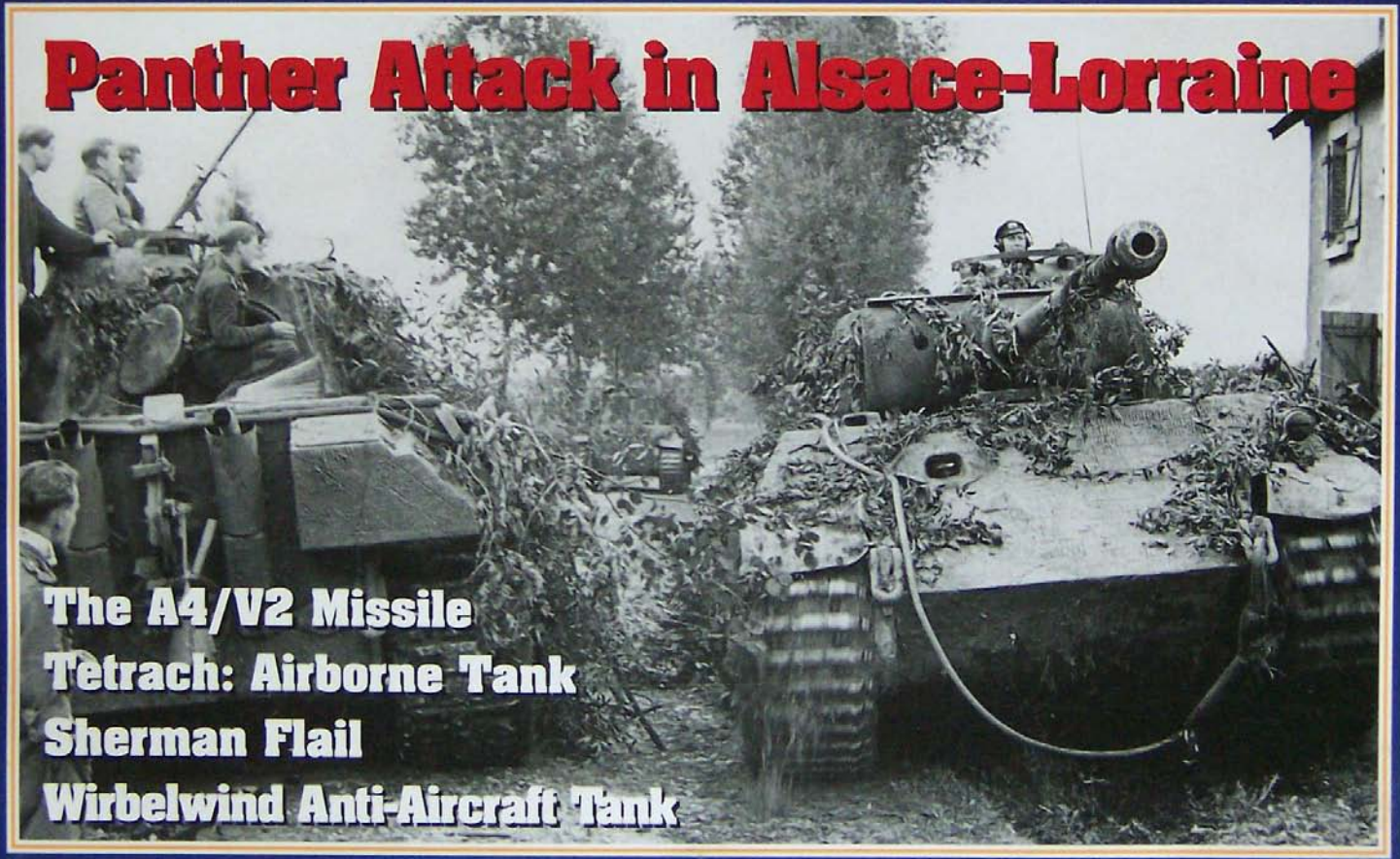
Allied-Axis

THE PHOTO JOURNAL OF THE SECOND WORLD WAR



Panther Attack in Alsace-Lorraine

The A4/V2 Missile

Tetrach: Airborne Tank

Sherman Flail

Wirbelwind Anti-Aircraft Tank

Issue 1

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The A4/V2 Missile

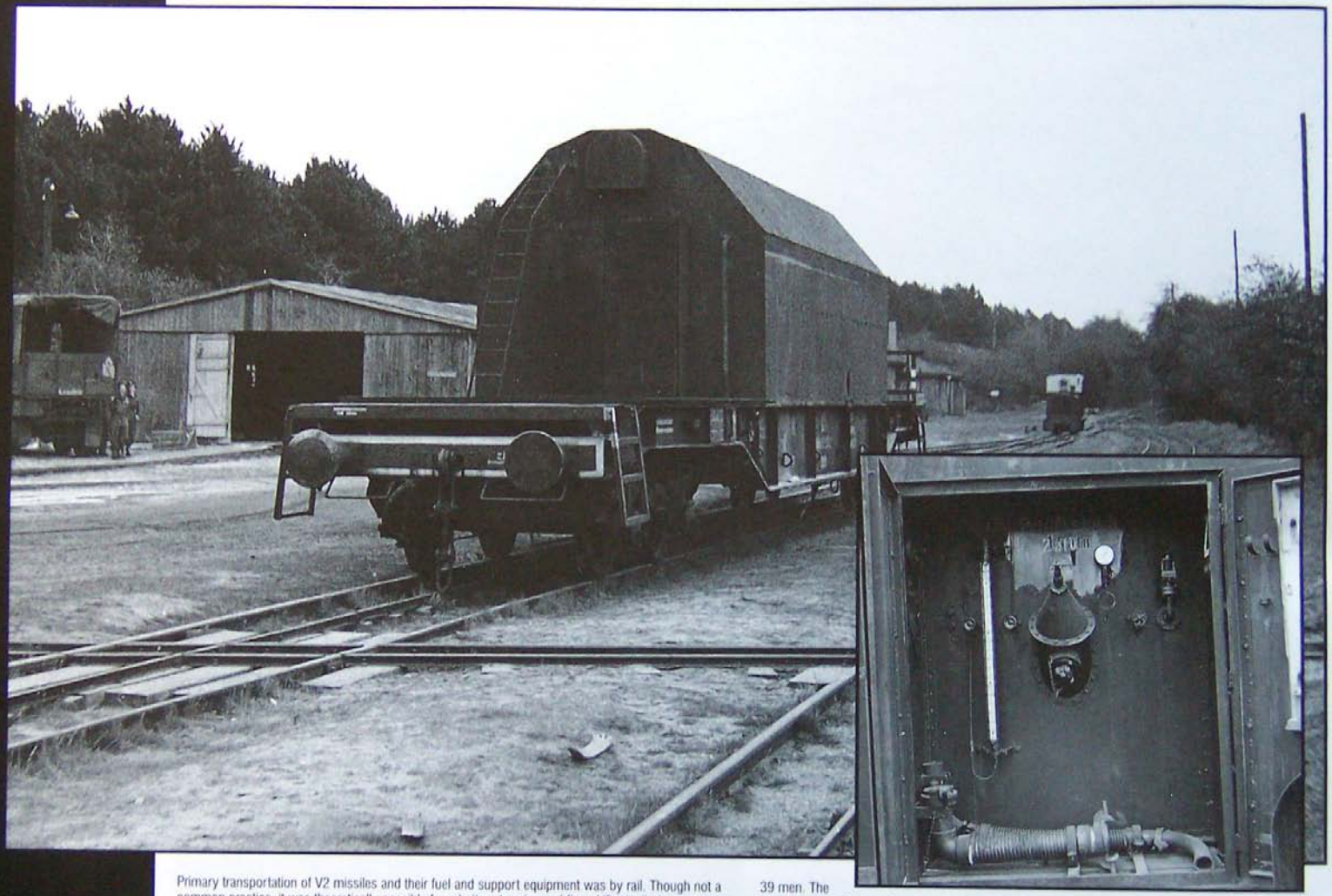
At the end of World War II, the victorious Allies searched across Germany for technical information on German weapons, especially the advanced jet aircraft and rockets of the late war period. Virtually all completed V2 missiles had been expended or destroyed. The U.S. Army occupied the Mittlewerke underground V2 assembly plant in Nordhausen, removing enough materiel to build some 200 V2 missiles in the United States. The British managed to find enough parts to build eight complete V2s, but lacked key components and support equipment to use the V2s as intended. After searching Europe for several months, the British managed to gather the equipment needed to fire several V2 missiles.

