.

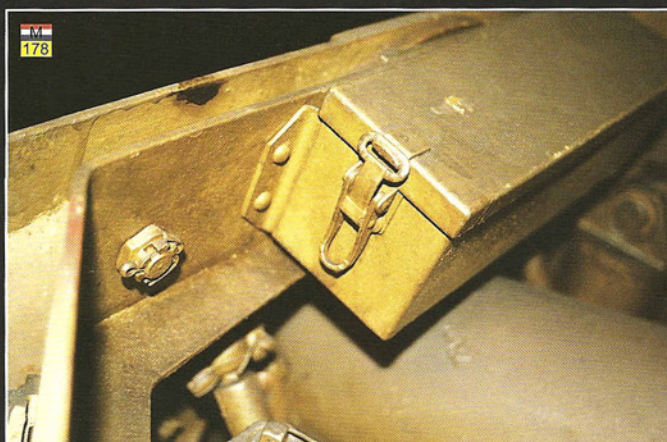
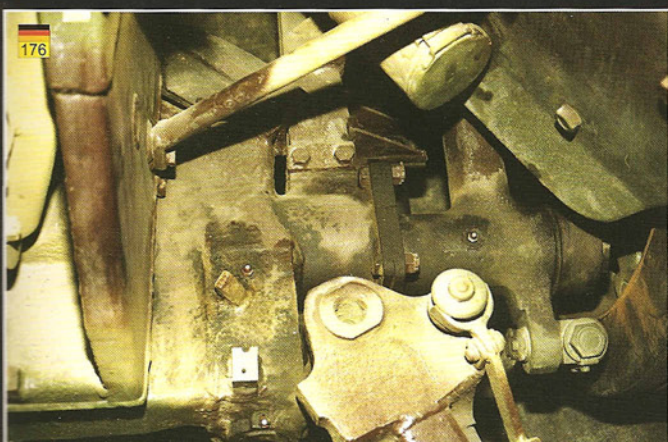
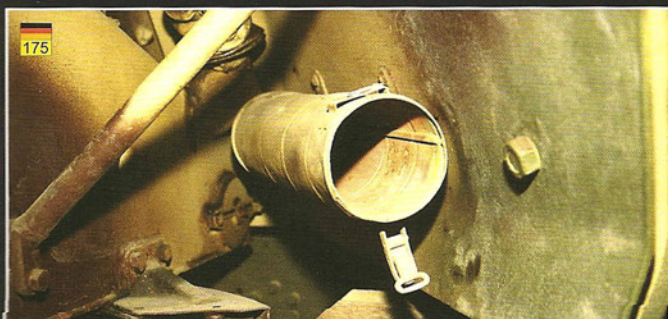
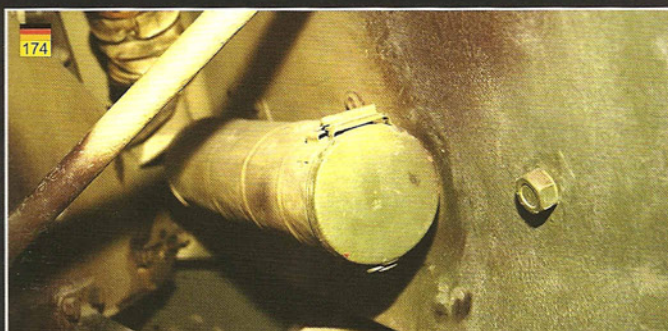
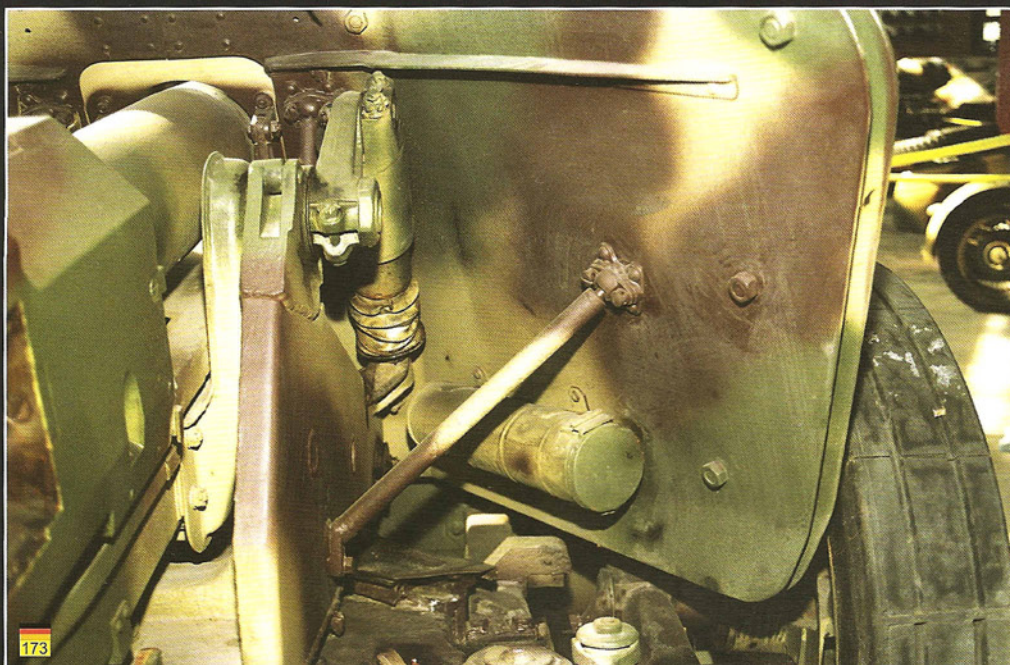
177 The Maaldrift gun also has the protective cover on the equilibrator. Note the cover for the cam arc of the traversing mechanism that is attached to the side of the undercarriage.

178 The box over the barrel holds a



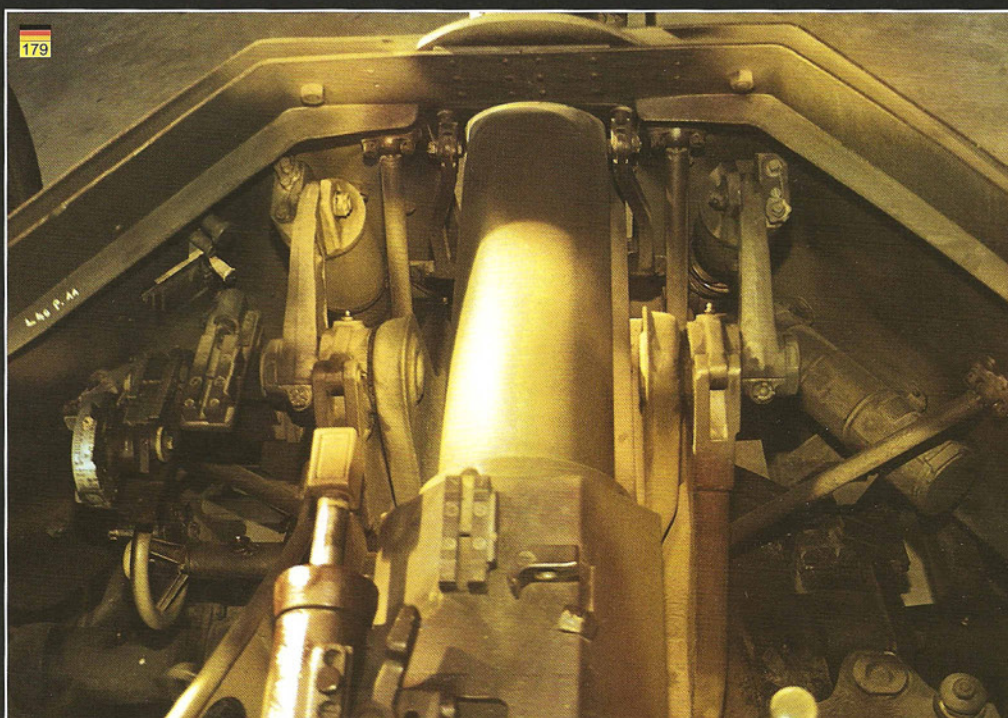


spare firing pin and spring, an instrument light and battery case for the sight and an oilcan. It is fastened with the standard clamp also used on the containers for the sight and bore brush. This photograph provides a good view of an original nut and Cotter pin.

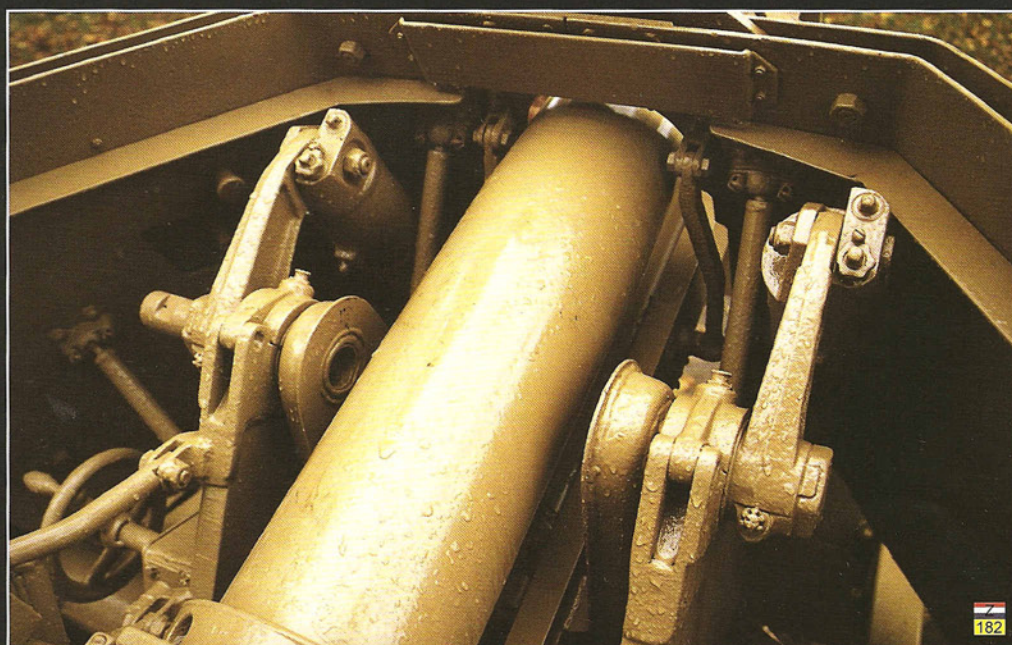
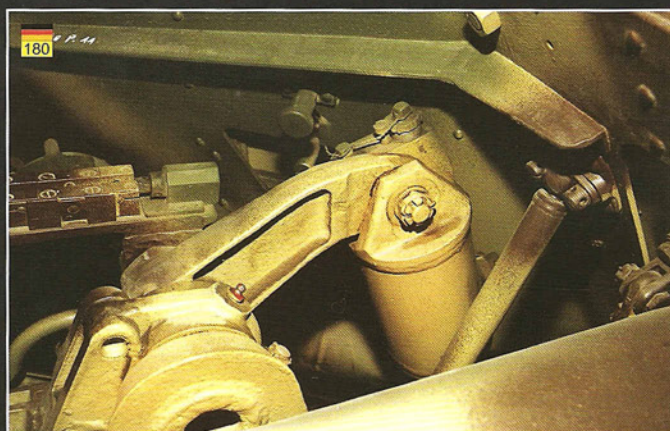


7,5 cm PaK 40

179 The trunnions are the structures on the side of the cradle that connect it with the top carriage. The arms of the equilibrators are fixed to the trunnions mounting stubs. The equilibrators are the cylinders on the top carriage that keep the gun balanced under any angle of elevation. The forward attachment rods for the gun shield are visible next to the equilibrators. The innermost pair of rods attaches the sliding armor plate to the cradle.

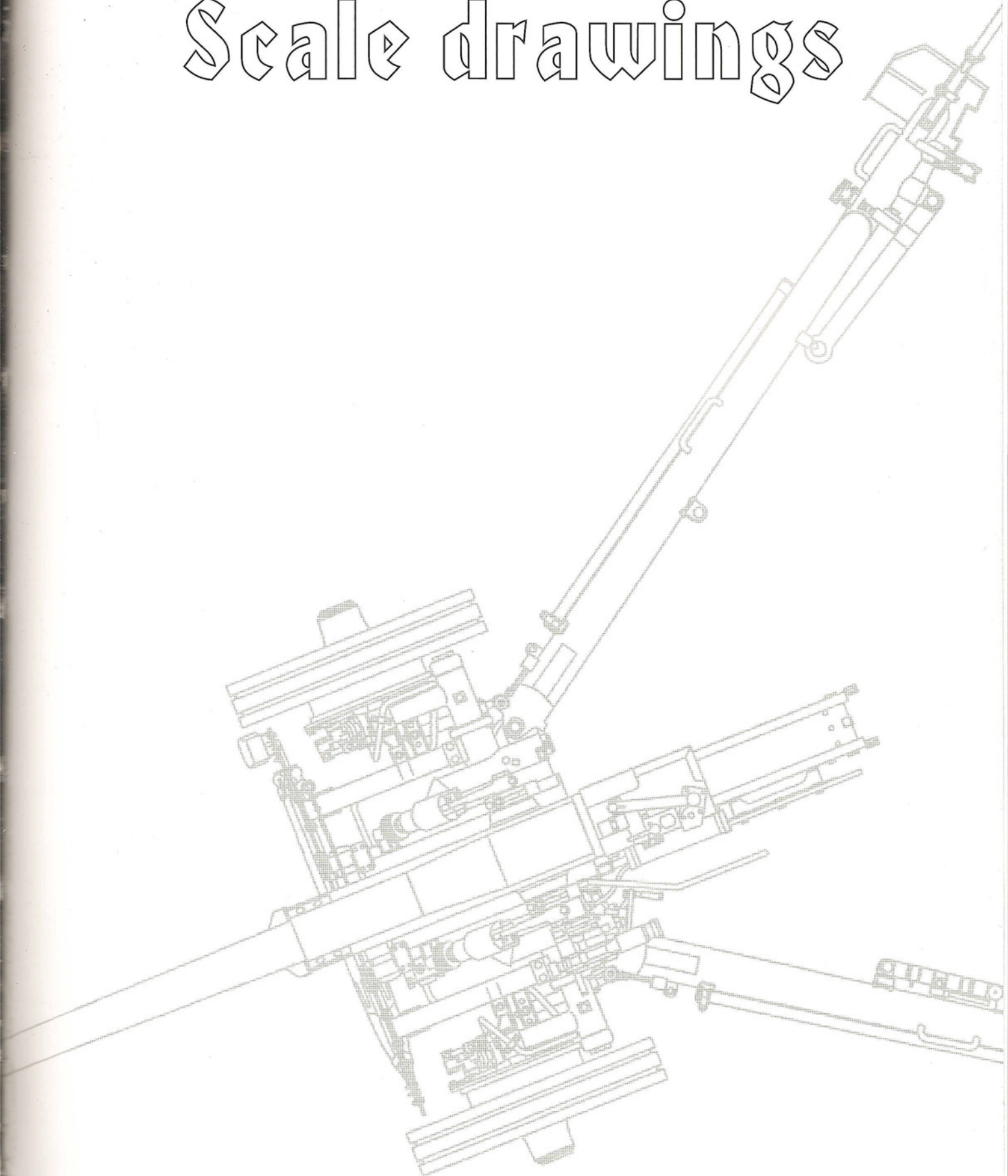


180 181 The tops of the equilibrators and their connecting arms are shown here. The thicker part on the top of the equilibrators is facing out on the gun in Munster. They should both be on the right side of the connecting arm as is shown in photograph [182].



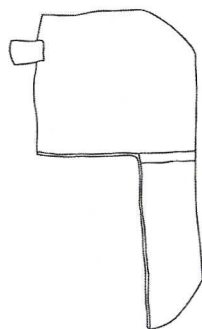
182 The equilibrators are mounted in the correct way on the Zandoerle gun. This is the configuration shown in the manual. The equilibrators are filled with oil and compressed air. The filler caps are on the top of the equilibrator.