The British V2 test program was called "Operation Backfire," and was conducted in October 1945 at Altenwalde, near Cuxhaven in the British occupation zone, on the site of a naval gunnery test range. Some of the 8000 German POWs taken from missile units and the Peenemuende test facility were detailed to re-enact the preparation and firing of V2 missiles for the British Army. As the Germans wore their wartime uniforms, the photos and movies taken during "Operation Backfire" appear to be wartime German footage. Due to the secret nature of the V2 program, most of those who worked on the project knew only a small part of the whole thing. "Operation Backfire" was a learning experience for all concerned.

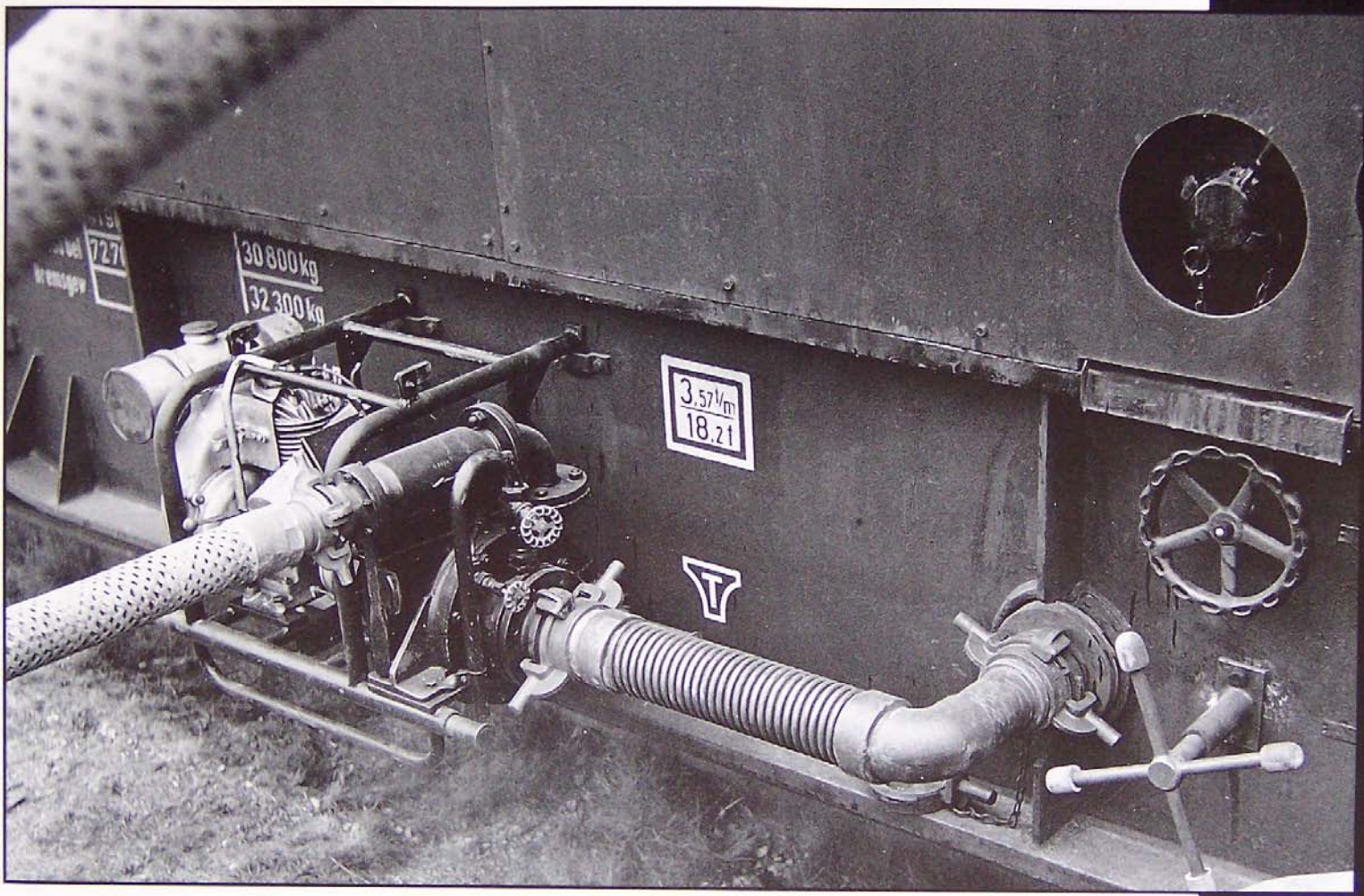
At Cuxhaven, gunners of the Royal Artillery examined a V2 missile during a lecture on the V2 system as part of "Operation Backfire." The V2 was a large weapon, measuring 46 feet (14 meters) in length and 11 feet 8 inches (3.5 meters) across the fins. The movable fin sections were simple vane type rudders, which steered the missile in flight once it was traveling fast enough for air flow to work against the rudder sections. For initial control at launch, there were guide vanes which sat in the exhaust stream of the rocket motor and provided pitch and roll control at low speeds during liftoff. Note that this V2 has been fitted with dollies for transport, using the narrow gauge tracks formerly used to handle ammunition for the naval weapons test center. The British chose a black and white test scheme, instead of operational camouflage. There were several color schemes applied to operational V2s. Most missiles actually used were painted in a "Gezackt" ("ragged") pattern using Signal White, Earth Gray, and Olive Green. Late war missiles were painted overall Olive Green. (IWM)

The motor assembly for the V2 produced some 55,000 lbs (25,000 kg) of thrust and typically burned for about 65 seconds. The motor burned a mixture of liquid oxygen (A-Stoff) and a 3:1 ratio mix of methyl alcohol and water (B-Stoff). The fuel was contained in large tanks in the center of the missile body, and was fed into 18 burners in the rocket motor by high speed turbine pumps. The turbine pumps used a mixture of 85% hydrogen peroxide and 15% water (T-Stoff). The T-Stoff was fed through a catalyst (calcium permanganate) and decomposed into high pressure steam and oxygen to drive the pumps. In this view of a V2 motor, note the turbine pumps to the left (behind the nitrogen pressure bottles), the multiple burners on the combustion chamber and the simple welded frame that mounted the motor assembly to the missile body. (IWM)

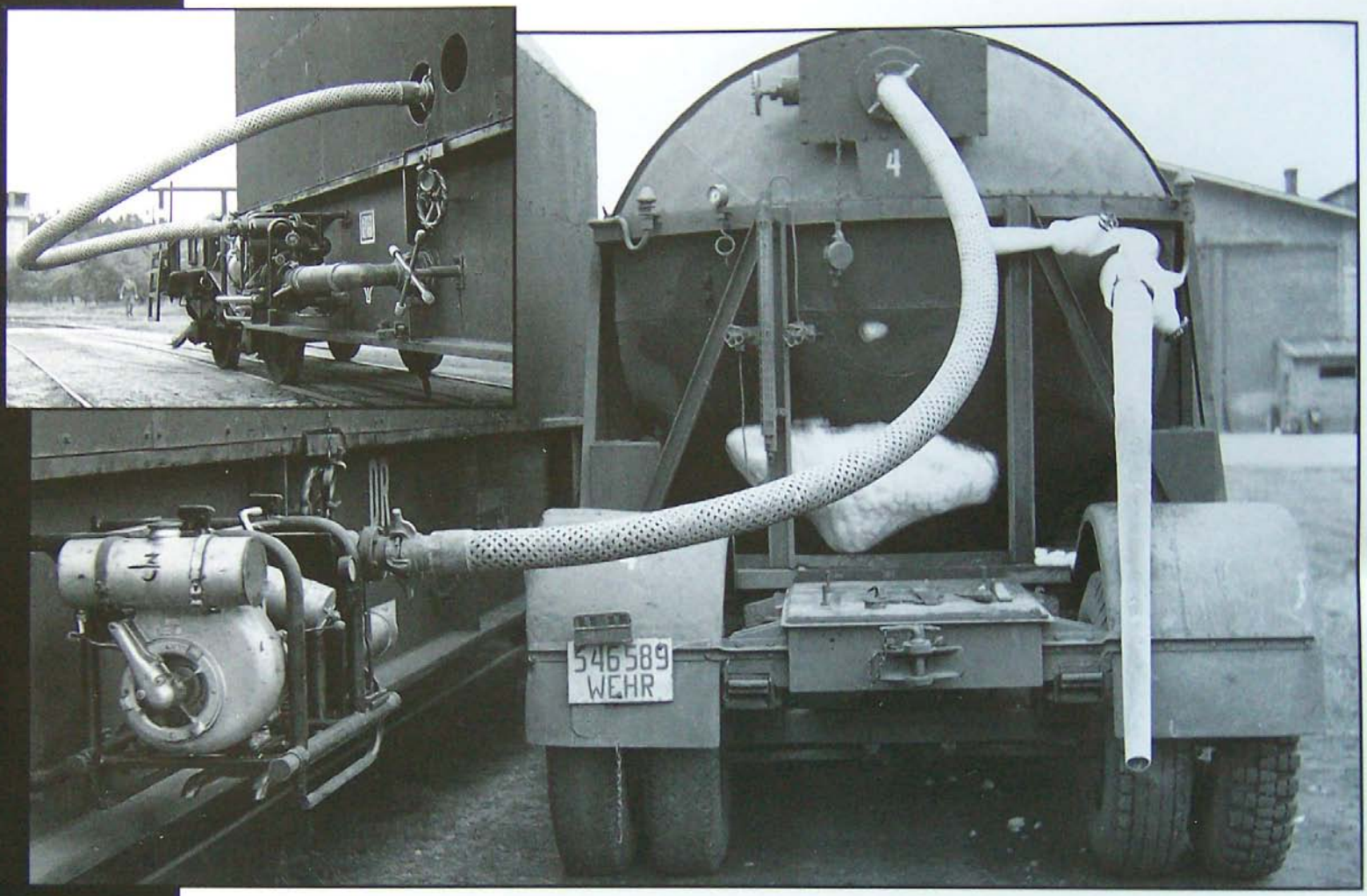
Right: The V2 missile was guided by a combination of three-axis gyroscopes and an electronic system that sent directional control signals to the guide vanes in the tail section and also received guidance signals from the control vehicle prior to launch. The guidance package (seen here) was the weakest point of the V2; most of the 3,300 V2s launched did not land close to their intended targets. This led eventually to the V2's being used as a "terror weapon" aimed at large population centers or military port facilities, such as Antwerp in Belgium. Almost 10,000 V2 missiles were completed or had reached an advanced stage of assembly by the end of the war. Launch sites against Britain were located on the Dutch coast. (IWM)



Primary transportation of V2 missiles and their fuel and support equipment was by rail. Though not a common practice, it was theoretically possible for a battery to raise and fire a V2 missile from a stationary train. German railroads were favorite targets of Allied aircraft, and so most V2s were fired from mobile launchers traveling by road. Nonetheless, most supplies of fuel were carried by train, as were replacement missiles. The missiles were delivered to a forward transfer point called a "Field Store," each of which could handle 30 missiles and supplies at a time. The V2 batteries arrived at the Field Store to receive missiles and supplies. Each battery had three V2 missiles, each crewed by a platoon of 39 men. The rail car in this photograph was an insulated tank car carrying liquid oxygen (A-Stoff). Each of these cars could refill several A-Stoff trailers used by the launch crews. **Inset**: At one end of the A-Stoff rail tank car was a locker to store the pipes and hoses. Above the hoses in this view is a refilling point for the tank car with a pressure gauge and fluid level to guide the refilling crew. Also stowed in this compartment were feed hoses to connect to other A-Stoff vehicles. All the A-Stoff used in the V2s at launch was carried in towed, wheeled trailers. (IWM)

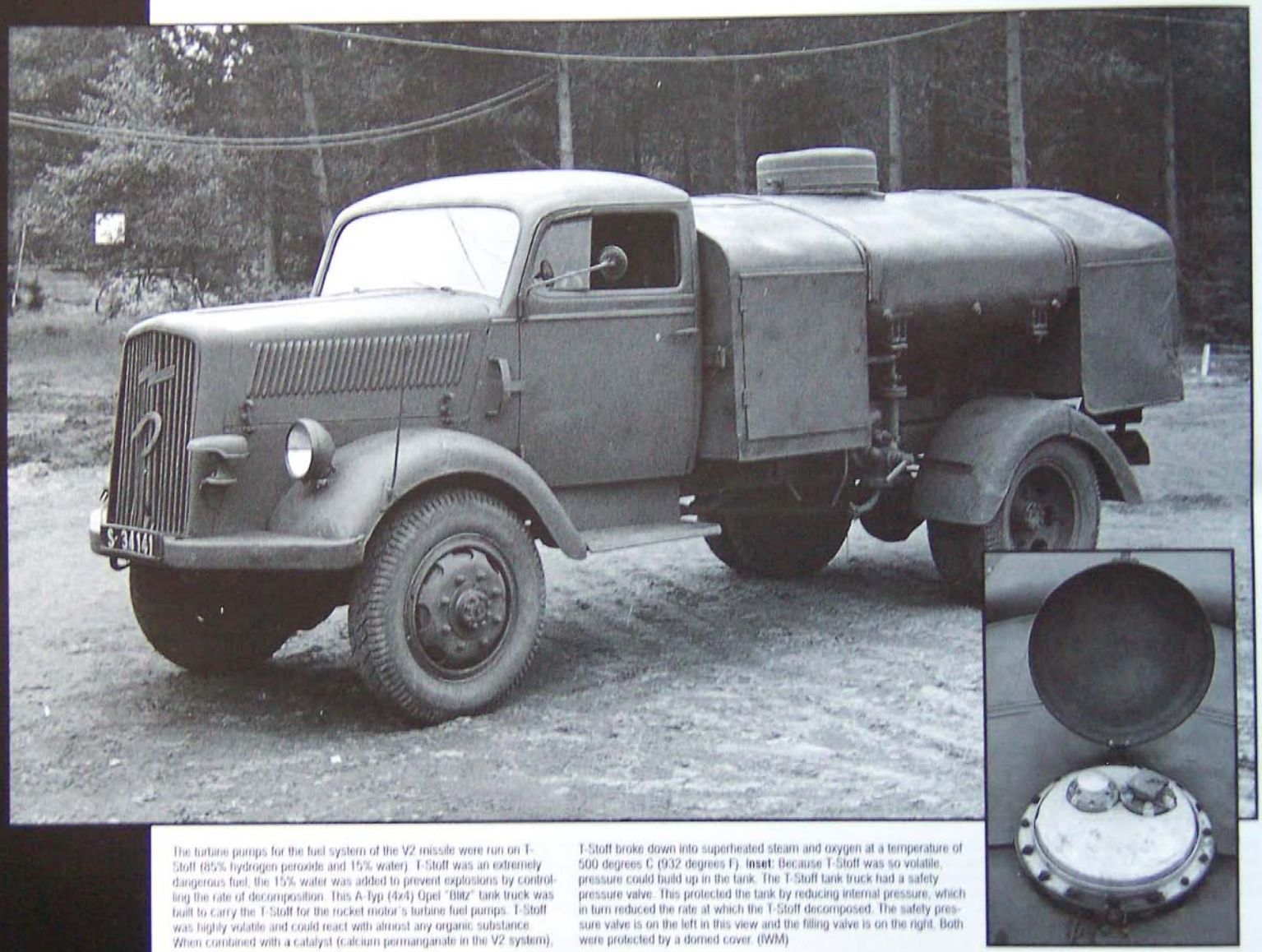


An engine-driven pump was attached to brackets on the side of the A-Stoff rail tank car and hoses were then connected to the pump and wheeled A-Stoff trailer. The pump was a simple rotary type, and was driven by a one-cylinder air-cooled gasoline engine. The straight portion of the feed pipe and all of the feed hoses to the wheeled trailer were insulated with external covers to keep the A-Stoff as cold as possible. When not in use, the hoses were disconnected and stowed on the wheeled A-Stoff trailer, and were used later to fuel the V2 missile. The pump was used when the rail tank car was only partly full; when the car was full, gravity was sufficient to fill the first few A-Stoff trailers. The pump was also stowed on the wheeled trailer to pump A-Stoff into the V2 during the launch. (IWM)