Scale drawings

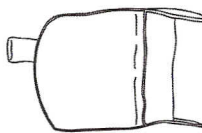


7,5 cm PaK 40

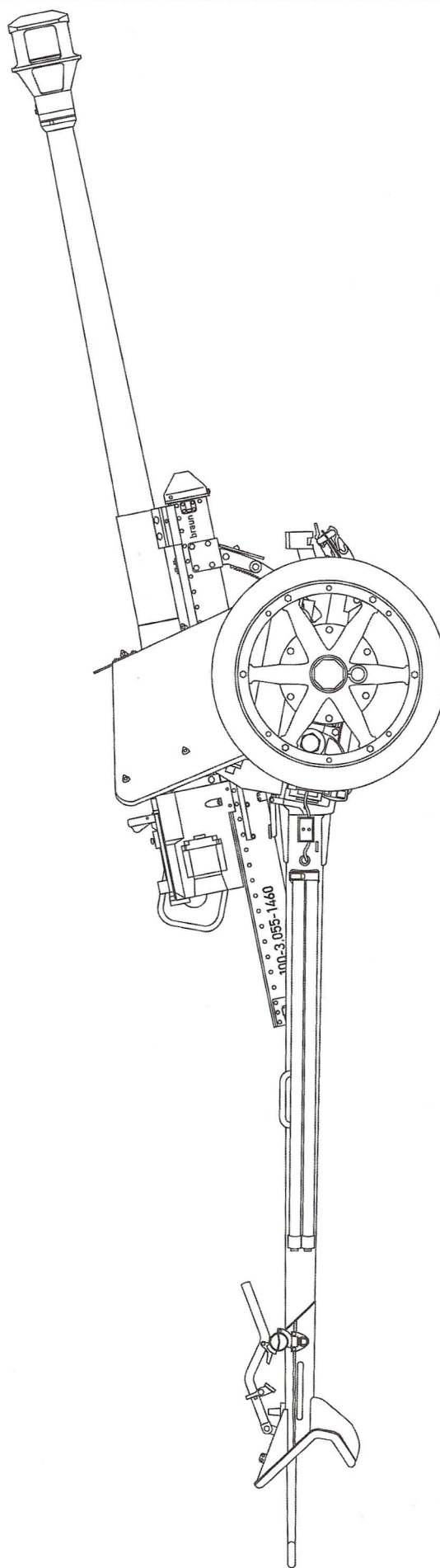
Side view



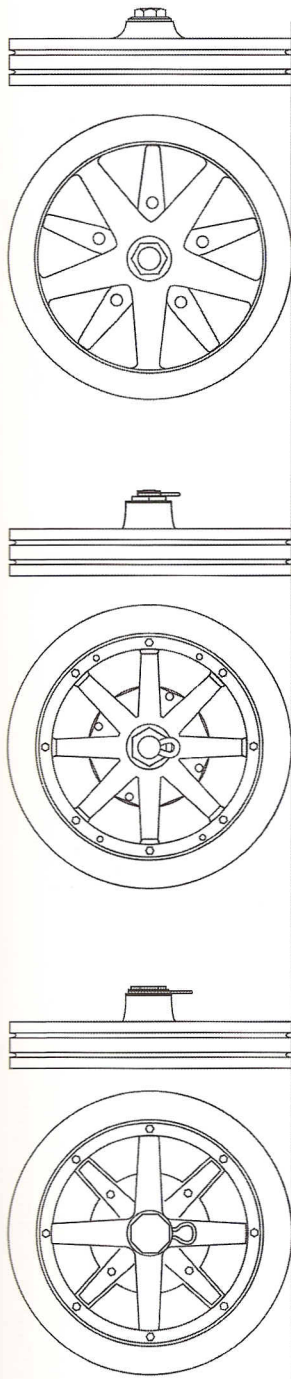
Rear view



Breech cover for PaK 40. It is found in a shiny leather-like material or in canvas. This cover would be used to protect the breech of the gun from dirt and damp. A rather shapeless bag with a drawstring or strap and buckle served as a muzzle cover. Some muzzle covers have a stiff front in the shape of the front baffle of the muzzle brake.



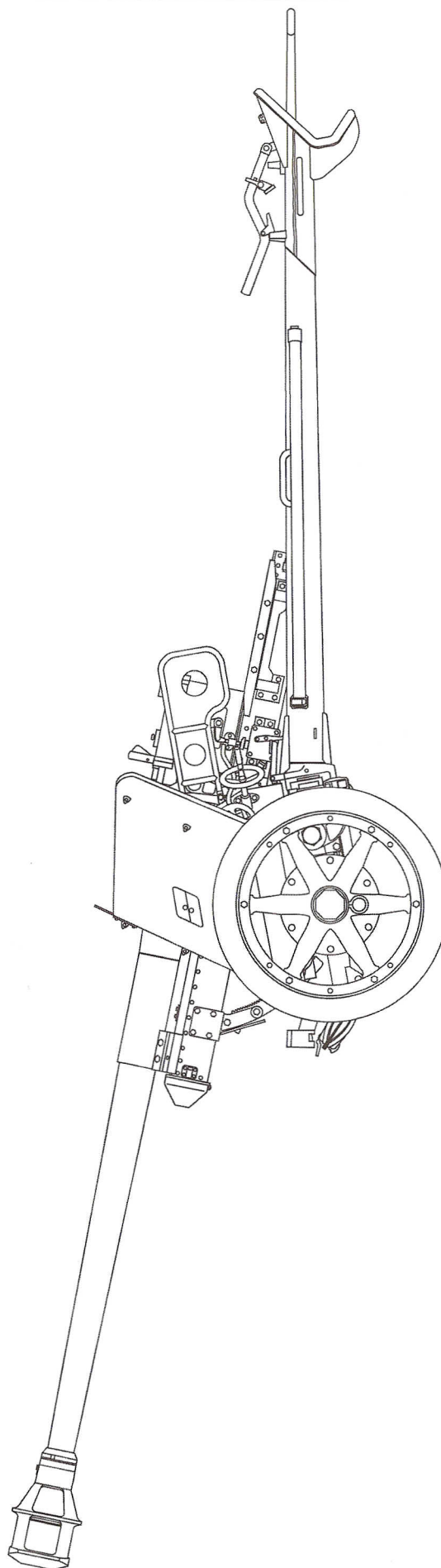
PaK 40 in transport mode



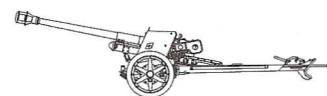
8 spokes (Maaldrift), alternate concave and convex

8 spokes (Zandoerle)

Stamped dish wheel

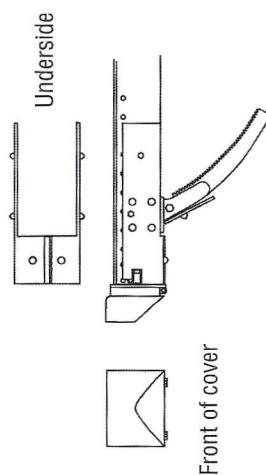


Pak 40 in transport mode
The wheels are the version with 6 spokes as seen on the guns in
Munster and Valkenburg

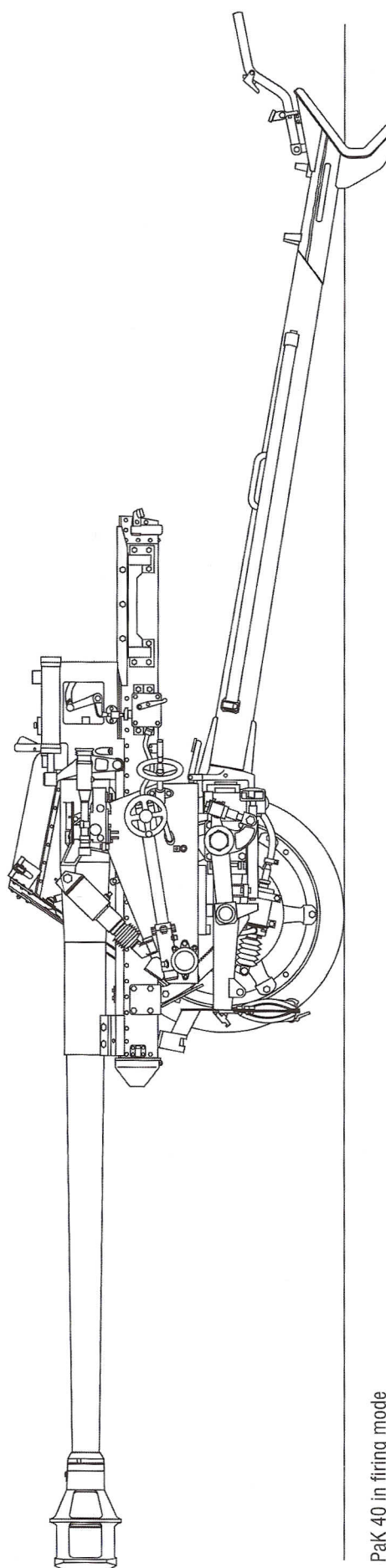
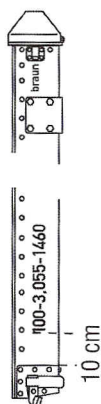


7,5 cm PaK 40

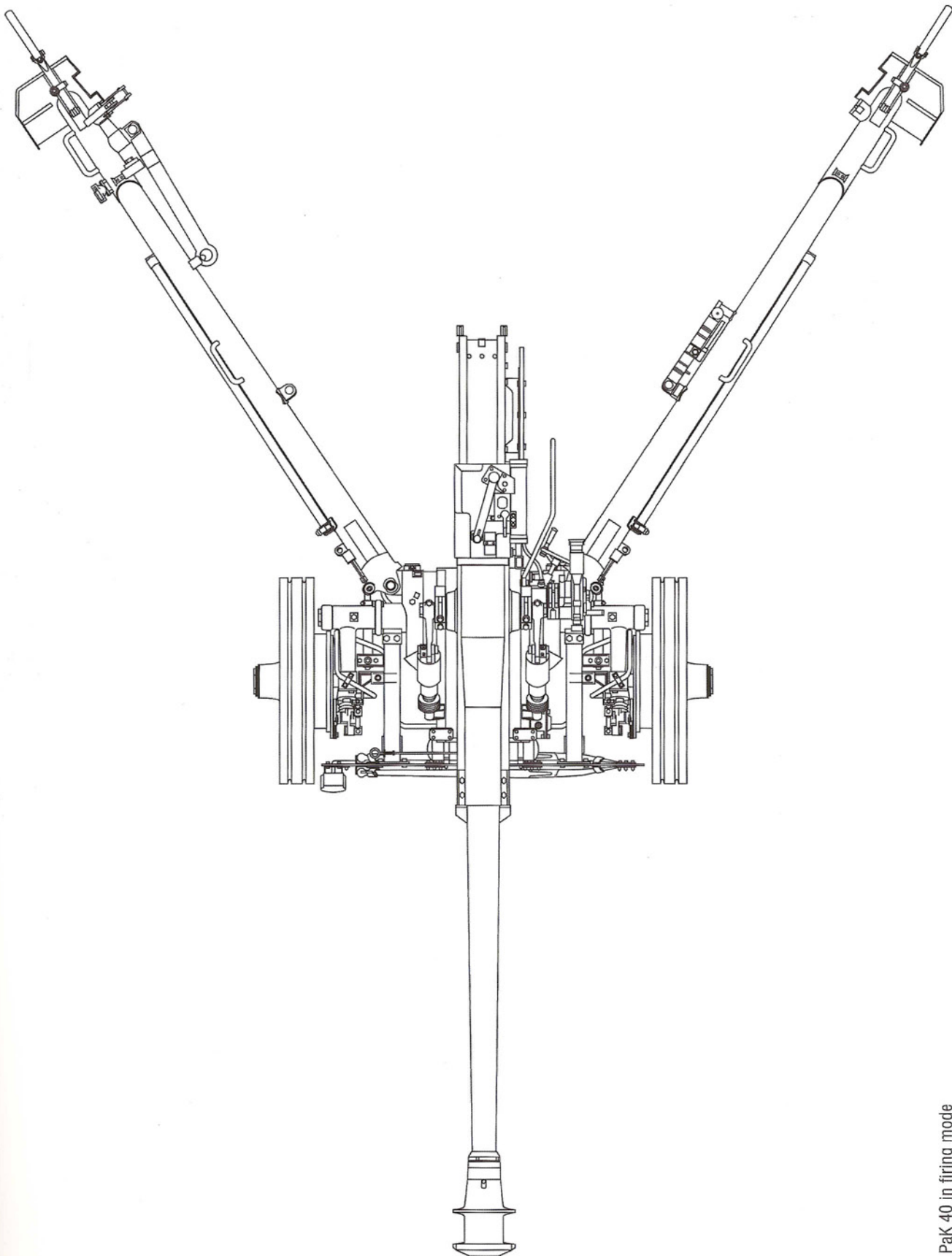
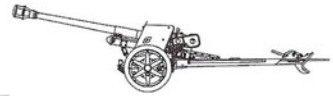
Lettering on the right side of the cradle
It is only occasionally seen on guns in action
Lettering is in Mittelschrift Bold 40 Din 1451
Color of the number: Red (RAL 3000)
Color of „braun“: White on Panzergrau base
and black on Dunkelgelb base



Additional armor on the front of the cradle
as seen on the Munster gun
The early type of front cover for the cradle
is shown here



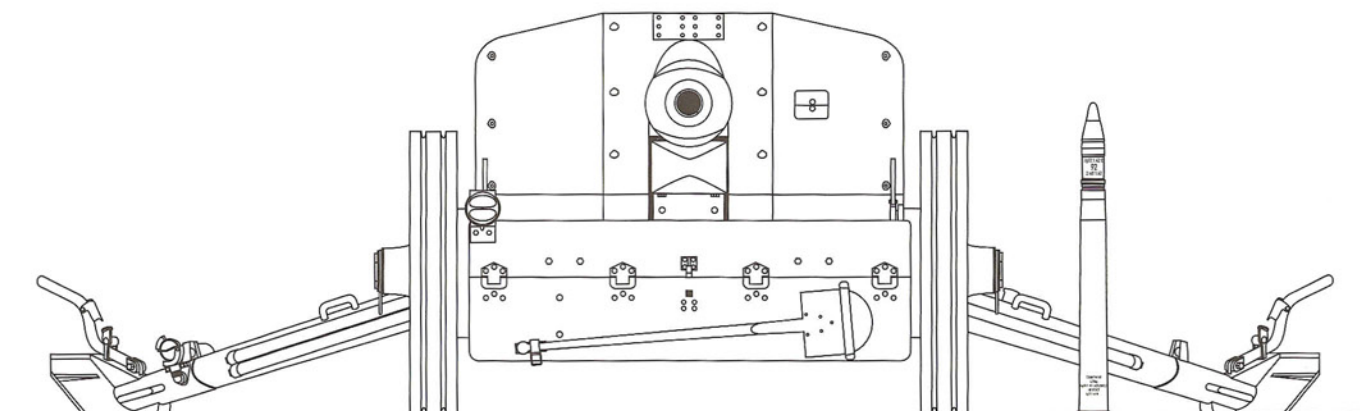
PaK 40 in firing mode
The wheel, brake drum and gun-shield on the rear side were left off
The wheel is the version with six spokes found on the guns in Munster
and Valkenburg
The later type of front cover for the cradle is shown here



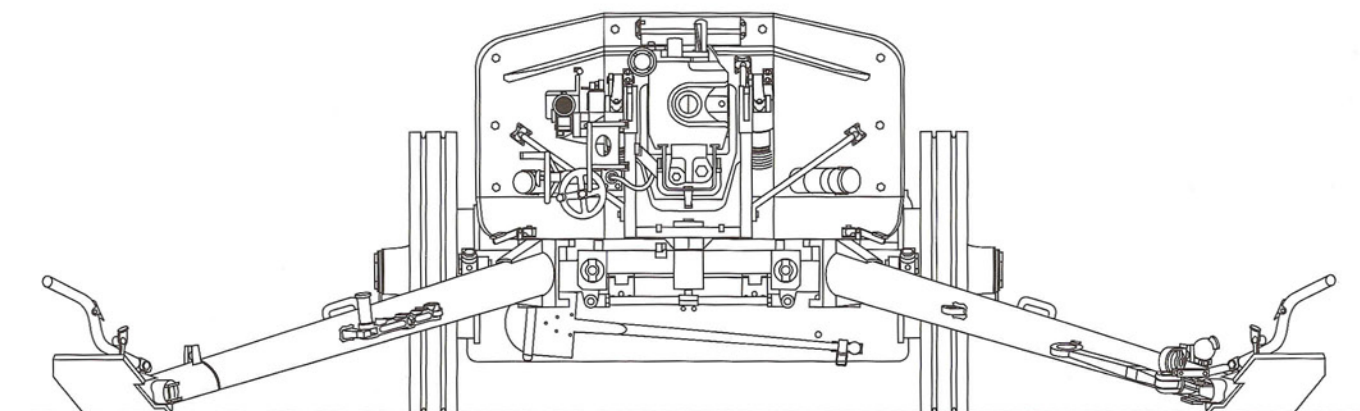
PaK 40 in firing mode
The gun-shield is left off

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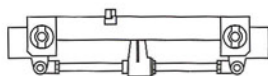
7,5 cm PaK 40



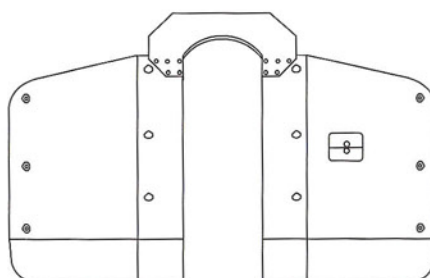
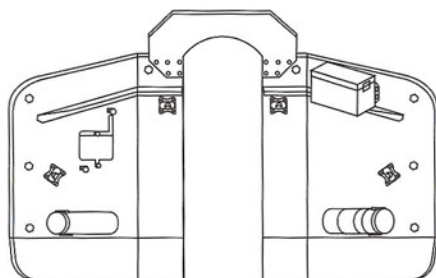
PaK 40 in firing mode, from the front
The spades are shown dug into the ground



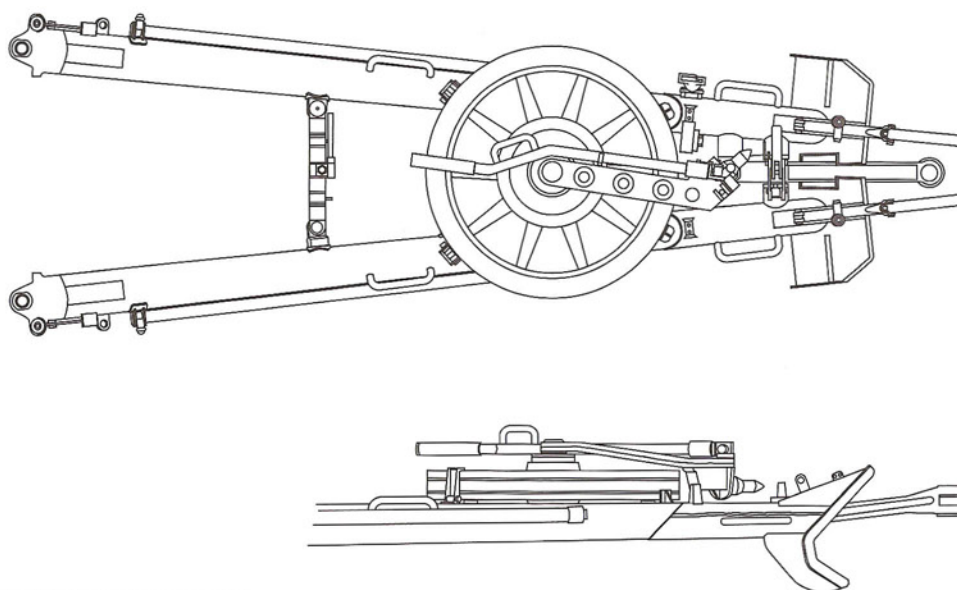
PaK 40 in firing mode, from the back



Tie-rod for the early version of the PaK 40 with stamped dish wheels

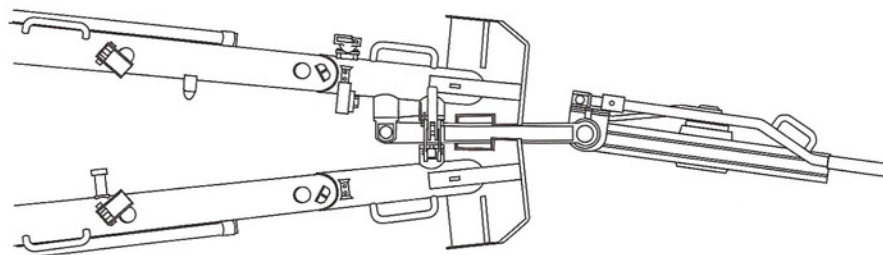
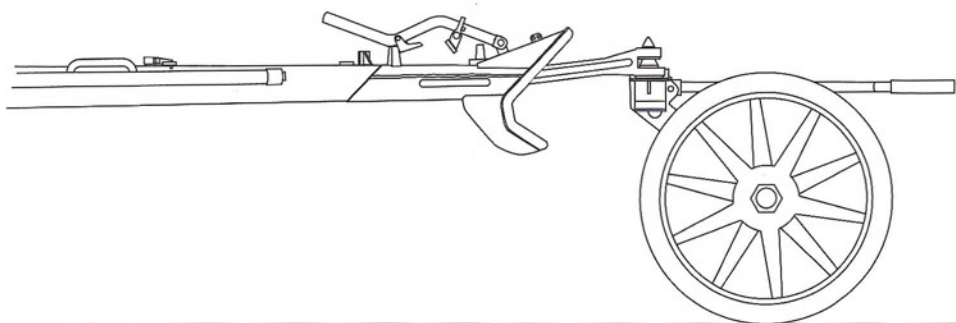


In and outside of the gun-shield for the artillery version of the PaK 40, the 7M59



PaK 40 in transport mode

The Lenkrad, trail caster, and early type of tow bar are shown. The swivelling handles have been left off for clarity. This feature is found on early PaK 40s with stamped dish wheels. The Lenkrad is exactly the same as that found on the PaK 38.