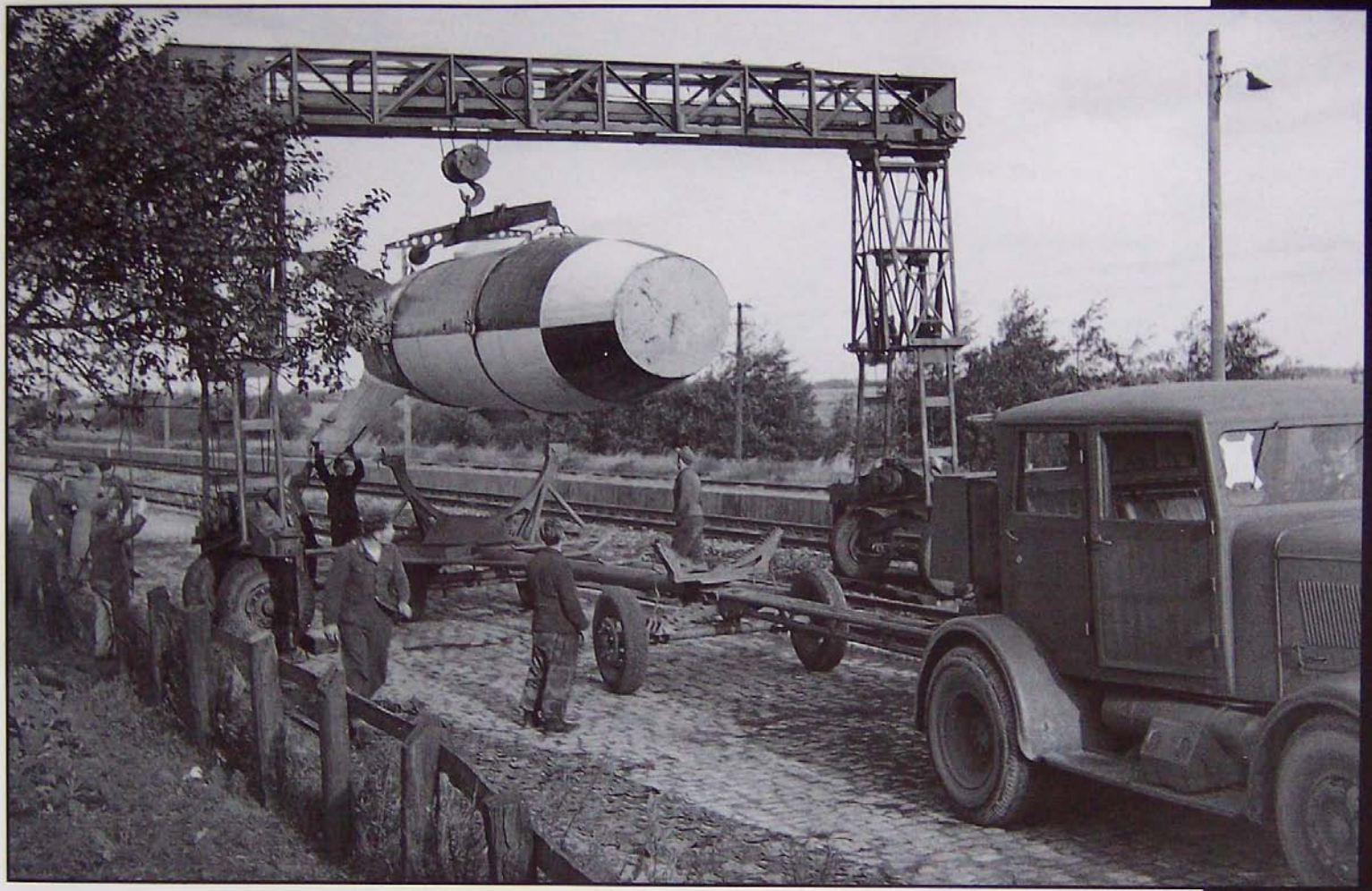


During the filling process, the extremely cold temperatures of the A-Stoff caused ice and frost to condense around the metal fittings. The A-Stoff wheeled trailer was heavily reinforced to contain the pressure in the tank. Here the engine-driven pump is used to transfer the A-Stoff to the trailer. The British Army had to spend months trying to locate all the equipment needed to fire the V2 the same way the Germans had during the war. All the trailers, trucks and support equipment had to be rounded up and gathered at Cuxhaven to conduct "Operation Backfire." **Inset**: The pump could also be used to fill the A-Stoff rail tank car or to re-circulate the liquid oxygen, as seen here. Note the double gauge track beneath the tank car. The test facility at Cuxhaven had an extensive network of narrow gauge rail tracks to handle ammunition during firing tests. (IWM)

When the A-Stoff rail tank car was completely full, gravity was used to fill the wheeled trailers without using the portable pump. The A-Stoff wheeled trailer was a simple design but heavily reinforced to hold the weight of the insulated tank and the fuel inside. These trailers normally were towed by special tractors, most commonly the Hanomag SS100, a 4x2 heavy road tractor built for the purpose, as seen here. Though it was possible to tow more than one trailer, generally each trailer had its own towing vehicle. The overhead gantry crane in the background was a permanent type, not the folding crane used by the V2 batteries. (IWM)



The turbine pumps for the fuel system of the V2 missile were run on T-Stoff (85% hydrogen peroxide and 15% water). T-Stoff was an extremely dangerous fuel; the 15% water was added to prevent explosions by controlling the rate of decomposition. This A-Typ (4x4) Opel "Blitz" tank truck was built to carry the T-Stoff for the rocket motor's turbine fuel pumps. T-Stoff was highly volatile and could react with almost any organic substance. When combined with a catalyst (calcium permanganate in the V2 system), T-Stoff broke down into superheated steam and oxygen at a temperature of 500 degrees C (932 degrees F). **Inset:** Because T-Stoff was so volatile, pressure could build up in the tank. The T-Stoff tank truck had a safety pressure valve. This protected the tank by reducing internal pressure, which in turn reduced the rate at which the T-Stoff decomposed. The safety pressure valve is on the left in this view and the filling valve is on the right. Both were protected by a domed cover. (IWM)

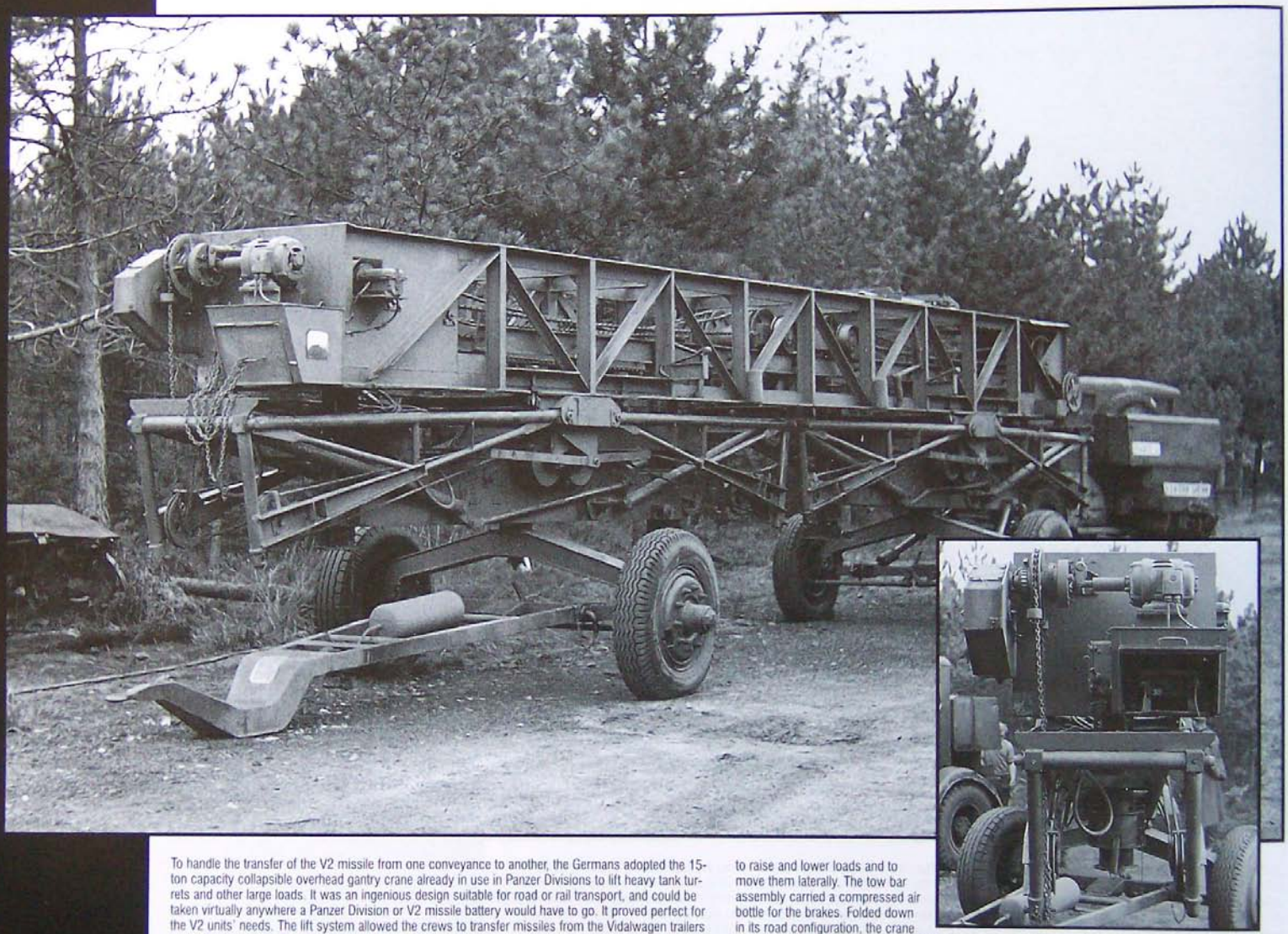


After the V2 missiles were delivered by train to the Field Store, they were transferred from the rail cars to transport trailers using a 15-ton collapsible overhead gantry crane. The crane was set up at the rail-head to off-load the missiles and other equipment. The crane would then be collapsed into its travel configuration and towed to the forward launch preparation site. There it would be erected again and used to transfer the V2s to their launch trailers. Note that at this point, the V2 missiles did not have war-heads installed or fuel in the tanks. The missile airframe and motor weighed 4,485 lbs (2040 kg). The towing vehicle here was the Hanomag SS100. (IWM)

The V2 missile was transported from the railhead to the battery forward preparation site on a transport trailer called the "Vidalwagen." This was a simple A-frame tubular structure with formed supports to cradle an unloaded, unarmed V2 missile. The weight of the trailer and missile was enough that only heavy duty road tractors like the Hanomag were used to tow them. The Vidalwagen was very simple and inexpensive to build and each battery had three Vidalwagen trailers for every launch trailer. The V2 battery would fire their first trio of missiles and then return to the forward preparation site to reload missiles onto the launch trailers. When all the missiles had been expended, the battery could then return to the Field Store and reload all the trailers and refill the support vehicles. (IWM)

The Hanomag SS100 tow vehicle was the type most commonly used in V2 batteries. This view shows how the V2 was secured on the Vidalwagen trailer, as well as the guard rails and supports to protect the lower fins. The use of mobile equipment like this enabled German rocket troops to fire thousands of these missiles without being detected by Allied aircraft. Only a lucky sighting of an erected V2 at launch would have given an Allied pilot the chance to attack the firing battery. The use of road equipment also kept the V2 units from being totally dependent on the railroad system, which in the spring of 1945 was under constant attack. About one third of the 10,000 V2s built were fired at Allied military and civilian targets.

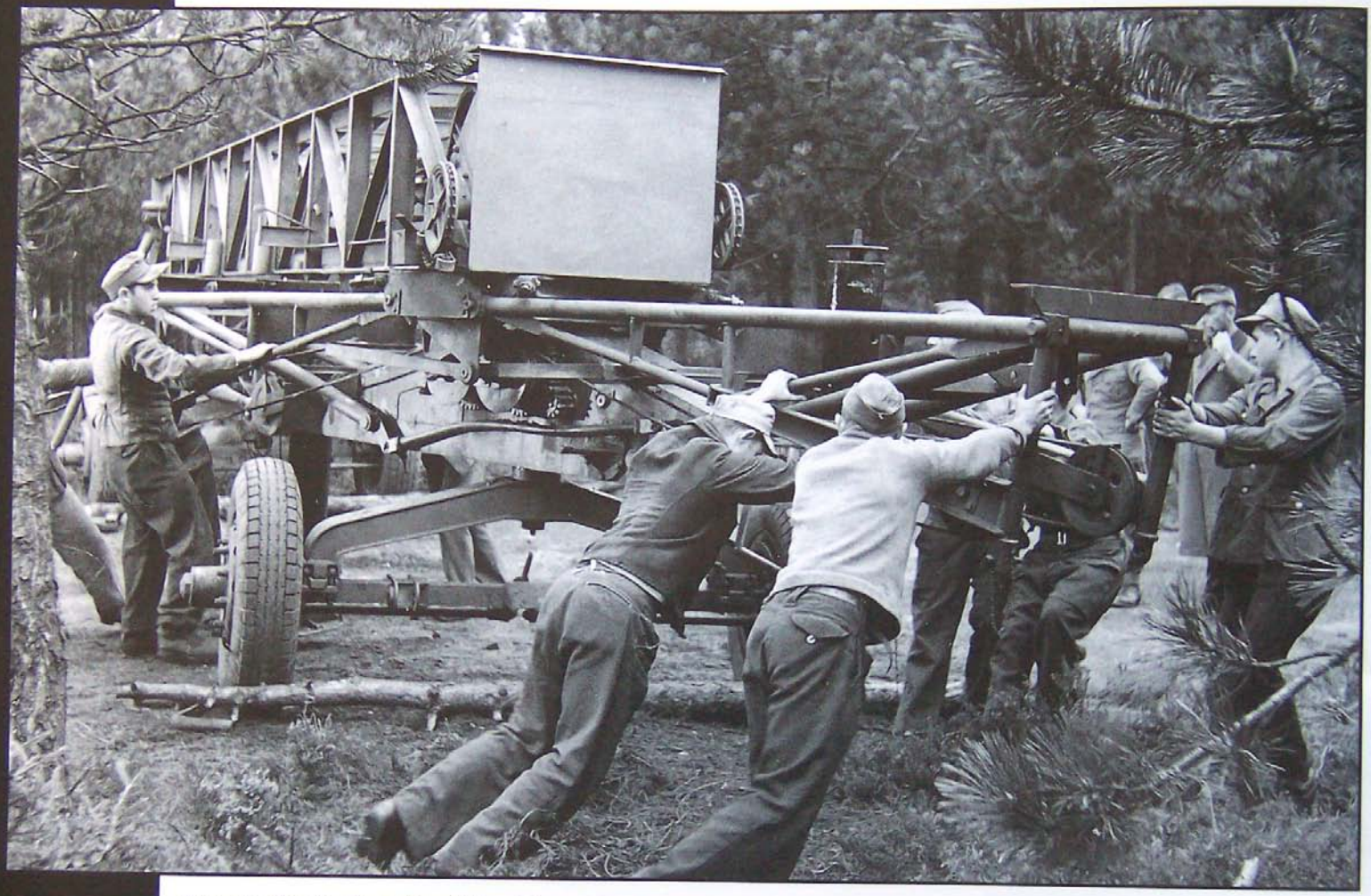
Once the V2 missile had been brought to the battery forward preparation site, the warhead and fuse were installed. A small fixed overhead crane was used to lift the 1-ton warhead into place and the assembly crew fastened it to the front of the missile body. The cylindrical fitting around the warhead protected it during transport and carried the lifting loads during assembly. The V2s were shipped without the warheads as a safety precaution and to keep the missile as light as possible during shipment. The handling and firing of liquid-fueled missiles was far more complex than the scientists at Peenemuende thought field troops could accomplish. In fact, field units launched some 3,300 V2s within a six month period (September 1944 to March 1945). (IWM)