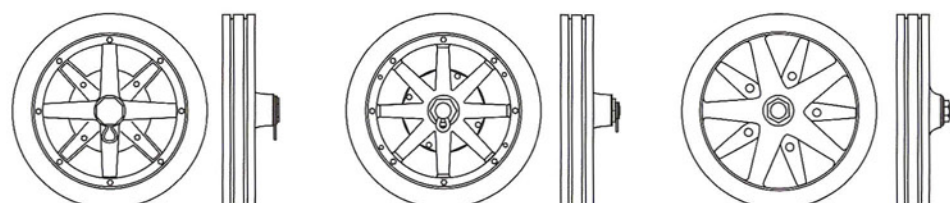
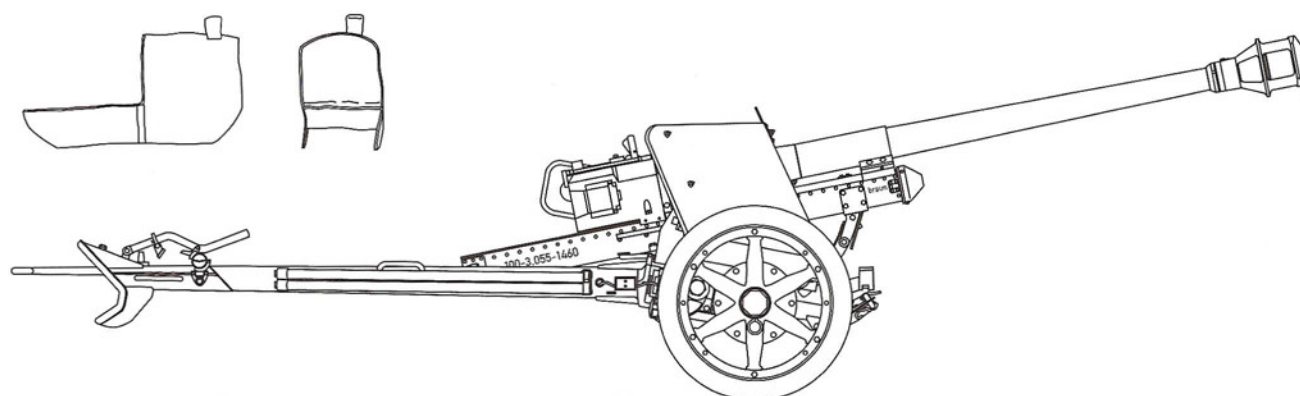
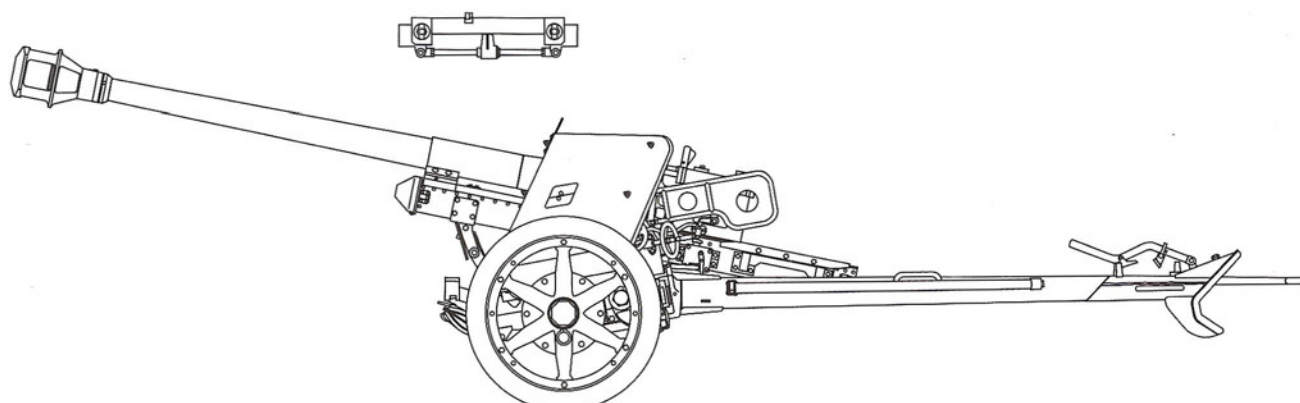
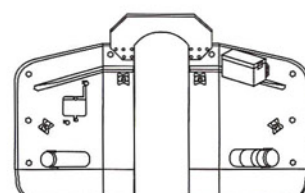
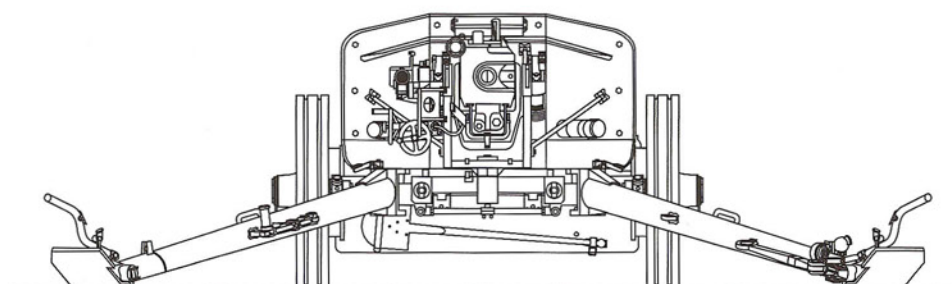
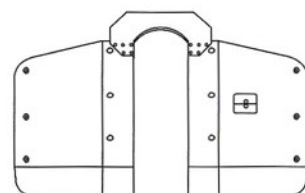
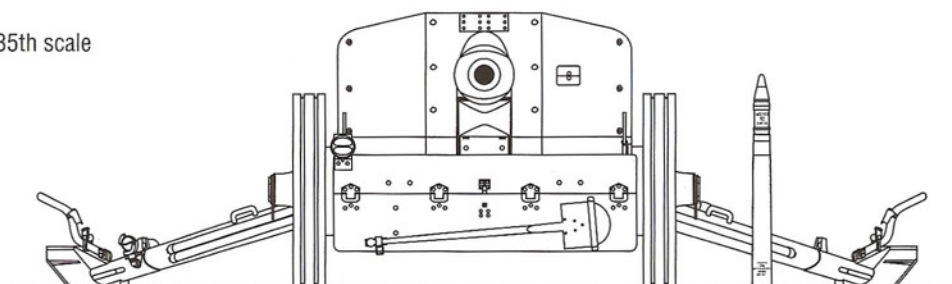


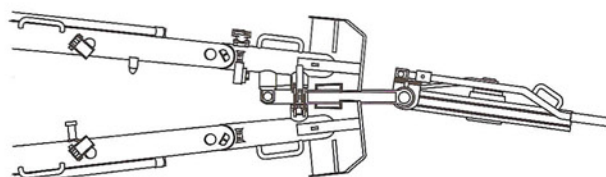
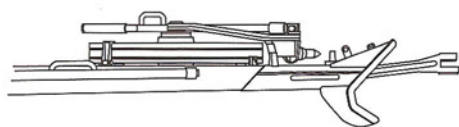
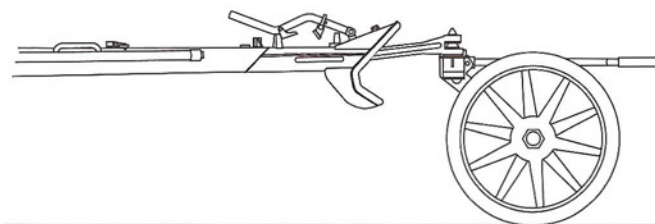
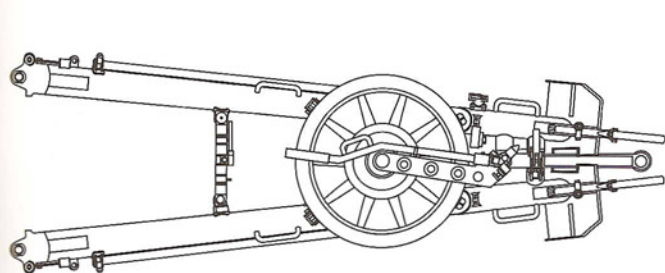
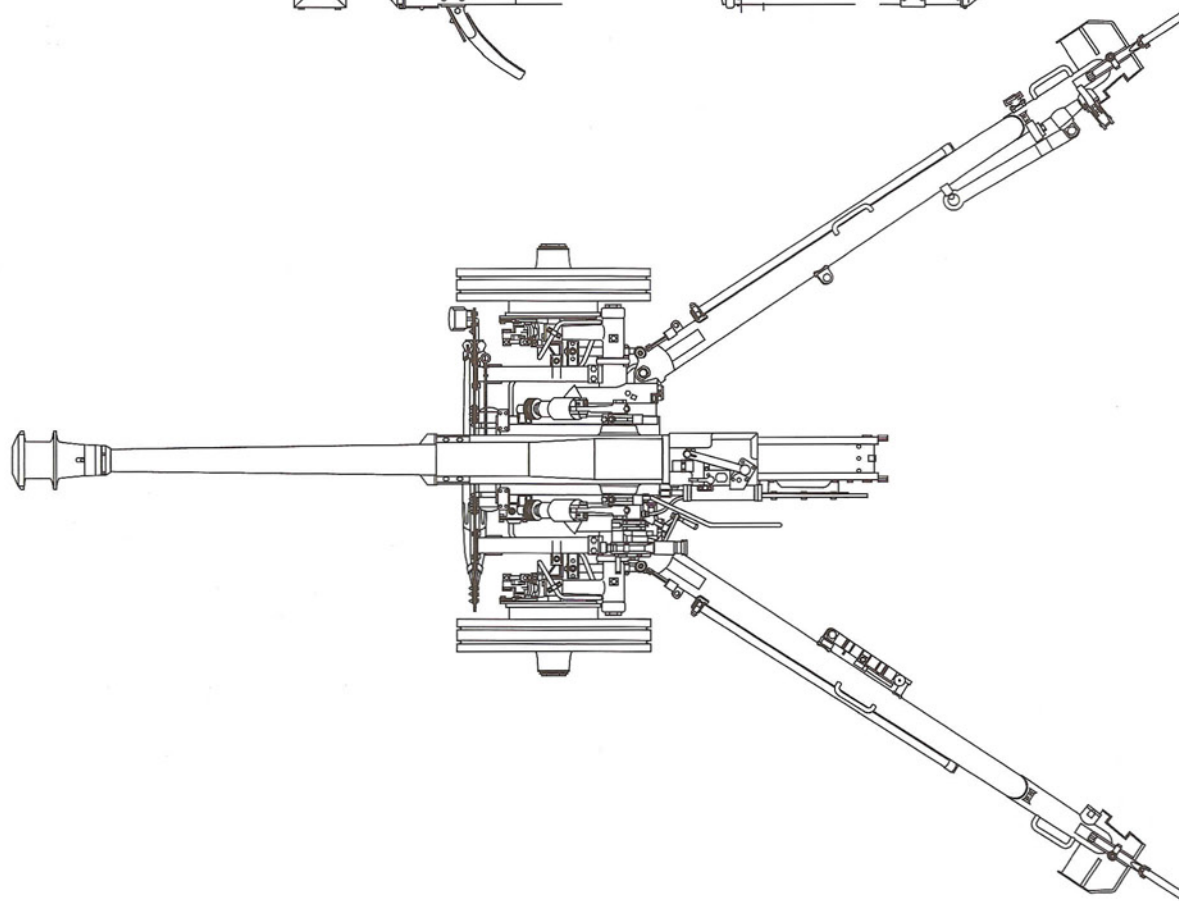
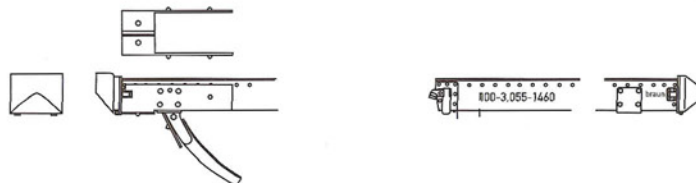
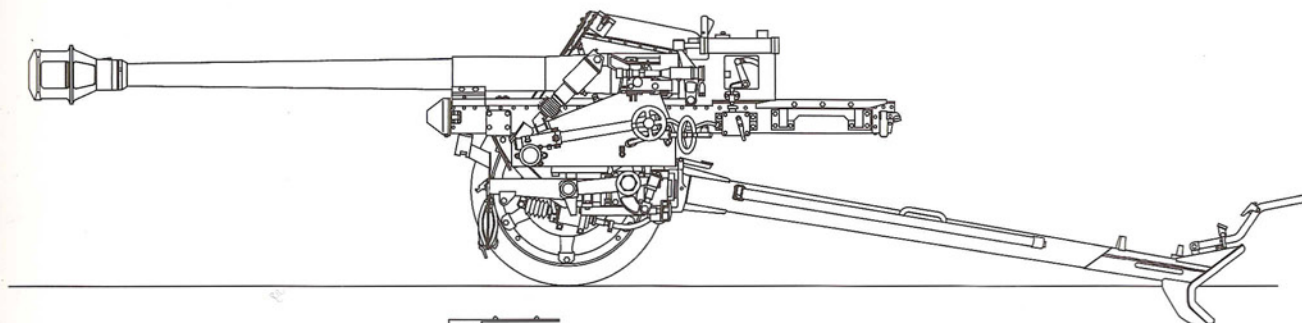
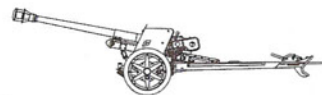
PaK 40 prepared for manhandling, movement is to the left with the barrel pointing forwards. The handle on the Lenkrad is used for steering

7,5 cm PaK 40

7.5 cm PaK 40

1/35th scale



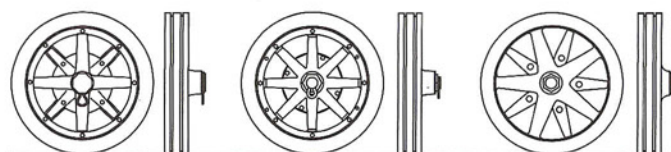
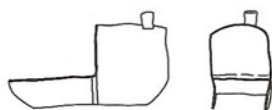
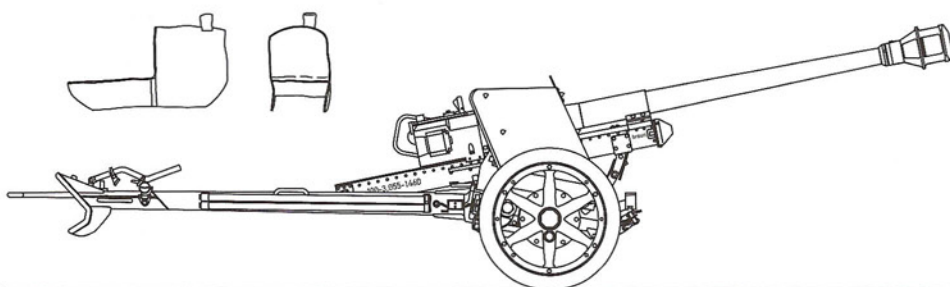
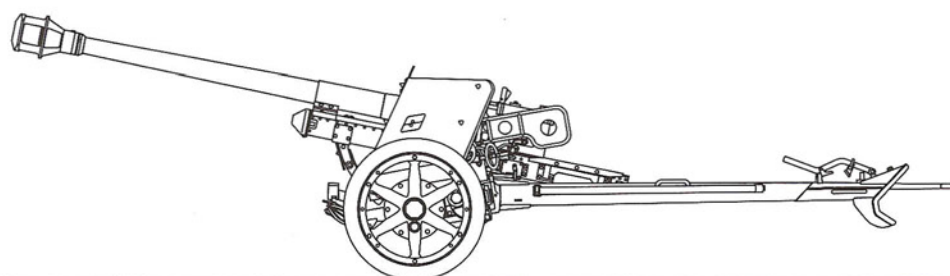
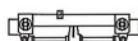
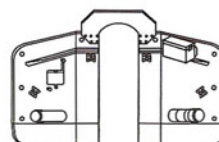
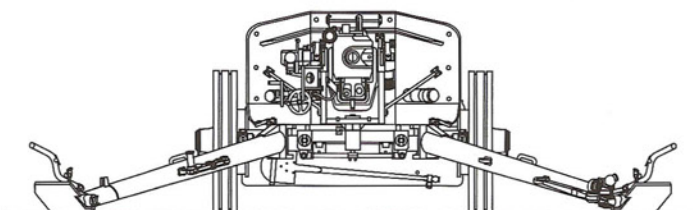
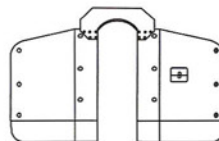
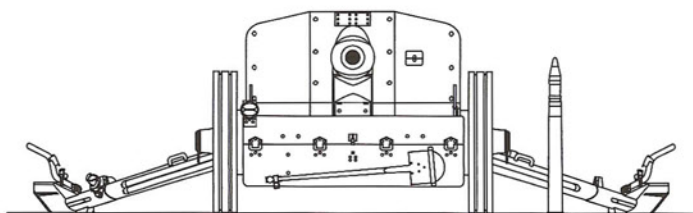


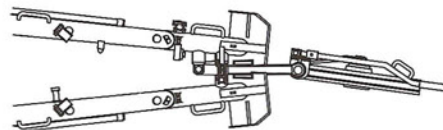
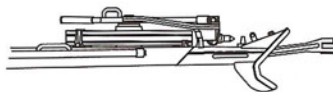
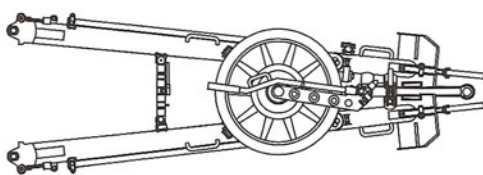
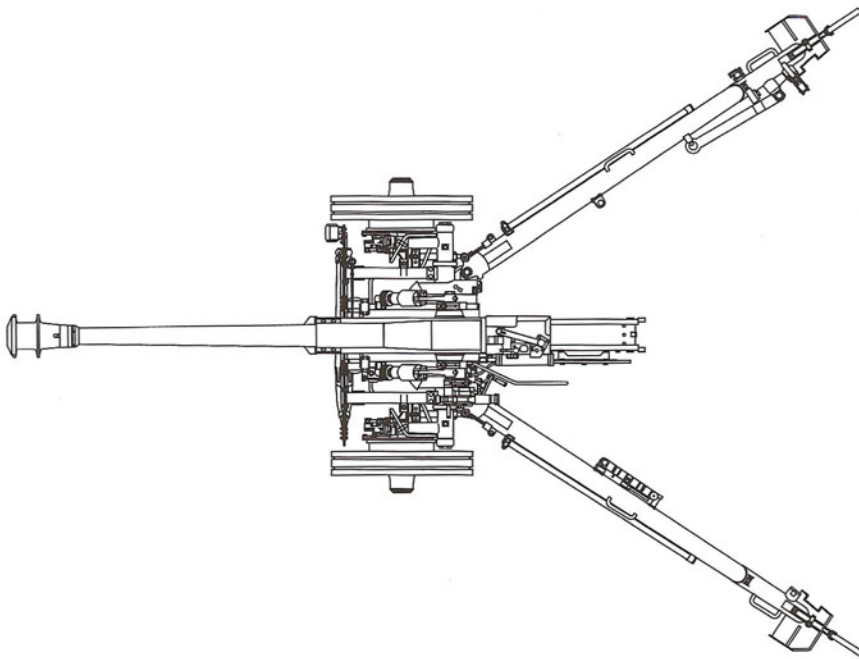
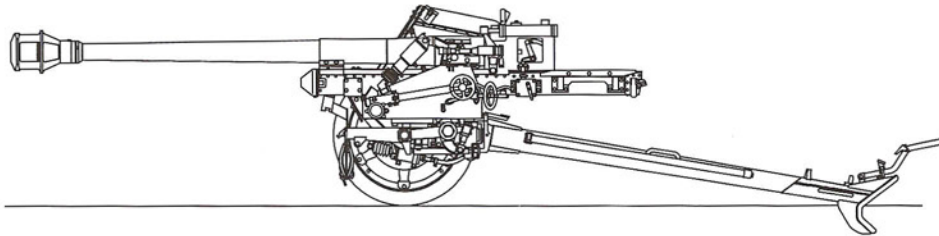
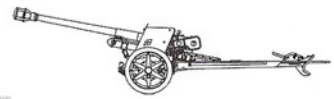
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7,5 cm PaK 40

7.5 cm PaK 40

1/48th scale





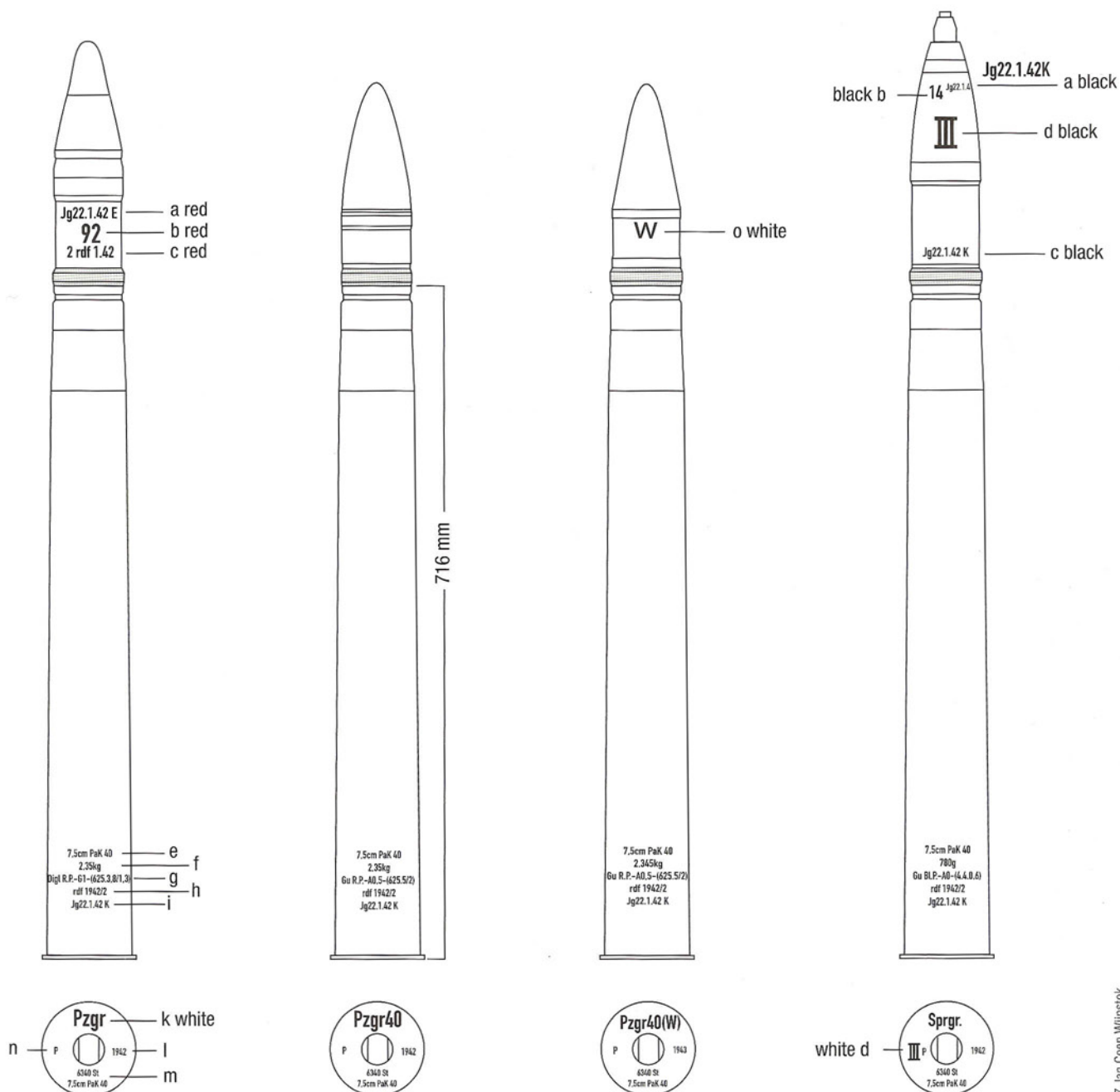
7,5 cm PaK 40

7,5 cm PaK 40 ammunition

1/7.5 scale.

The color of the stenciling on the rounds is shown with the letter referring to the key, except for the color of the stenciling on the side of the cartridge, which is always black. Where the stencils are partly obscured, they are shown fully next to the drawing. The rotating bands are shown light grey in the drawings; they were never painted. The airtight trans-

port container can be field grey or dark yellow, German Feldgrau or Dunkelgelb respectively. The type of projectile is in red, the other text is white on the field grey and black on the dark yellow base. The text is either 1451 Mittelschrift or 1451 Engschrift, regular and condensed respectively.

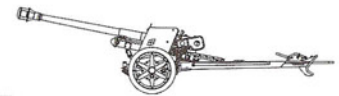


7,5 cm Pzgr. Patrone 39
color of projectile: black
height: 969 mm

7,5 cm Pzgr. Patrone 40
color of projectile: black
height: 931 mm

7,5 cm Pzgr. Patrone 40 (W)
color of projectile: black
height: 931 mm

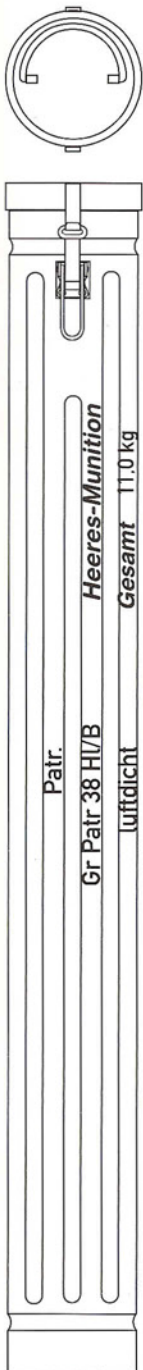
7,5 cm Sprgr. Patrone 34
color of projectile: field grey
height: 1005 mm



a
b
c
d
e
f
g
h
i

place and date of priming the shell
code for type of explosive
place and date of loading the shell
weight class, on opposite sides
type of gun
weight of propellant
type of propellant
place, year and batch-number of propellant
place and date of completing the round

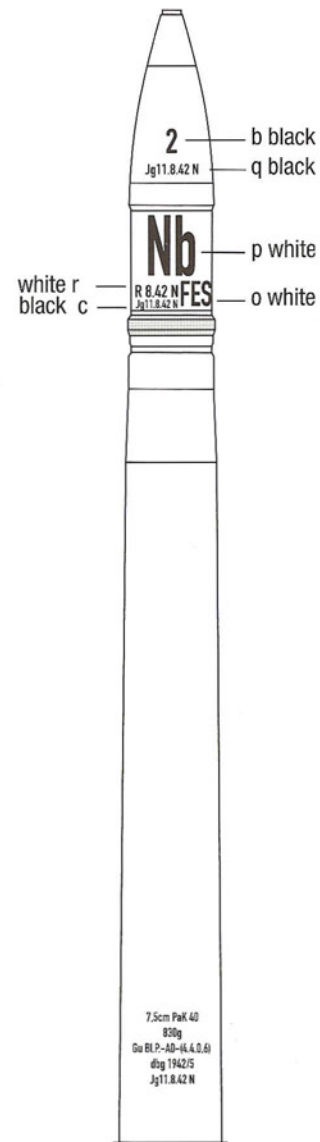
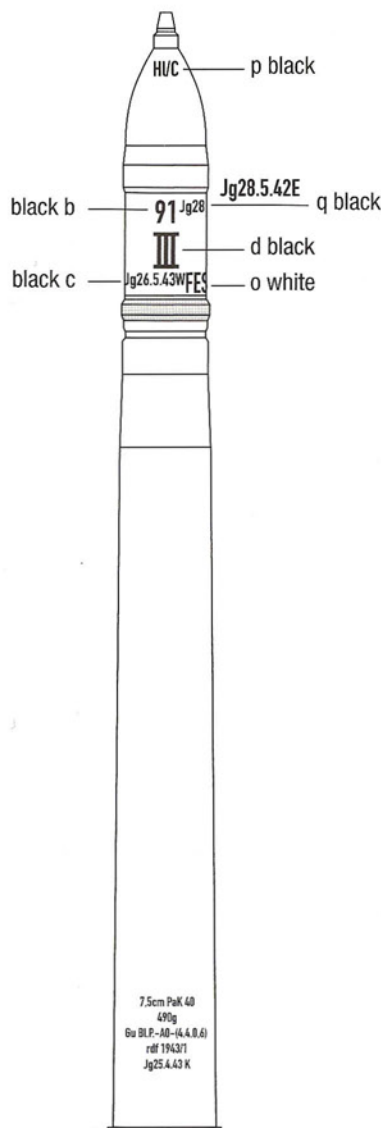
k type of projectile
l year of production of the cartridge, stamped
m code for the cartridge and type of gun, stamped
n code for the manufacturer, stamped
o type of iron used for the rotating band, on opposite sides
p type of shell, on opposite sides
q place and date of fixing the fuze
r firm and date of filling the shell



Transport container
height: 1050 mm



7,5 cm Gr. Patrone 38 Hl/B and Hl/C
color of projectile: field grey
height: 970 mm

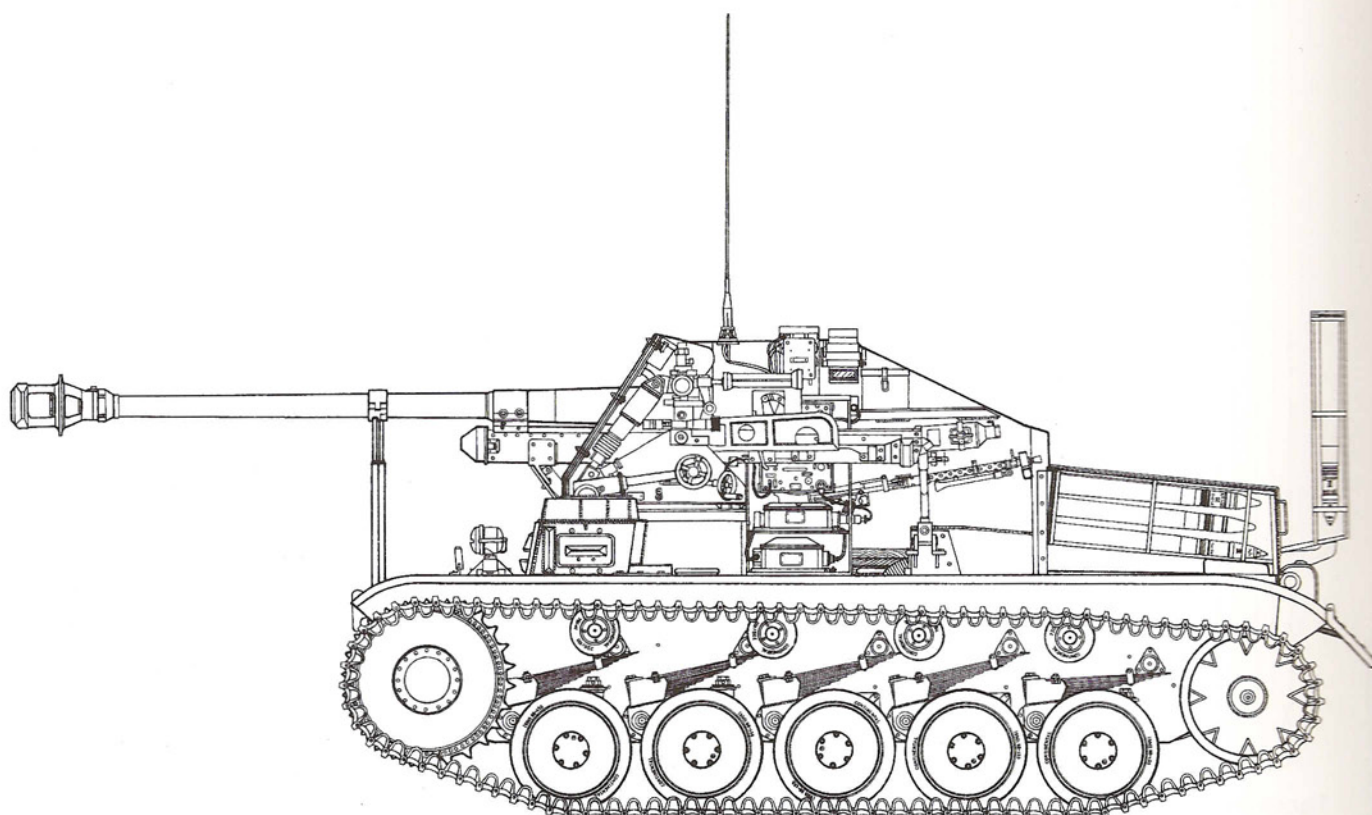
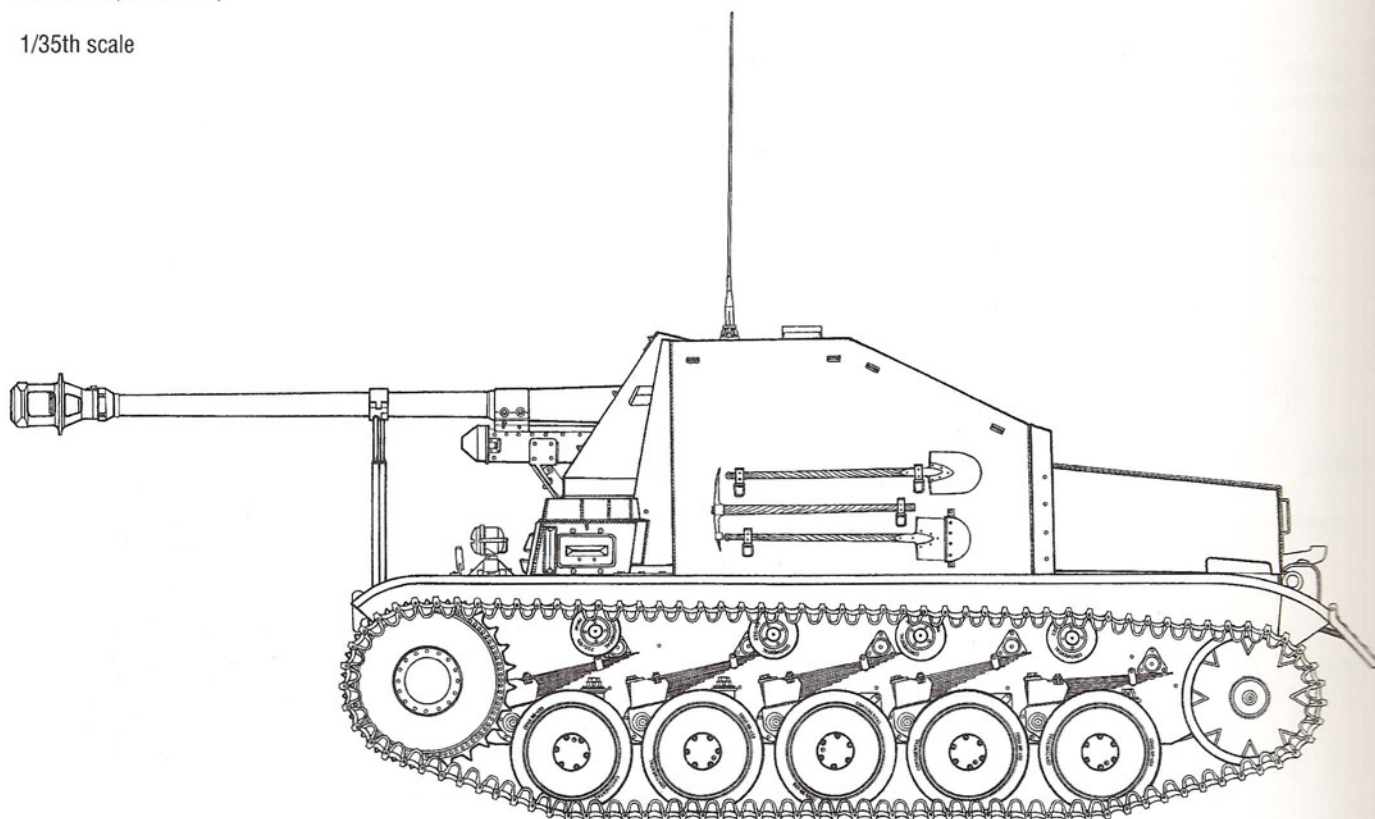