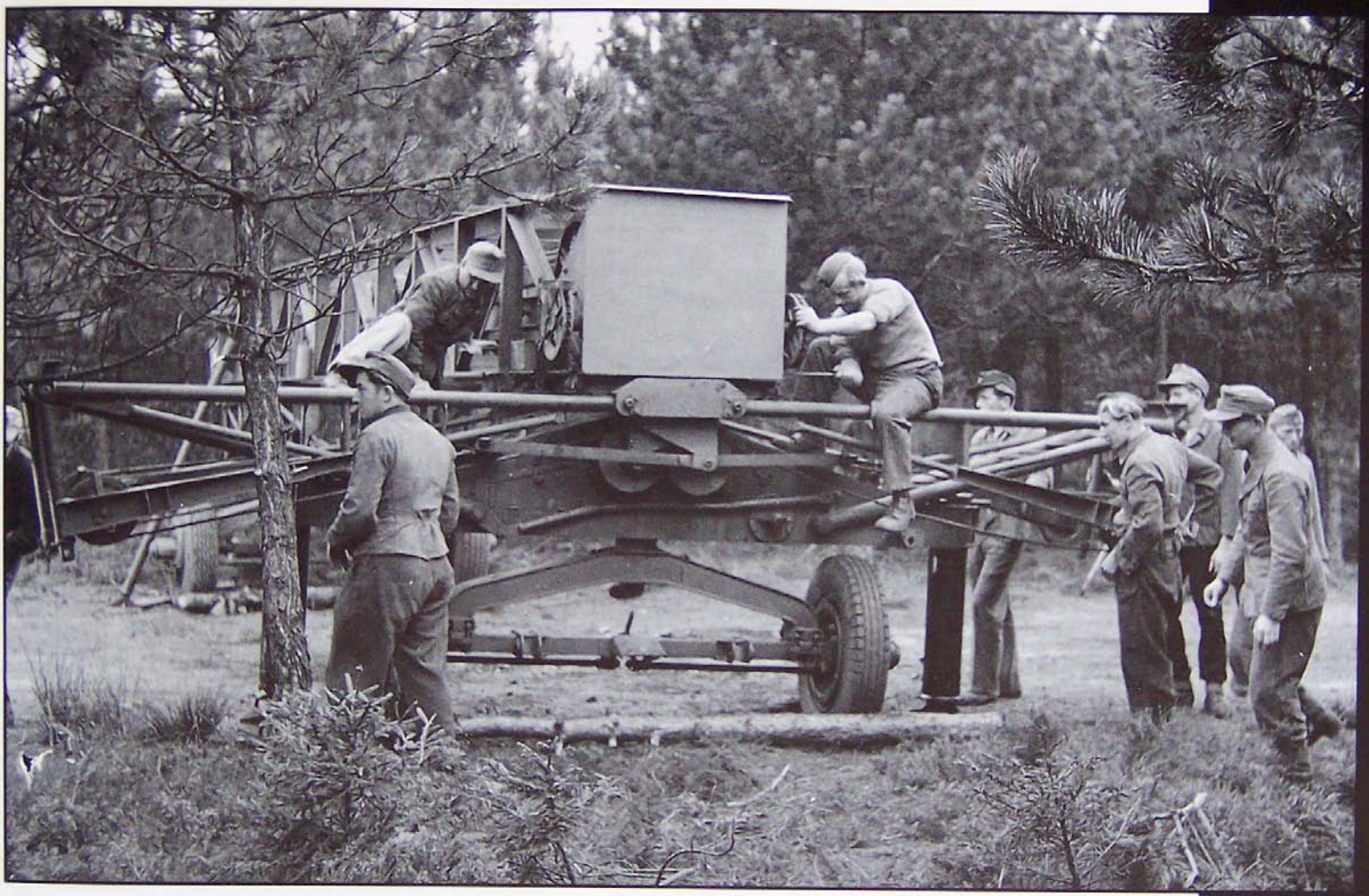
To handle the transfer of the V2 missile from one conveyance to another, the Germans adopted the 15-ton capacity collapsible overhead gantry crane already in use in Panzer Divisions to lift heavy tank turrets and other large loads. It was an ingenious design suitable for road or rail transport, and could be taken virtually anywhere a Panzer Division or V2 missile battery would have to go. It proved perfect for the V2 units' needs. The lift system allowed the crews to transfer missiles from the Vidalwagen trailers to the "Meillerwagen" launching trailers. Here the Hanomag SS100 tractor had dropped the trailer at the missile forward preparation site. **Inset:** The 15-ton gantry crane had a motor drive for the winches, both to raise and lower loads and to move them laterally. The tow bar assembly carried a compressed air bottle for the brakes. Folded down in its road configuration, the crane could be transported by road or rail within most normal clearance limits for bridges, tunnels or curves. Just inside the vertical tube struts were the cables and winches for raising and lowering the crane. (IWM)

Left: Erecting the gantry crane took a number of men, as the process of unfolding the support structures had to be done manually. With the road wheels blocked against a tree trunk, the crew began the task of erecting the crane. Time was of the essence in the last months of the war, due to Allied planes, but in fact, the great difficulty in spotting a V2 being prepared for launch made this a fairly safe procedure. The complex scissors arrangement of tubes and struts had to extend and retract reliably and quickly, but also had to support the weight of the gantry overhead frame and of the load being carried. (IWM)

Right: The first step in erecting the gantry crane was to move the folded end tower sections out to the ends of the gantry cross frame. This was done using pulleys and cables. Once the end structures were in position, the crew could raise the crane to its working height. Here, the end tower structures have been moved to the end of the cross frame. With the folded end frames repositioned, the crew began to turn them sideways. The uniforms here were a mix of various service types and work fatigues. The end frames pivoted in the center, but it took most of the crew to rotate them. (IWM)