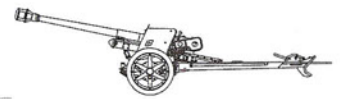
7,5 cm Nbgr. Patrone
color of projectile: field grey
height: 1005 mm

7,5 cm PaK 40

7.5 cm PaK 40/2 auf Fahrgestell PzKpfWg II (Sfl)
Marder II (SdKfz 131)

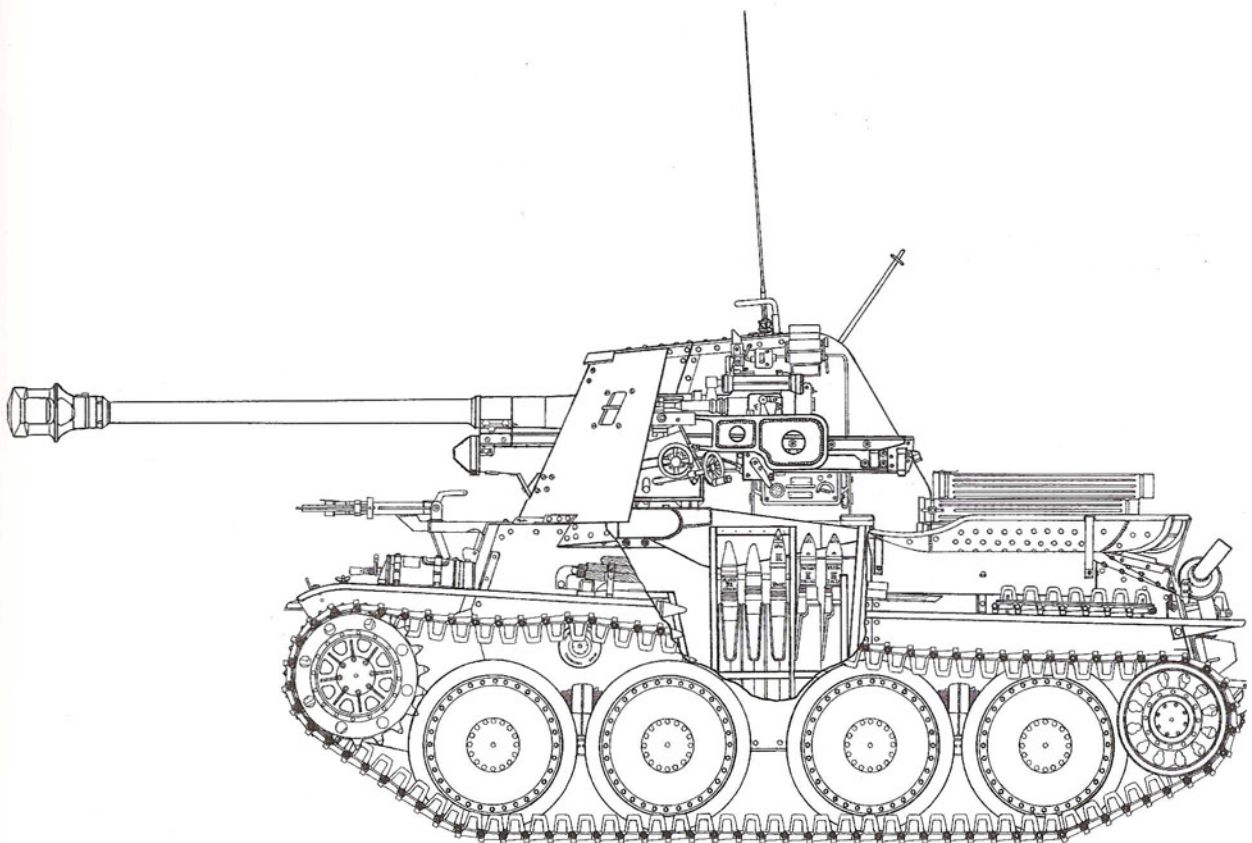
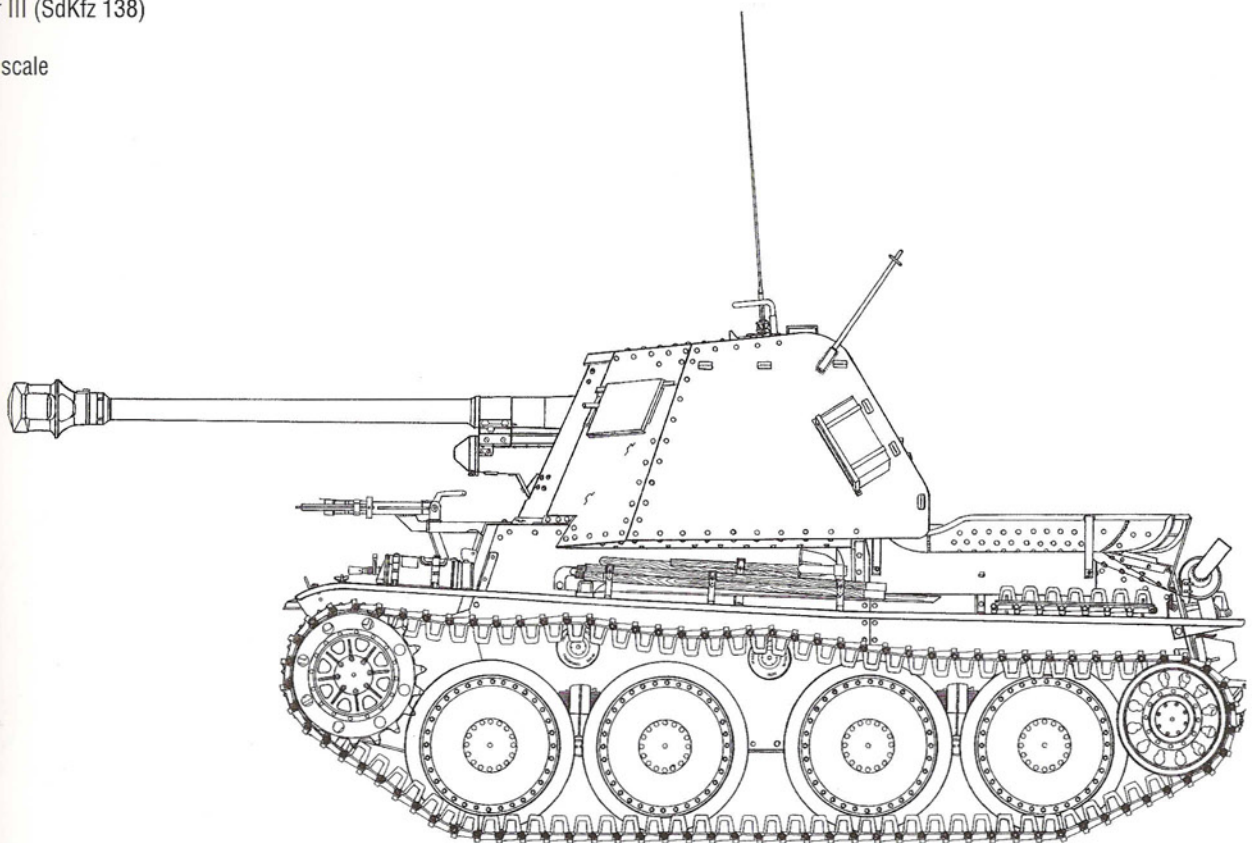
1/35th scale





Panzerjäger 38(t) für 7,5 cm PaK 40/3 Ausf. H
Marder III (SdKfz 138)

1/35th scale

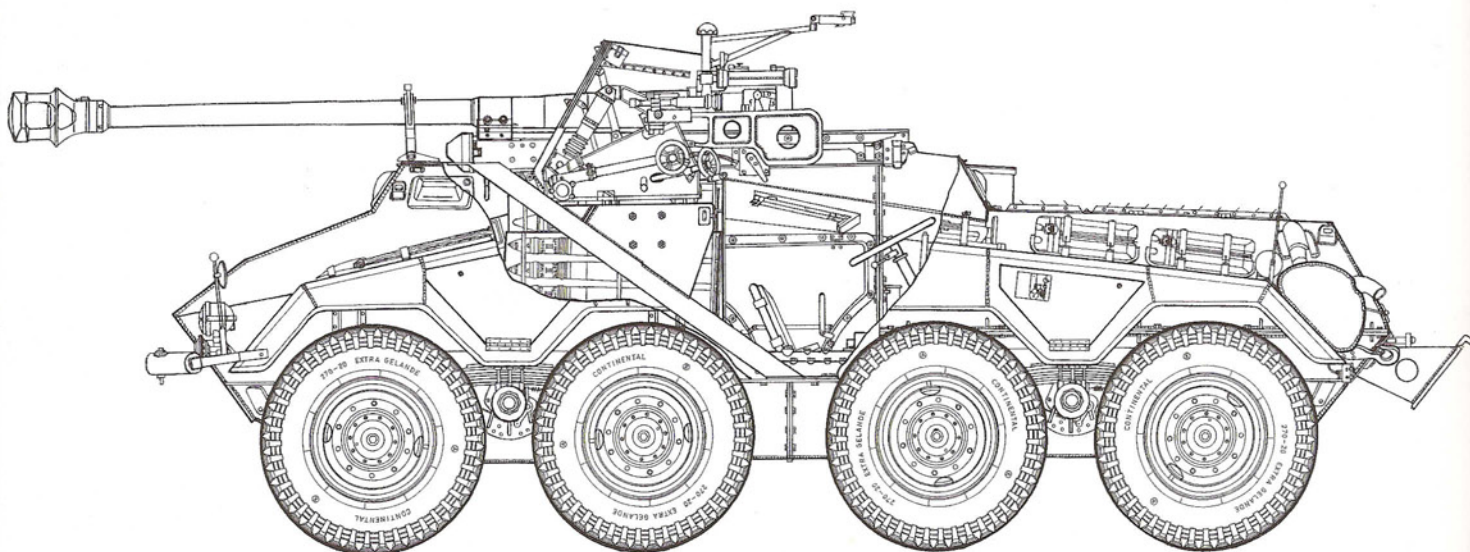
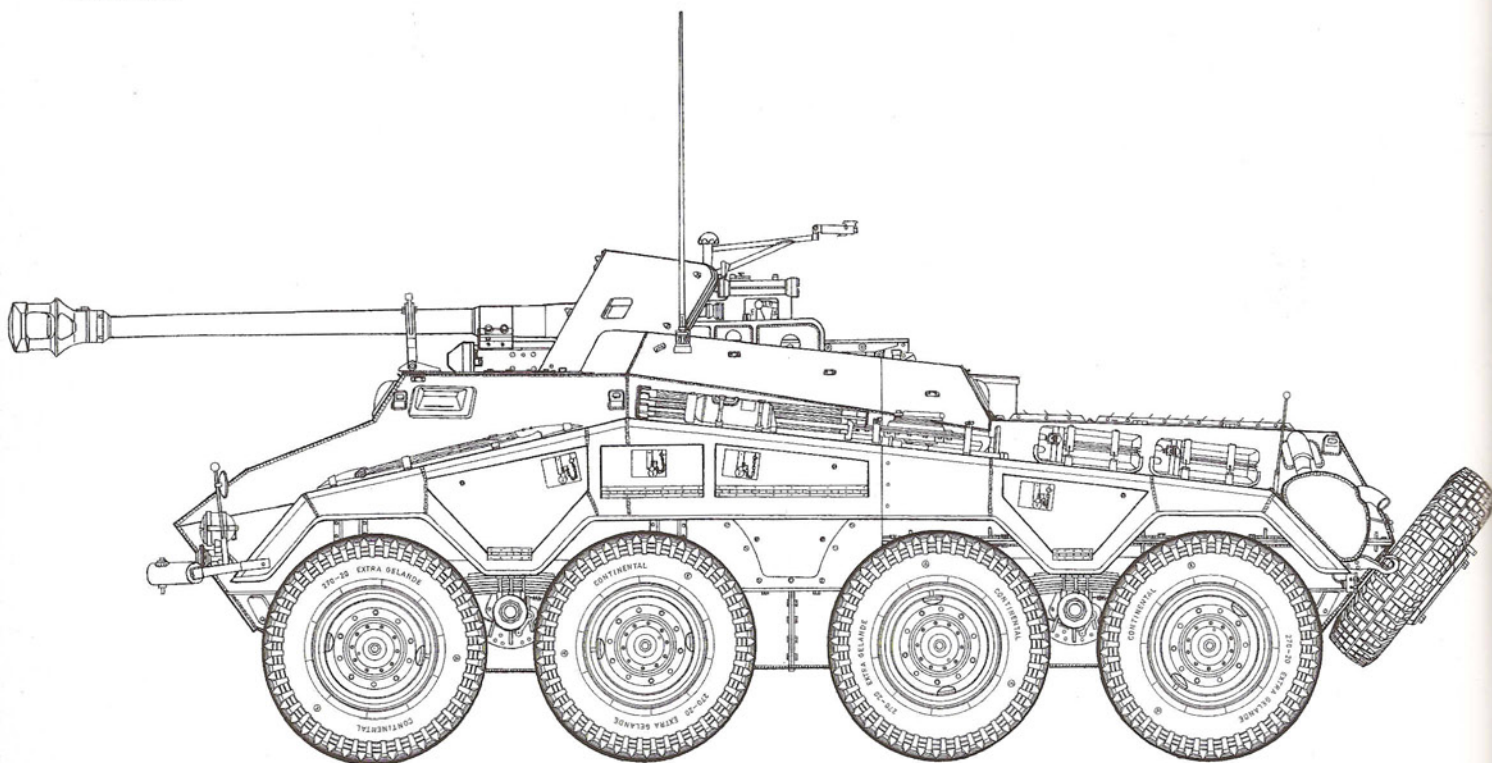


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7,5 cm PaK 40

Schwerer Panzerspähwagen (7,5 cm Pak 40)
(SdKfz 234/4)

1/35th scale



PhotoHistory



The PaK 40 was probably the most numerous and widely used anti-tank gun in the German Army inventory. It entered service in early 1942 and soldiered on until the very end of World War II. PaK 40s were used on all fronts on a number of different mounts.

Development

The appearance of tanks in the later stages of World War I started the development of anti-tank weapons and tactics. Most countries followed more or less the same path. The German Army was, of course, the first to feel the impact of tank attacks. At first, a 7.92 mm armor-piercing round originally developed for anti-aircraft use was issued to the infantry. Thicker armor soon made these rounds obsolete. Their answer lay in a heavy rifle based on the Gewehr 98 infantry rifle, called T-Gewehr that fired a 13 mm round. But ever-increasing armor defeated this type of anti-tank rifle as well. Notwithstanding this, most armies still used anti-

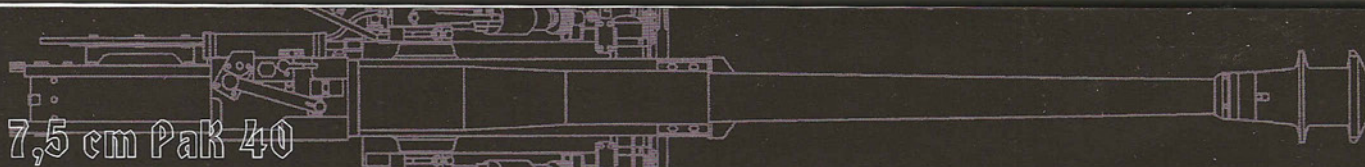
tank rifles of differing calibers in the opening stages of World War II. The British .55 in Boys anti-tank rifle is probably the best known. The next generation of anti-tank weapons were true artillery pieces. The German Rheinmetall company developed the 3,7 cm PaK L/45 for horse traction. "PaK" is the abbreviation of Panzerabwehr Kanone, "anti-tank gun" is the English equivalent. The term "L/45" indicates the length of the barrel in calibers (a caliber is a unit equal to the diameter of the bore, in this case, 37 mm). In 1934, the gun was modernized for use with motor vehicles. It received lightweight magnesium wheels with pneumatic tires. Now known

as the 3,7 cm PaK 35/36, it was capable of tackling most tanks of the period. The gun was light, because it made extensive use of lightweight materials, and low, so it could be easily concealed. Large numbers were exported and the Soviet Union built their own version. The PaK 35/36 stayed in front-line use with the German Army until the appearance of KV-1 and T-34 tanks rendered them completely ineffective. The OKH, Ober Kommando des Heeres (German Army High Command), had fore seen this development and ordered a heavier gun in 1937. Rheinmetall designed the

5 cm PaK 38, which was light and low just like its predecessor. The 5 cm PaK was also the basis for the 5 cm tank gun used in the Panzer III. The gun was only just capable of defeating the T-34. Nonetheless, the German Army had such a need for anti-tank guns that the PaK 38 was produced until mid 1944. Once more ahead of things, the OKH had ordered the development of a 7,5 cm weapon in 1939. Once more, Rheinmetall was the chief developer. The 7,5 cm PaK 40 was basically an enlarged PaK 38, with one big difference. Right from the start of World War II the German

[Top] This PaK 40 was photographed somewhere in central Russia in early 1943. The gun is dug in to reduce its height even more. Camouflage consists of grass and snow. The gun seems to be dark yellow. If this is so, it may be among the first dark yellow

equipment to be delivered. The change over was ordered in February 1943. The crew is dressed in greatcoats and side caps, not the special winter uniform that was available at the time. [Bundesarchiv 276/0706/24]



7,5 cm PaK 40

[Right] A PaK 40 and Sdkfz 7 of the Grossdeutschland Division near Voronezh in the Soviet Union. The photograph was taken in 1942. The Sdkfz 7 was the intended tractor for the PaK 40, however, they were complicated machines and hard to build, so there were never enough to go round. The crew is mounting through the back door of the half-track. The gun is probably relocating to a new position. When traveling longer distances the muzzle and breech covers would be installed. The gun and vehicle must be dark gray, although they seem much lighter due to accumulated dust. [Bundesarchiv 732/0132/08A]



industry was facing a lack of raw materials, which meant that light-weight alloys could no longer be used. The PaK 40 was an all steel construction, making it a heavy gun at almost 1500 kg. When the PaK 40 was presented to Hitler, he objected to Abwehr, defense, because it wasn't dashing enough. So the official name was changed to 7,5 cm Panzerjäger Kanone 40, Tank hunter Gun. Strangely though, the full

name in the inventory is 7,5 cm Panzerjäger Kanone 40, whereas the official abbreviation is given as 7,5 cm PaK 40.

The PaK 40 first appeared in the Army's inventory in February 1941 with 15 guns, only three of them towed versions. Right from the start the PaK 40 was to be used on a variety of self-propelled carriages. The first self-propelled mounts proposed were captured French Lorraine tractors and tank chas-

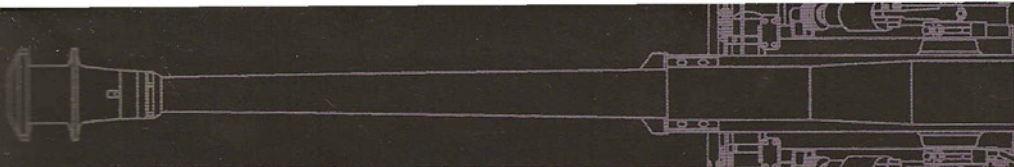
sis. The official names are: 7,5 cm Panzerjäger Kanone 40/1 auf Selbstfahrlafette Lorraine Schlepper or 7,5 cm PaK 40/1 Sfl LrS, 7,5 cm PaK 40 auf Geschützwagen 39 Hotchkiss (f) and 7,5 cm PaK 40 auf Geschützwagen FCM (f). Less than a hundred of each was built. In the same period, chassis from the obsolete Panzer II were proposed as mounts. The result is best known as the Marder II. The official name is: 7,5 cm Panzer-

jäger Kanone 40/2 auf Selbstfahrlafette II or 7,5 cm PaK 40/2 Sfl II. Next in line was the Marder III based on the Czech Panzer 38(t) chassis, officially known as: Panzerjäger 38 mit 7,5 cm PaK 40/3. Later in the war, the fully tracked Raupenschlepper Ost, the heavy eight wheeled armored car and the half-track troop carrier were added to the list.

Visually, the towed version of the PaK 40 changed very little during

[Bottom] The RSO, Raupen Schlepper Ost, was a fully tracked artillery tractor especially developed for use on the Eastern Front. It was a simple, easy to produce design. The RSO entered service in late 1942 or early 1943. This is the early production model with all steel cab, later versions had wooden cabs. This photograph was taken in the spring of 1943 at the earliest. The PaK 40 is an early production model made with pressed steel disc wheels. Grass is attached to the gun shield and barrel as camouflage. The long barrel of the PaK 40 was often disguised by draping netting or foliage over it. Both gun and RSO are dark gray. The standing soldier is an Obergefreiter or corporal. He can be identified by the double chevron on his sleeve, which is worn only on the left, unlike in the US and British armies where chevrons are worn on both sleeves. [Zbigniew Lalak Collection]





[Left] A snowy scene somewhere in the Soviet Union. This is an example of an early PaK 40 with pressed steel disc wheels. The gun is dark gray with white sheets used as camouflage. Note the two white kill rings on the barrel. Lying in transport containers, the ammunition is ready behind the gun. The crew is wearing the first pattern gray winter uniforms that were available for the winter of 1942–43. [Zbigniew Lalak Collection]

[Bottom] Another example of a dug-in PaK 40 in the Russian winter. Note how it presents an amazingly small target. No attempt at camouflage seems to have been made, and the gun is overall dark yellow. The crew is all dressed in reversible winter uniforms, one side has splinter camouflage, and the other is white. The commander is wearing the winter trousers with felt topped boots. Note the size of the gunner's fur hat. This photograph was taken in early 1944. [Bundesarchiv 690/0201/28]

its production. The early version had stamped dish wheels just like the PaK 38. These are called Elektron Rad, because the pattern resembles electrons spinning around the nucleus. This stamped pattern gives the wheel its strength. The first PaK 40s were equipped with a trail caster that was fitted to the eye of the tow-bar to increase maneuverability when the gun was manhandled into position. This wheel was stowed on

the trails of the gun. This feature was later omitted. Whether this was done to speed up production or because it didn't make much difference in action is not known. There was an ever-increasing demand for PaK 40s, so most of the changes to the gun were done to simplify production.

The stamped wheels were later changed to a cast design with six or eight spokes. Casting doesn't require complicated machinery

so cast wheels could be produced by a wider range of manufacturers. Up until at least 1943, the guns had pneumatically operated brakes as well as a rear light. Electrical and air conduits ran through the right trail. These features were later left off.

When the anti-tank effectiveness of the PaK 40 diminished by 1944 it was decided that it would serve as a field gun as well. The guns and crews that were until then

attached to infantry units now became part of the artillery. The name of the gun was changed to Feld Kanone 40, FK 40. The maximum elevation of the PaK 40 was +22 degrees, which is quite small for a field gun. Anti-tank guns use direct sights to track their normal targets. There is no need for high elevation or long range. Newly built guns were provided with an extended elevation cam, which gave them a maximum eleva-



7,5 cm PaK 40

[Right] A camouflaged PaK 40 being towed by an Sdkfz 10, the 1-ton half-track. This photograph and the next one were taken in central Russia in May or June 1944. The gun has a lattice work of darker paint over the dark yellow base. The open grassy terrain makes green the more obvious choice of camouflage color. The muzzle cover is a simple bag with a stiff front in the shape of the front baffle. It closes around the barrel with a drawstring or buckle and strap. Note the reflector on the inside face of the folding lower gun shield. The shovels are not stowed here. [Bundesarchiv 280/1058/13]

[Bottom] The same vehicles photographed from the other side. The breech and muzzle covers are in place on the PaK 40. In contrast to the gun, the Sdkfz 10 has a lattice work of lighter strokes on a dark base, most likely dark yellow and dark gray. The crew of this PaK 40 consists of six men, including the driver and commander. The latter can be identified by the white lace on his collar and shoulder straps as an Unteroffizier, the lowest non-commissioned rank in the German Army; sergeant would be the US equivalent. [Bundesarchiv 280/1058/14]



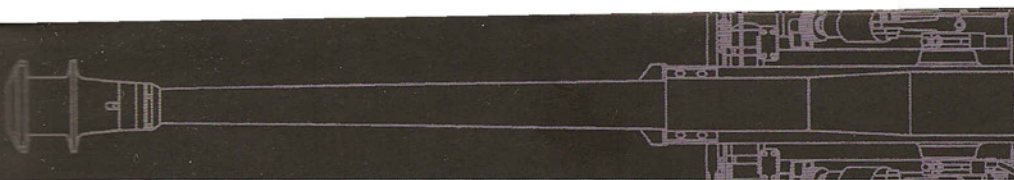
tion of +35 degrees and a longer range. These guns can be identified by the modification made to the gun shield to accommodate this higher elevation. PaK 40 barrels were also placed in leichte Feld

Haubitze 18/40 carriages, which used the undercarriage of the PaK 40 and the top carriage of the le. FH 18. The guns were named 7 M 59 and 7 M 85, according to a new system introduced in Sep-

tember 1944. The "7" indicates caliber, "M" the type of ammunition fired and, finally, the last two digits the drawing number. Only few of these guns were built. The PaK 40 was produced from

late 1941 right until the end of the war in Europe. In total, more than 23,000 were built, about 19,500 of which were towed guns. These numbers include the PaK 40s on self-propelled mounts,



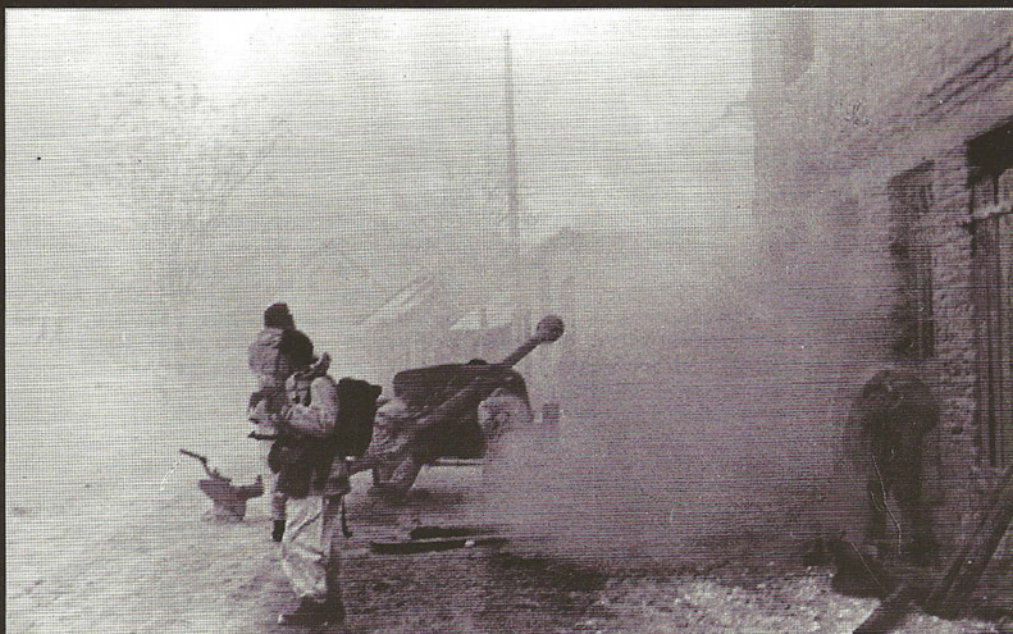


[Above] A well prepared gun position somewhere in Russia in 1944. The gunner is hanging against the shoulder guard in a rather awkward position. The gunner and commander are definitely German soldiers judging from their uniform and marching boots. The loader and ammunition handlers, however, wear a different style of uniform and their equipment isn't German either. Note the ankle boots and puttees worn by them. [Bundesarchiv 024/3543/09]

[Left] A PaK 40 being manhandled onto the road. This photo clearly shows how much effort it took to move the gun without the help of a motor vehicle. At least twelve men are visible around the gun, which is twice the normal crew. The man sitting on the end of barrel helps to balance the gun. The gun is clearly dark yellow. The earliest date of this photograph is 1943 because the men are wearing the model 1943 uniform with simplified pockets and also ankle boots with gaiters that were also introduced in 1943. [Zbigniew Lalak Collection]

7,5 cm PaK 40

[Right] A PaK 40 in full recoil with the cartridge shooting out of the breech. The gun's muzzle blast kicks up a lot of snow. The elevation of the gun is high in order to fire over the houses in front. A distance and a direction are set and the gun is fired, without the crew being able to see the target. This is called indirect fire. There was an auxiliary artillery sight available for this. The small mound of snow behind the spade is caused by the backward movement of the gun when fired. The spades should preferably be dug in to provide a stable firing platform. There is no sign of snow camouflage on the gun. The men are all in white winter uniform. These reversible winter uniforms were worn mostly on the Eastern Front. [Zbigniew Lalak Collection]



but not the derivatives used as tank guns. Production reached its peak in 1944, when an average of 1,000 guns per month was built. October 1944 had the highest production with 1,054 guns being produced or about 35 guns each day. There was a need for these high production figures as losses were staggering. Poor manhandling characteristics meant that PaK 40s frequently couldn't be

retrieved by their crews when their tow vehicles were unable to reach them because of enemy activity. The crew of six men was simply unable to move the gun in difficult terrain. Photos on pages 61 (bottom) and 63 (top) show how cumbersome the gun was and how many people were needed to move it. As an example, in August 1942 175 PaK 40s were built and 77 lost. In August 1944 840 PaK 40s

were built and no less than 1,236 lost. This is the highest loss in a single month. In the first days of March 1945 the inventory of the German Army still counts 5,228 PaK 40s of all variants.

The intended tow vehicle for the PaK 40 was the 3-ton half-track SdKfz 11 with artillery body that had storage for ammunition. The 5-ton half-track SdKfz 6 could also be used. The RSO fully tracked

tractor, which entered service in early 1943, was also used. These types of vehicles provided good cross-country traction. Any vehicle that was able to pull the gun was used later in the war. The 1-ton half-track SdKfz 10 was at the limits of its capability when it was used to tow the PaK 40.

The tow vehicle was used to get the gun into position; the crew disconnected the electrical and

[Right] This is an example of an early gun. It has the pressed steel disc wheels and one can just see the folded down holders of the Lenkrad, a dolly wheel, near the handles halfway down the trails. These were installed only on early guns. The gun is probably dark gray. This gun emplacement is very well prepared, with wooden floorboards and a plank or log wall around the dugout. The trees around the position give visual cover and make it harder to attack. The camouflage smocks and helmet covers identify the crew as members of the Waffen SS. The loader is operating the lever that opens the breech and cocks the gun for the first shot. [Zbigniew Lalak Collection]





[Left] Manhandling the gun was hard work. The men are wearing a mixture of normal and tropical uniform; the two very light caps are reminiscent of the North African campaign. The man on the left pulling on the rope is wearing puttees. This mixture of clothing was common during the Italian campaign. [Daniele Guglielmi Collection]

[Bottom] Men of "A" company of the 5th Royal West Kents advance along a road past an abandoned German 7.5 cm anti-tank gun in the Rapido bridgehead, Italy, 16 May 1944. The lowered gun shield indicates the gun was in firing mode when it was pushed. The folding half of the lower gun shield is pushed back, while normally it hinges to the front. The gun is overall dark yellow. This gun has the early armored cover for the trough with the straight top. [Photograph NA14957 courtesy of the Imperial War Museum, London]

air supply and lifted the gun off the towing pintle. The cradle lock was released and secured along the trail. The trails were unlocked and spread, which locked the suspension to create a rigid firing platform. The spades then had to be dug in. Ammunition would be unloaded and the tow vehicle would then pull back under cover. Three men were needed to operate the gun, a commander, a

gunner and a loader. The rest of the crew would be engaged with transporting and unpacking the ammunition.