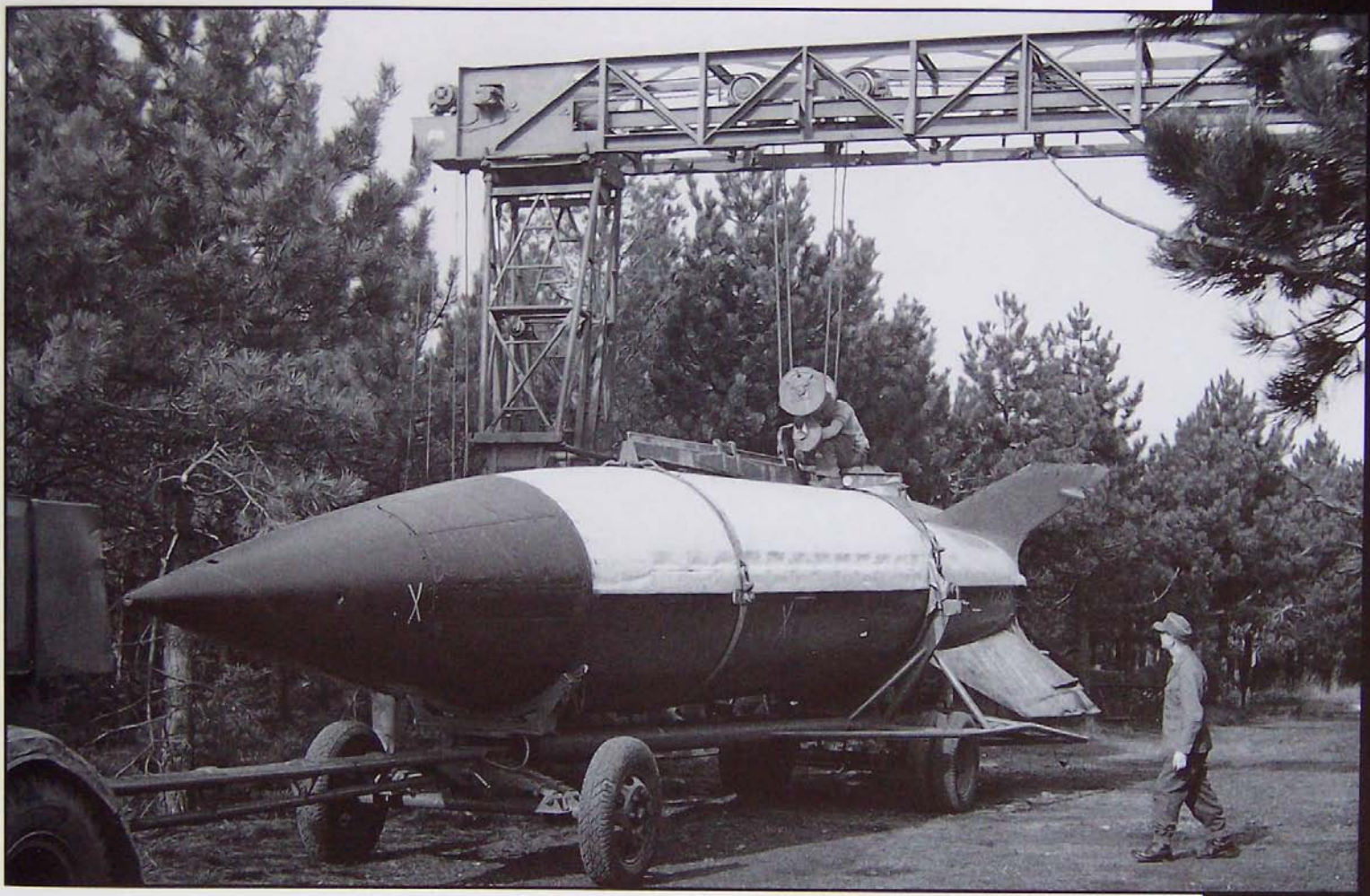


The crew swung the collapsed tower end frames 90 degrees to be perpendicular to the gantry cross piece. From this position the gantry was raised to its full height. When the crane had been erected, several missiles would be loaded onto their "Meillerwagen" launching trailers. The cables and pulleys on the folded tower end frame were used to draw the scissors frame upright, raising the gantry to its working height. (IWM)



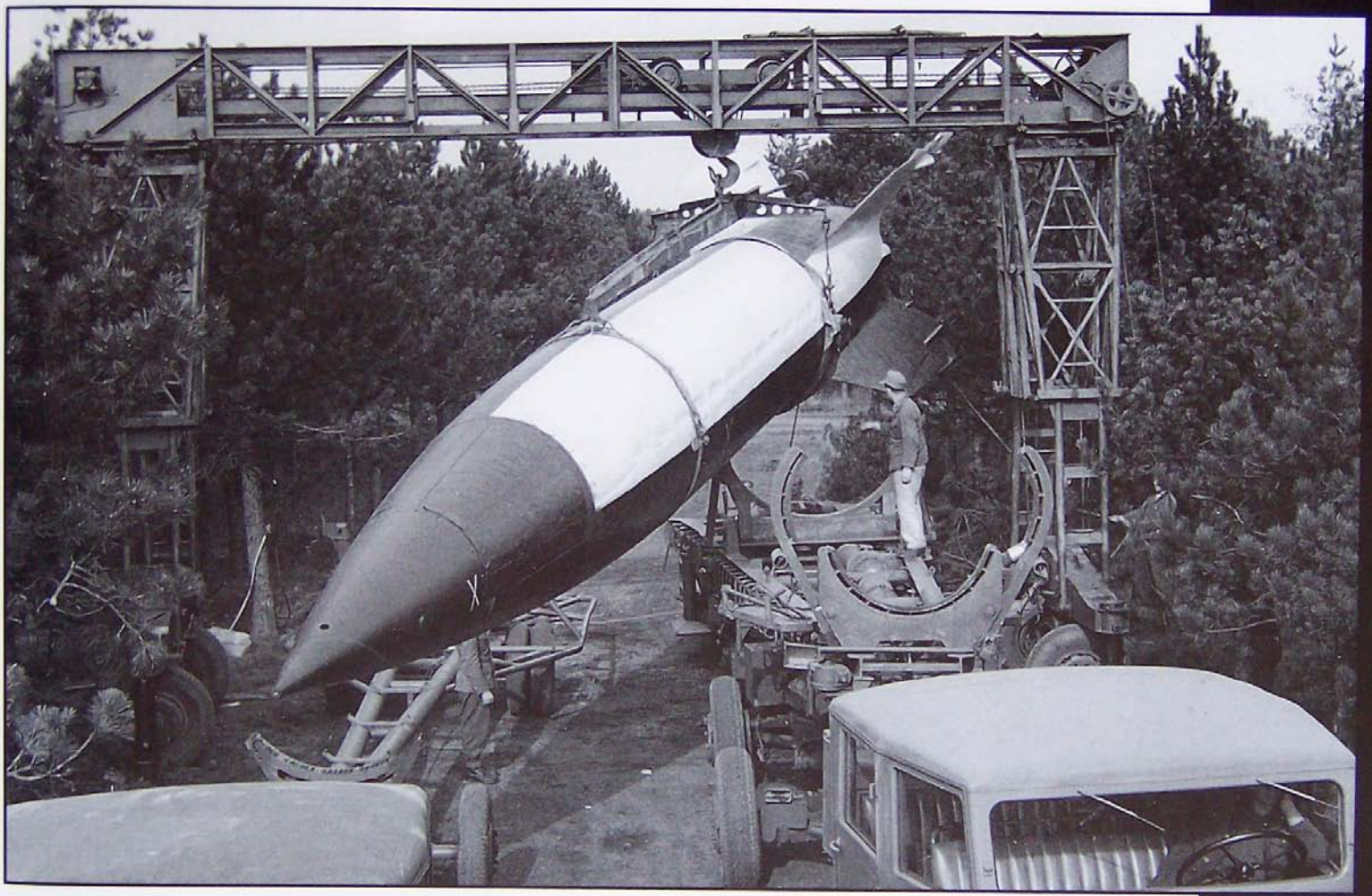
With the folded end frame turned sideways to the cross piece, the crew could then raise the crane structure. The scissors design was light weight and very strong. The cable and pulley system was the simplest way to move the scissors to raise (or lower) the entire crane. After adjusting the cables and pulley system, the crew carefully began lifting the crane, making sure the two ends were raised evenly together. The large jack struts were adjustable and were locked in place before the crew raised the gantry. Stabilizing the crane was very important, as the heavy loads could cause an unstable crane to fail. (IWM)

The 15-ton gantry crane was a large structure, long enough to straddle two railroad tracks to transfer loads from one train to another or to a truck or wagon parked next to the track. The motorized bogie truck and lifting hook ran transversely along the gantry, allowing loads to be moved side to side. Here, the crew had raised the gantry about half way, tightening the cables on the tower frames to lift the cross piece to its full height. Because of the size of the V2, the gantry crane needed as much ground clearance as possible. (IWM)