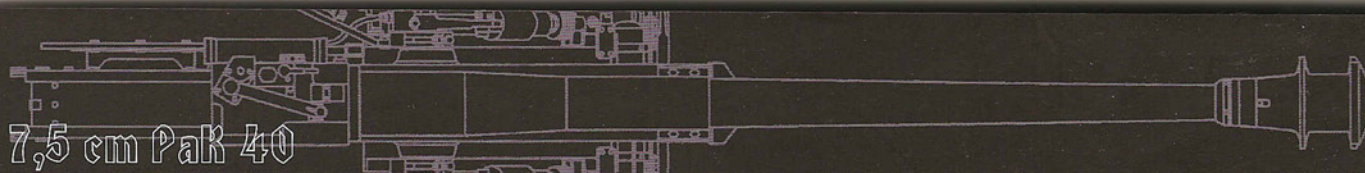
Anti-tank tactics

The years between the two world wars saw the emergence of two contrasting tank doctrines. On the one hand there was the infantry tank doctrine, which hailed back to World War I and used tanks solely

to support infantry. On the other hand was the breakthrough doctrine, which used tanks as a mobile force that smashed through enemy lines and then pushed on to create havoc with communications and supply. Since both doctrines had their merits they were both adopted. This meant that anti-tank tactics would have to tackle both kinds of attack. When an infantry attack supported by tanks suc-

ceeds, the troops will pull back to their reserve positions and continue the fight. It was thought that stopping the tanks far from your own lines was the best tactic. The anti-tank weapons would have to be in or even ahead of the front line. They would start firing at maximum range. When a tank breakthrough occurs, the infantry will stay in their positions to fight enemy infantry. The tanks behind





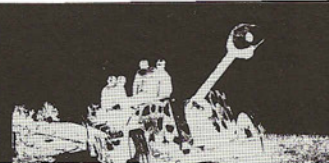
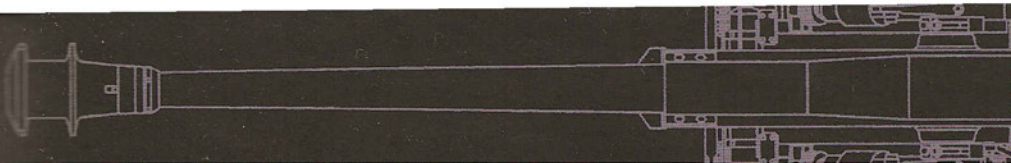
7,5 cm PaK 40

[Right] An abandoned PaK 40 in Italy. The gun has no rear light or hand brakes, so it is a late production model. There seems to be a hole in the left side of the gun shield. The three color camouflage scheme was painted by hand. The soldiers passing the gun are Gurkhas.

[Below] The loader is pushing a cartridge into the breech. The color of this gun seems very light. Once more the provision for the electrical system is there, but not the actual socket to plug in the electric lead from the tow vehicle. The men are SS, the collar patch on the standing man and the sleeve eagle on the man sitting nearest to us are the indicators.

[Below right] An overall dark yellow PaK 40 in service with paratroopers. Their helmets clearly identify them as such. This is probably a late production model since it has no rear light. The holes for bolts and the electric lead are visible however. This is not uncommon, the parts of the gun may have been manufactured by a variety of producers to certain specifications, regardless of whether the rear light would be installed or not. The binoculars are very similar to ones used by anti-aircraft batteries to observe high altitude planes. The paratroopers all wear splinter pattern jump smocks. [All photos: Daniele Guglielmi Collection]





[Left] A PaK 40 in a textbook setting, dug in behind a low earth barricade with trees to give visual cover as well as protection from attack. The camouflage on this gun is very distinctive; it consists of some sort of material with tufts of bristle attached to it, draped over the trails and gun shield. The gun itself is overall dark yellow. Ready ammunition is kept in transport containers. [Zbigniew Lalak Collection]

[Bottom] The same PaK 40 as in the previous photograph, this time from the front. The muzzle brake has a different shape from those on the surviving guns in the color section. From this angle it is clear how effectively the camouflage hides the boxy shape of the gun shield and the awkward barrel especially against the bushes in the background. The gun's commander is on the far left. [Zbigniew Lalak Collection]

the line will have to be stopped by anti-tank weapons in reserve positions. This is called in-depth defense and in practice meant that there would be anti-tank weapons in and behind the line. When hostilities broke out in 1939 it was soon realized that firing at maxi-

mum range was hardly effective and gave the enemy time to react. Waiting until the last moment before firing, literally ambushing the tanks, proved to be much better. These anti-tank tactics basically stood their ground throughout the World War II. Fine-tuning and

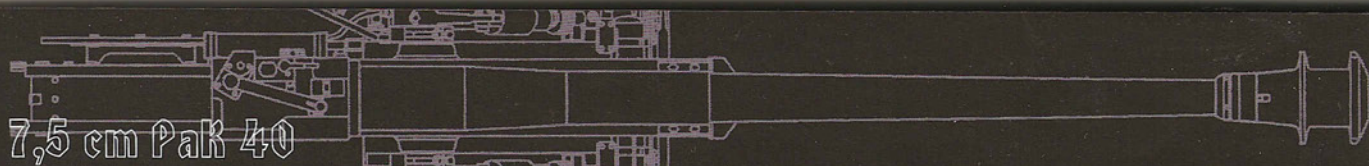
adaptation to circumstances did, of course, take place.

To illustrate the German anti-tank doctrine, this is the translation of the appropriate parts from D135: *Ausbildung der Infanterie*, 1940, *Panzerabwehr* (Infantry Training Manual, Anti-tank Tactics).

129. The possibility of an enemy tank attack has to be taken into account at all times. The more surprising their appearance, the more danger they pose. The troops must be ready at all times to defend against enemy tanks.

130. The infantry regiment's





[Right] Mud completely obscures the tread on the tires of this PaK 40 in inclement weather. Since the rest of the gun is relatively clean, it has probably only traveled through the mud just from the road to its present position. The gun is protecting the vehicles on the road. The gun has some distinguishing features, such as yet another shape of muzzle brake. This one, like the other one is unlike any in this book, but similar ones were used on Marder IIs. The gun has the early type of armored cover for the trough and the reflector on the bottom half of the lower gun shield as well as the pressed steel disc wheels indicating that this is another early production model. Although it is sometimes hard to tell from black and white photographs, it seems that this gun is dark yellow. The vehicles on the road all appear to be dark yellow as well. [Zbigniew Lalak Collection]



equipment gives it an effective anti-tank capability. It can withstand a strong enemy tank attack. 132. In defense the anti-tank platoon comes under the command of the battalion commander responsible for that sector of the front. If more than one platoon is assigned they are led by their company commander. In all other situations the anti-tank units are led by their company commander.

Deployment is always by platoon. The guns must be deployed near the troops they have to protect, and preferably at an early stage, to be ready in case of the appearance of enemy tanks. Preferably they should hold their fire and fire from the flank. In case the anti-tank guns cannot keep pace with advancing infantry, their movement should be part of the schedule of the advance. Adequate reconnais-

sance should enable the guns to be ready when needed.

140. The threat posed by tanks should be lessened, if possible, by making use of natural obstacles and by building barriers and tank traps. The aim is to funnel the enemy tank attack into confined spaces and then bring the anti-tank guns to bear. This makes it possible to concentrate the anti-tank weapons in the most

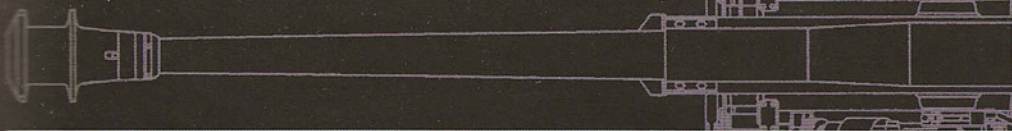
vulnerable places. The anti-tank guns themselves should remain hidden from the enemy as long as possible. Defense by using the terrain, barriers and anti-tank weapons can be made consistent by drawing up an anti-tank plan.

142. Conduct in case of an enemy tank attack depends on the situation.

On the march, the anti-tank guns will quickly deploy according to

[Right] A PaK 40 in recoil, at this stage the breech block will start to open. As the barrel travels back even more, the cartridge ejects and the gun is cocked. The breech will stay open until a new round is loaded. Rounds can be fired in quick succession. The gun's target is exploding on the right. Note the amount of dust and debris kicked up by the gun's discharge. [Zbigniew Lalak Collection]





[Left] Training the SS gun crews. PaK 40's low profile has its disadvantages, aiming the gun is an awkward job. The wheels on the two guns have different spokes. The muzzle cover is draped over the folding handle on the spade. Like the one on the gun in the background, it has a number in white, corresponding with the number on the inside of the gun shield. These muzzle covers are simple bags, without the stiff front seen in an earlier photograph. Both gunners are pulling or pushing the gun, this may be a way to speed traverse and thus aiming the gun. The man on the right and the gunner of the gun in the back have cuff titles on their greatcoats. Take notice of the different style of gaiter worn by the man on the right. [Zbigniew Lalak Collection]

orders and open fire independently. The rest of the troops will take cover on the orders of the unit commander and open fire if possible. Horse drawn and motorized units will break formation and try to get off the road. When this is not possible the vehicles combined with other materials will be used as a barricade and defended by the attending infantry. The other troops will stay dismounted

with the draft horses and vehicles. During combat the anti-tank weapons will open fire independently according to their orders. Anti-tank weapons from unthreatened sectors will take part when so ordered. The rest of the infantry will fight the enemy infantry that attacks with or behind the armored force, in order to separate them from the tanks. Heavy infantry weapons will fire on those

of the enemy that attack our anti-tank weapons. Especially effective is the use of flanking machine gun fire from unthreatened neighboring sectors. In close combat the infantry will take part in fighting the enemy tanks with all means available. They will avoid direct confrontation with enemy tanks by taking cover. Even when enemy tanks have broken through the lines, the fight against enemy

infantry is to be continued with vigor.

As will be clear from the above, the terrain plays a large part in anti-tank warfare, both as an obstacle or to provide cover and camouflage. Forests are a fine example of this, as they provide cover from the ground and from the air. A line well within the border of a forest would be protected from tank attack. Other examples



[Left] A PaK 40 in the position next to a road. Empty cartridges are gathered next to the trail of the gun so as not to be underfoot. These would be collected to be reused or melted down. One of the gunners is still adding branches to camouflage the gun. Its tow vehicle is further down the slope. Single color camouflage over dark yellow is visible on the door. The machine gunner is wearing a helmet cover issued from 1942 onwards, though never as widely as with the SS. Note the open container with the spare barrel for the machine gun. [Zbigniew Lalak Collection]

7,5 cm PaK 40

[Right] This PaK 40 and RSO were photographed in northern France in the autumn of 1943. Both are overall dark yellow. This gun has the early armored cover for the trough, brakes and a rear light. The handle of the hand brake is visible on the offside wheel. No shovel is stowed on the lower gun shield. The rear light shines horizontally when the gun is in travel mode. Wires to hold branches and such are threaded through the bolts on the gun shield. The breech cover is in place, it is visible between the shoulder guard and the wheel. The tires are quite dirty, but the rest of the gun is pretty clean. Gun crews were known to maintain their weapons meticulously. The RSO is the early type with a steel cab. The crew is sitting on the sides of the load bed because there are no seats. [Bundesarchiv 296/1688/38A]



are rocky terrain, cliffs, swamps and rivers.

The manual also contains paragraphs on the use of infantry, field and anti-aircraft guns as anti-tank weapons. Defense against tanks was a combined effort, although the larger part would be played by the anti-tank and infantry units.

After the defeat at Stalingrad the German Army was primarily on the defensive, and could then make better use of prepared posi-

tions for their anti-tank guns. In view of the doctrine this would be an advantage. The appearance of portable anti-tank weapons such as the Bazooka, Panzerschreck and Panzerfaust gave the infantry much more short-range anti-tank capability. The anti-tank guns could now be deployed behind the main line and use their longer range without coming under fire themselves. In theory this also gave them more time to retrieve

the guns in case of a breakthrough. Self-propelled anti-tank guns were used as a mobile reserve to reinforce threatened parts of the line or to tackle enemy tanks that had broken through.

By the end of World War II it became clear that the best anti-tank weapon was another tank. Mobile, well armored and armed with a potent gun they have exactly the qualities required. Specialized anti-tank guns disappeared soon

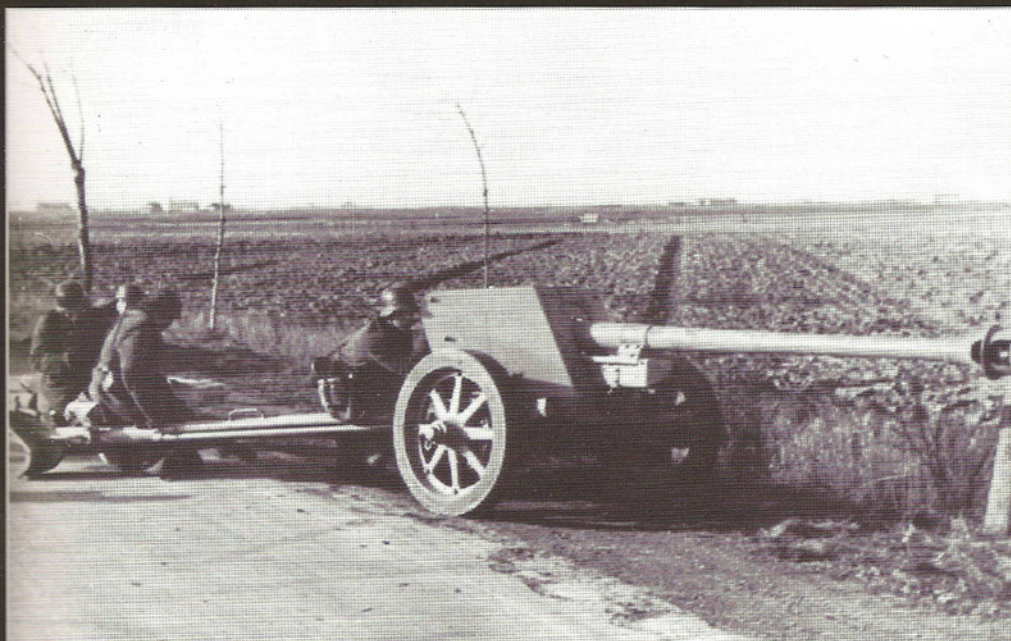
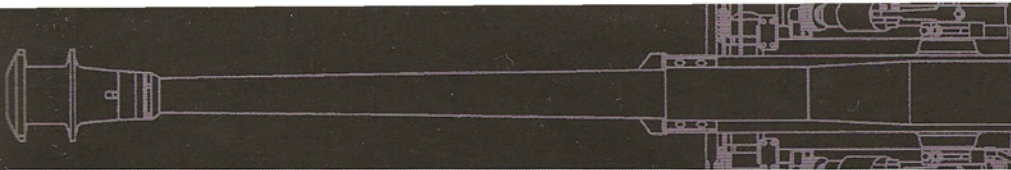
after World War II, and their role was filled by ever more sophisticated portable weapons systems.

Camouflage

Until 1943, the PaK 40 was delivered with a coat of Panzergrau paint. Then the introduction of Dunkelgelb as a base color and green and brown as camouflage colors, spawned a host of different liveries for the guns. They were finished in Dunkelgelb when they

[Right] A PaK 40 in firing mode in the north of France in autumn 1943. This may be the same gun as in the previous photograph. The gun is ready to fire. When the spades are not dug in the gun will travel backwards when fired. The men are lying across the trails to add their weight in order to minimize any rearward travel. The snap-hook that is visible under the upper leg of the gunner is attached to a sling used to pull the gun into its final position. It can be attached to eyes on the trails or hub caps. The crew is all wearing full kit. They have fastened their tent halves under the flap of the bread bag. The man on the left has the canteen with the small Bakelite cup, the gunner one with the aluminium cup. [Bundesarchiv 296/1688/30A]





[Left] A PaK 40 in position on the side of a road. The photograph was taken in the winter of 1943/44 in France. Units were sent from the Eastern Front to the occupied countries in Western Europe to recuperate and train. This may well be such an exercise. This gun has both brakes and a rear light. The lower gun shield is still folded. There is a wooden ammunition case in the background. It is very hard to tell whether it is plain wood or dark yellow. [Daniele Guglielmi Collection]

left the factory. Camouflage was applied by the troops depending on terrain and time of year. Camouflage schemes were not standardized. The units themselves chose how and in what proportions the camouflage colors were applied. The paint came as a paste that could be thinned with gasoline or water or not at all, resulting in a very wide range of shades. The paint could be applied by brush or sprayed, again giving

very different results. Foliage or other natural materials were frequently used to conceal the guns in combat.

Ammunition

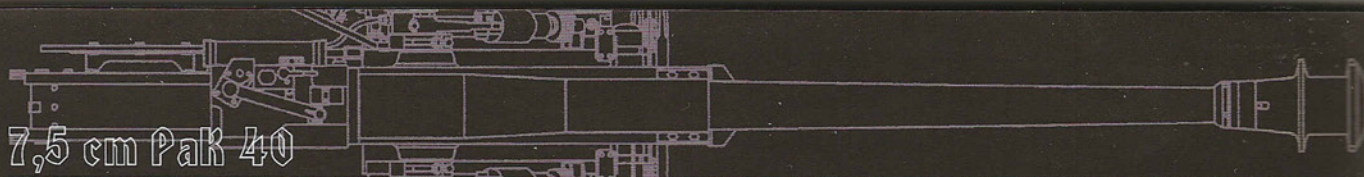
The PaK 40 could fire a number of different armor piercing and high explosive rounds. Before examining them in detail, let's have a look at the principles of piercing armor. The most common method of World War II uses the weight and

high velocity of a cannon round to literally punch through armor. This projectile could be all steel or have a heavy dense core made of tungsten (Wolfram). Anti-tank rounds could also have a small explosive bursting charge. The effectiveness of rounds like this depends very much on range. The longer the distance to the target, the lower the velocity and thus the lower the ability to penetrate armor. The other anti-tank method

common in World War II uses an explosive shell with a cone shaped insert that concentrates the blast in a small area to punch through armor. This is known as a shaped or hollow charge. The Bazooka, Panzerfaust and similar weapons all use this principle. As long as the device can reach the target, distance to the target doesn't make any difference to penetrating performance, as it is the explosive force that does the job.



[Left] A knocked-out German 7.5 cm anti-tank gun and one of its gunners lying dead beside it. A disabled Panther tank is visible in the background. This PaK 40 has received camouflage that appears to have been sprayed on. Note the vertical container for the Sprengpatrone Z 72 demolition charge. Fontenay-le-Pesnel, Normandy, 25 June 1944. [Photograph B5939 courtesy of the Imperial War Museum, London].



7.5 cm PaK 40

[Right] German 7.5 cm anti-tank gun captured at Mont Pincon, Normandy, 9 August 1944. This gun has lost both the main and lower gun shield, and one of the tires is almost blown off the wheel. No pieces of the gun shield are lying about in this photograph, but the damage is most likely to have been done during the fighting. No brake drums are visible, and the right trail completely lacks the provisions for the electrical system. The inside of the ammunition cases is plain wood guessing from the lightness of the color. The outsides are probably dark yellow. The round is most likely a high explosive artillery round (Sprgr. Patr. 34). The projectile is field gray rather than black. [Photograph B8878 courtesy of the Imperial War Museum, London]



In the case of the punch-through (or kinetic) method most damage is done either by the solid shot bouncing around inside the tank or, in the case of the shells with a bursting charge, by the explosion throwing splinters and fragments

around inside the vehicle. In the case of hollow charge weapons, the semisolid jet of super hot gasses (plasma) created by the focused explosion burns a small hole through the armor and then sprays molten metal and searing

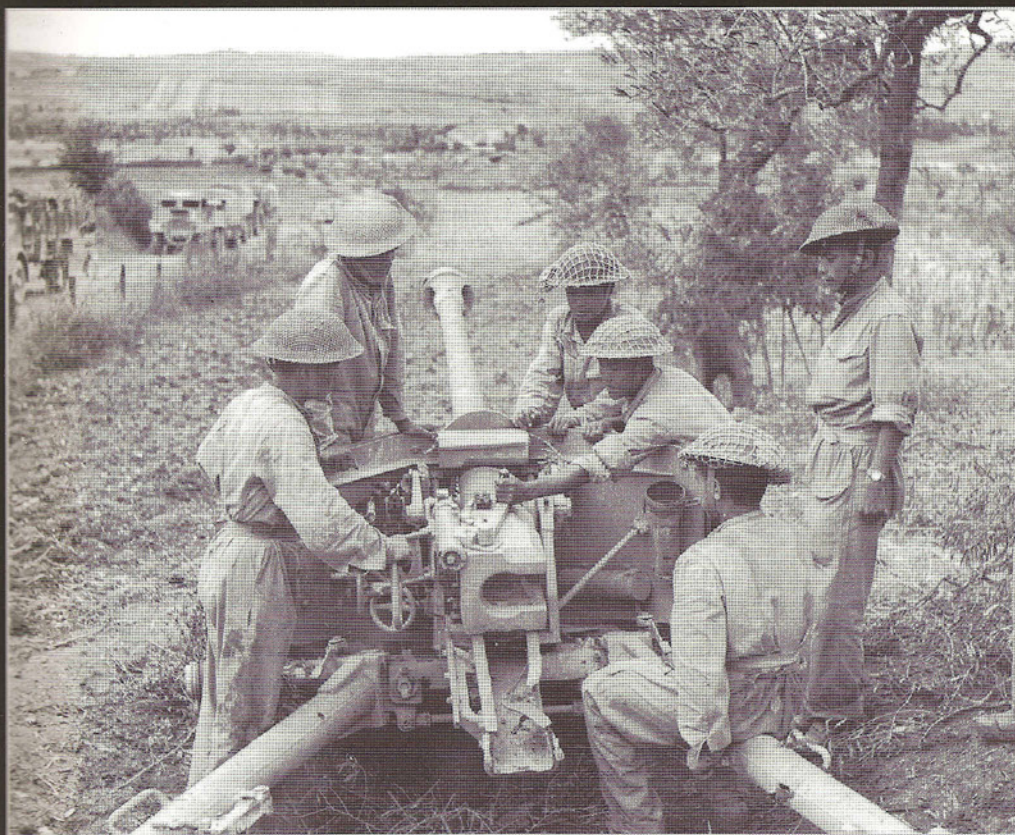
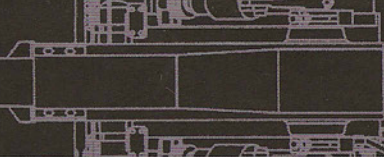
gasses around the interior of the vehicle. In both cases damage can include igniting fuel, setting off ammunition and killing or wounding the tank's crew.

The PaK 40 fired fixed rounds, in other words the shell was fixed to

the cartridge. This enabled a high rate of fire, which can be a matter of life or death in anti-tank warfare. The armor piercing rounds all had a tracer in the bottom that enabled the gunner to follow the trajectory of the shell so he could determine

[Right] Churchill tanks laden with infantry of the 9th Durham Light Infantry pass a knocked-out German anti-tank gun as they enter Schilberg, Germany, 20 January 1945. Apart from the dent in the shoulder guard there is no apparent damage on this PaK 40. It is however covered in debris, so the crew may have fallen victim to artillery fire or bombs. The position by the trees gives some protection. [Photograph B13932 courtesy of the Imperial War Museum, London]





[Left] Gurkhas of the 2/6th Gurkha Rifles inspect a captured German 7,5 cm anti-tank gun near San Clemente, Italy, 8 September 1944. This PaK 40 was covering the road and the surrounding countryside from a higher point. Some cover is provided by the trees and bushes to the right. This gun has a vertical container on the right inside gun shield. It holds a specially developed demolition charge, Sprengpatrone Z 72, which was to be used in case the gun had to be abandoned. These charges were introduced in December 1942. The wide top held the rolled cord of the safety fuse and the igniter. The stick shaped charge was in the bottom of the container. Note the damage to the trough. None of the Gurkhas is armed, so by the time the photograph was taken this would be well behind the lines. The men are wearing tropical shirt and trousers or overalls in a light khaki color. [Photograph NA18490 courtesy of the Imperial War Museum, London]

in advance whether it would be a hit. This enabled him to correct his aim at the same target again or choose a new one.

German artillery cartridge cases were originally extruded from solid brass. Even before the start

of World War II the Germans foresaw a lack of certain raw materials in case of a protracted war, copper being one of those. This led them to experiment with extruded steel cases. At first, these were brass plated to protect them from rust.

Later galvanizing or even a lacquer coating was used.

As the PaK 40 was introduced in 1941, its cartridge cases were always steel. The code for this particular case, 6340 St, was stamped on the bottom of the car-

tridge case. The code is shown on drawings from 1942, but is absent in drawings from 1943, so it may have been discontinued. Besides this code, "7,5 cm PaK 40", the manufacturer's code and the year of delivery were stamped on the



[Bottom] A line-up of PaK 40s at a collection point for captured equipment somewhere in Normandy. The GI in the back is guarding the lot. Anti-aircraft guns and their trailers can be seen in the background. The four nearest PaK 40s all have different camouflage schemes; a good illustration of the fact that only the colors were standardized, the schemes originated with the units. The camouflage on the nearest gun is painted by brush. It covers most of the dark yellow base. The three colors are easily distinguishable in the original photograph. The dried mud on the tire looks painted on as well. The second and third guns have sprayed camouflage, wide and narrow bands respectively. [Conseil Régional de Basse-Normandie / US National Archives]

7,5 cm PaK 40

bottom as well. All the other information on the cartridge case and the grenade was stenciled. The cartridge case is 716 mm high and 100 mm across the bottom.

The 7,5 cm Panzergranat Patrone 39 PaK 40

(7,5 cm Pzgr. Patr. 39 PaK 40)

This is the standard armor piercing round. It has a steel body with a small explosive charge in the bottom. Initial penetration was achieved by the weight and velocity of the projectile; the explosive charge then sprayed the inside of the tank with splinters. The weight of the round is 12 kg, with that of the shell being 6.8 kg. The designation "Pzgr. Patr. 39" denotes a type of armor piercing projectile, the same type was also fired by the PaK 38, in which case it was named 5 cm Pzgr. Patr. 39 PaK 38. This is why the caliber and type of gun are always included in the name of the round.

The 7,5 cm Panzergranat Patrone 40 PaK 40

(7,5 cm Pzgr. Patr. 40 PaK 40)

This round has a steel and alloy body with a tungsten core. The core punches the hole through the armor. This type of projectile

was phased out when tungsten became scarce. The 7,5 cm Pzgr. Patr. 40 (W) is identical, only the material for the rotating band is different. The weight of the round is 9.55 kg, and that of the projectile is 3.2 kg. The Pzgr. Patr. 39 and 40 had an effective combat range of about 1800 m.

The 7,5 cm Granat Patrone 38 HI/B PaK40

(7,5 cm Gr. Patr. 38 HI/B)

The 7,5 cm Granat Patrone 38 HI/C PaK40

(7,5 cm Gr. Patr. 38 HI/C)

HI or Hohlladung is German for hollow or shaped charge. These rounds seem to be identical apart from the propellant charge, which is 490 g for the B and 510 g for the C type. The weight of the round is 8 kg, and that of the projectile is 4.65 kg. Hollow charge rounds were initially meant for use against static hard targets such as concrete bunkers. The projectiles lightweight design required a lower muzzle velocity to prevent damage during firing. This makes them less effective against moving targets because leading the target becomes more difficult. Leading is aiming in front of the target to compensate for its speed.

The 7,5 cm Sprenggranat Patrone 34 PaK 40

(7,5 cm Sprgr. Patr. 34 PaK 40)

This is a conventional high explosive round with a relatively large charge in a steel body. It has a range of 8,000 m with the small propellant charge and 10,000 m with the medium propellant charge. The range was limited by the maximum elevation of the PaK 40. The 7M59 or artillery version had a maximum range of 13,000 m because of its longer elevation cam. As the gun used fixed ammunition, the propellant charge could not be adapted as in separate loading ammunition. There was a round with the small propellant charge and one with the medium one. The weight of the round is 9.15 kg, and that of the shell is 5.8 kg.

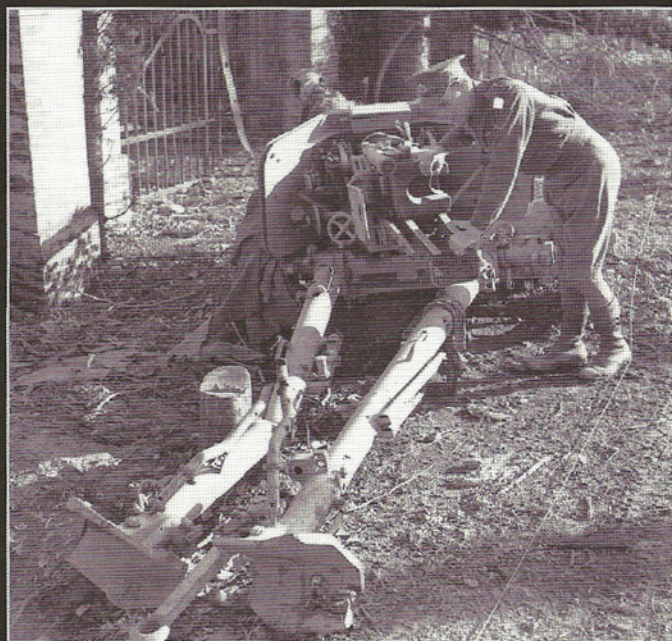
The 7,5 cm Nebelgranat Patrone PaK 40

(7,5 cm Nbgr. Patr. PaK 40)

This is the smoke shell, which looks very similar to the Sprgr. Patr. 34. It has a lighter steel body than the projectile of the high explosive round, filled with a chemical that produces the smoke. Like the high explosive round it has an impact fuze.

Terms and abbreviations

The names given to German equipment follow a system, as do the abbreviations. They can be looked up in the inventory or Gerätliste. There were also scale drawings for every piece of equipment with their specific numbers. Every piece of equipment in the Gerätliste had a number derived from the category and the drawing number. Then the official name was given and the official abbreviation. This system was adapted several times during the World War II. The names and abbreviations given in the text comply with this system, as far as it is possible. When German names are used, they follow German grammatical practice. Divisions in numbers are therefore indicated with a comma. If one deconstructs the designation "7,5 cm Panzerjäger Kanone 40", the caliber comes first, then the description and finally the year of acceptance. This last number is not always the same as the year the equipment came into service. Testing and production takes time. □



[Above] A badly mangled PaK 40 being studied by a British soldier. The gun is overall dark yellow, so the photograph was taken after February 1943, when the three color camouflage scheme

was adopted. The provisions for electrical and pneumatic systems are on the right trail, but not the actual socket or pneumatic attachment. [Daniele Guglielmi Collection]

GLOSSARY

Panzerabwehr Kanone, PaK	anti-tank gun
Panzerjäger	tank hunter
Selbstfahrlafette	self-propelled carriage
Geschützwagen	gun car, this can also designate tracked gun carriers
Schlepper	tractor
Raupenschlepper	caterpillar tractor, fully tracked tractor
Sonder Kraftfahrzeug, SdKfz	special purpose motor vehicle
Feld Kanone	field gun
leichte Feld Haubitze, le. FH	light field howitzer
Rad	wheel
Lenkrad	trail caster, also steering wheel in vehicle
Panzergrau	dark gray, literally tank gray
Dunkelgelb	dark yellow
Feldgrau	field gray, a greener color than Panzergrau, not used for vehicle
Patrone	cartridge
Panzergrana	armor piercing shell
Sprenggranat	high explosive shell
Nebelgranat	smoke shell

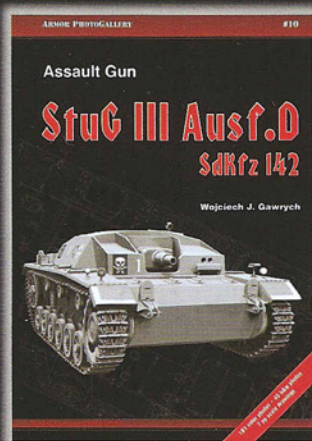
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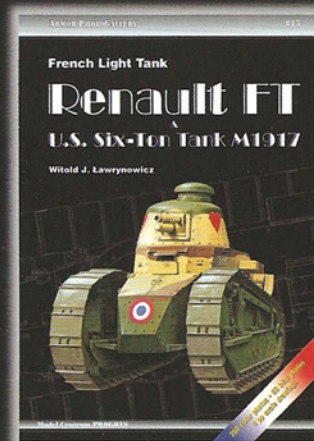
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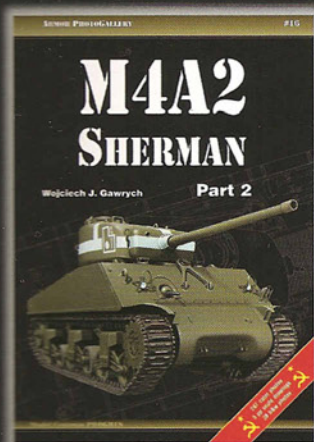
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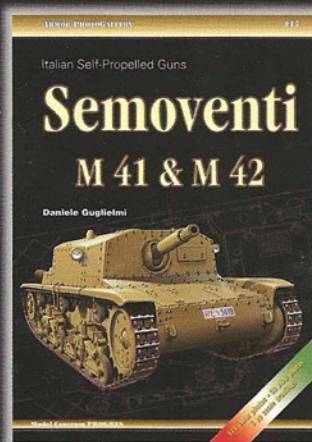
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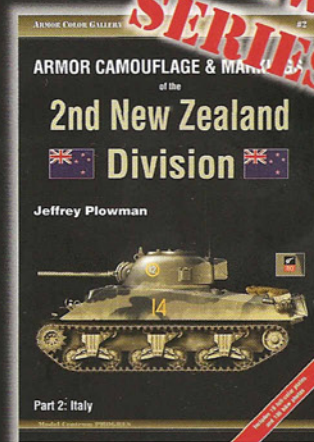
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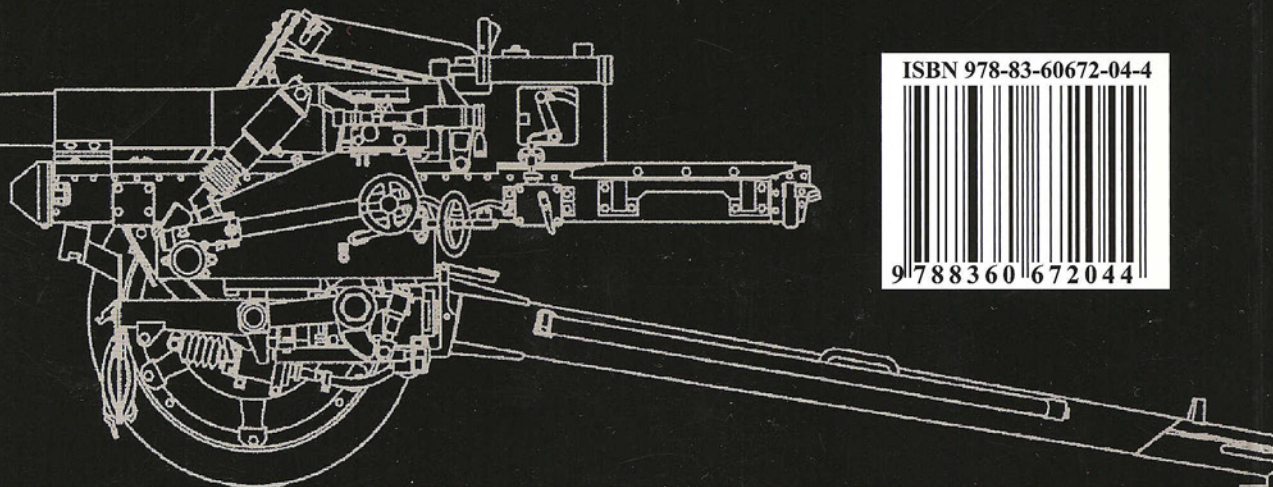
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