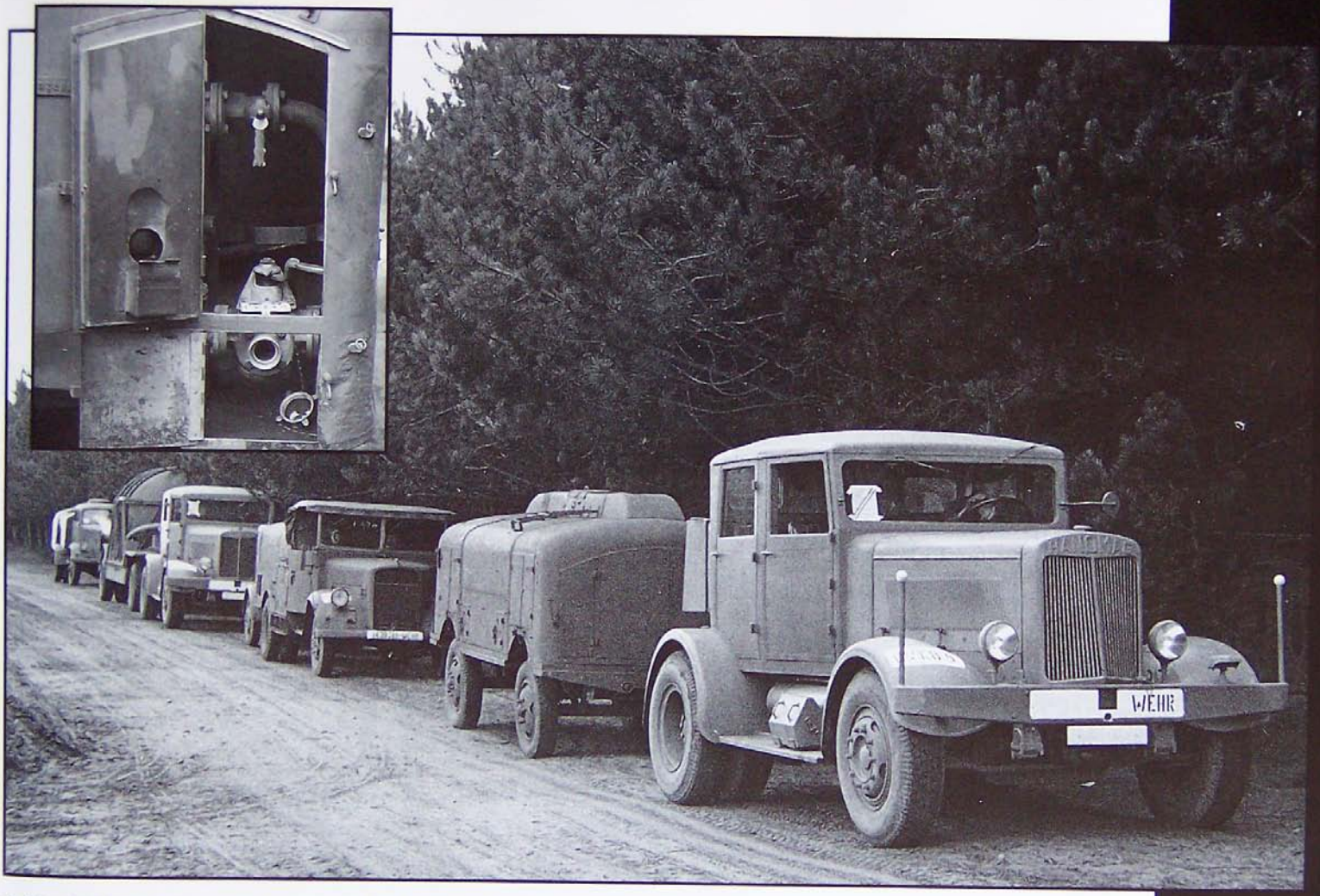
With the warhead attached, the V2 missile weighed about 6435 lbs (3015 kg), well within the working limits of this crane. When the warhead had been installed, the missile was ready to be transferred to the Meillerwagen launch trailer. The straps that had secured the missile to the Vidalwagen were fastened to a lift beam. This, in turn, was hooked to the gantry lift mechanism. When the crane was fully extended, as seen here, there was sufficient clearance to lift the V2 clear of the supports on the Vidalwagen and move it to the Meillerwagen. The size of the men here in relation to the rocket shows how large the V2 was. It was the largest tactical missile fired in combat, though some modern ICBMs are larger. (IWM)

The missile was lifted from the Vidalwagen trailer (left) and moved to the other side of the gantry to be loaded onto the Meillerwagen. As seen here, the Vidalwagen had a simple tubular frame intended only for transporting the missile. The Meillerwagen was heavier and much more complex, designed to transport the missile to the launch site and then launch it. The Meillerwagen also supported the V2 during fueling, which could be done only at the launch site. (IWM)

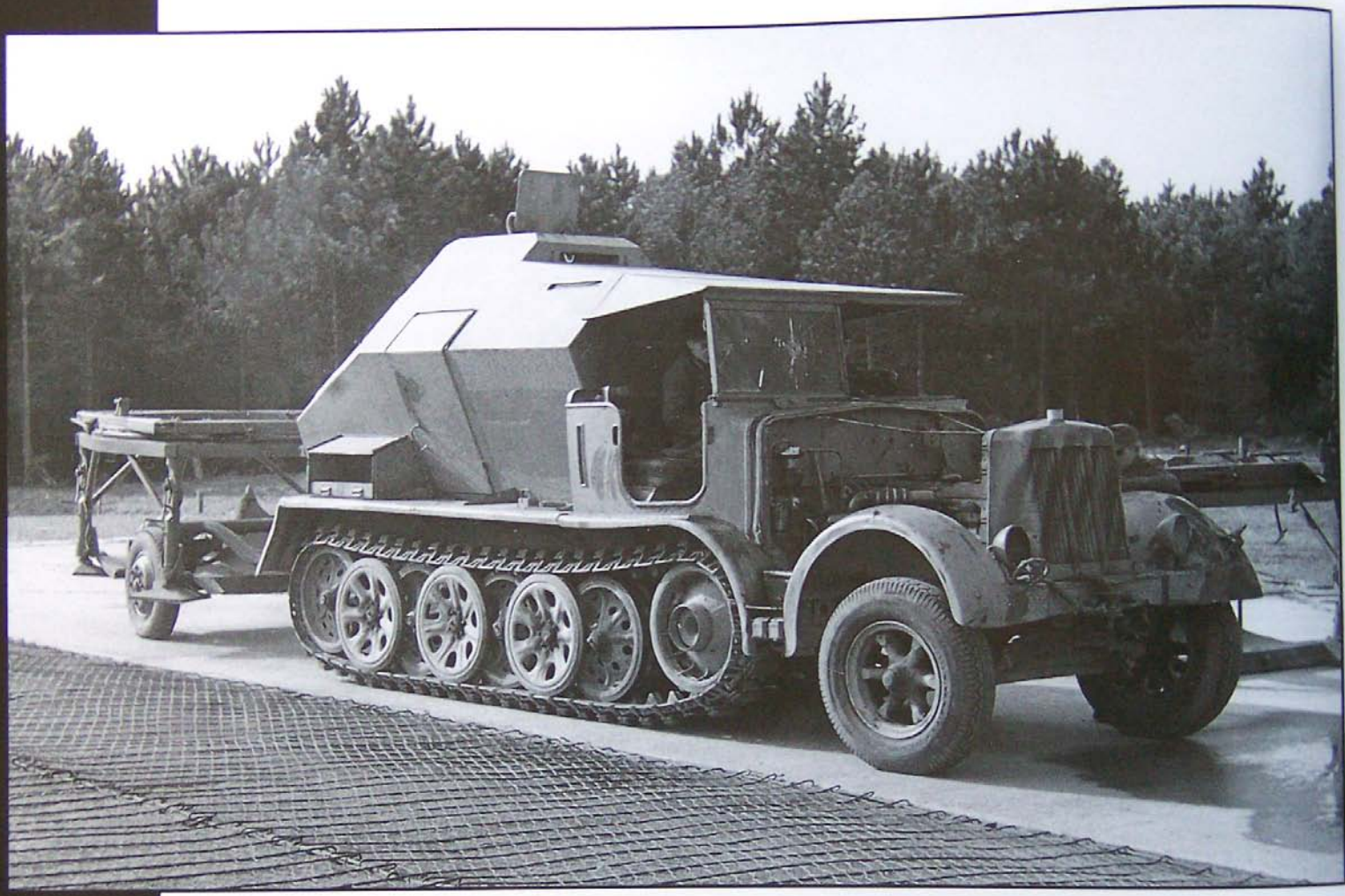


Crewmen guided the V2 missile as the crane moved it over to the Meillerwagen. The Meillerwagen trailer, also towed by a Hanomag SS100 tractor, consisted of two major assemblies: the transport trailer frame and the missile launch elevating frame. The elevating frame was hydraulically powered and raised the V2 to the vertical fueling and launch position. Since there were three Vidalwagens for each Meillerwagen, the launch trailer was usually reloaded two times after firing the first V2 before the battery broke down the firing site and returned to the transfer point to get more missiles. Note the cradle sections extended more than halfway around the missile body to secure the missile in place and prevent it from falling off the trailer during fueling. They were opened for loading, as seen in this view. (IWM)

Cradles and straps held the V2 onto the Meillerwagen launch trailer after loading. When all the missiles allotted to a fire mission had been launched, the gantry crane would be folded back to its road configuration and towed to a new launching site. The V2 launch sites were pulled back into Germany during the last months of the war and V2 firings lasted into March 1945. From this forward preparation site, the V2 on its Meillerwagen was towed to the launching site. A V2 battery was able to erect, fuel and launch three missiles within two hours. The relatively short launch time was a major factor in the inability of Allied aircraft to stop V2 launches, although many V2s were destroyed in bombing raids. Even in the last month of V2 operations, firings were not discovered until it was too late. Ground troops, as they advanced into Germany, destroyed a great many V2s. (IWM)



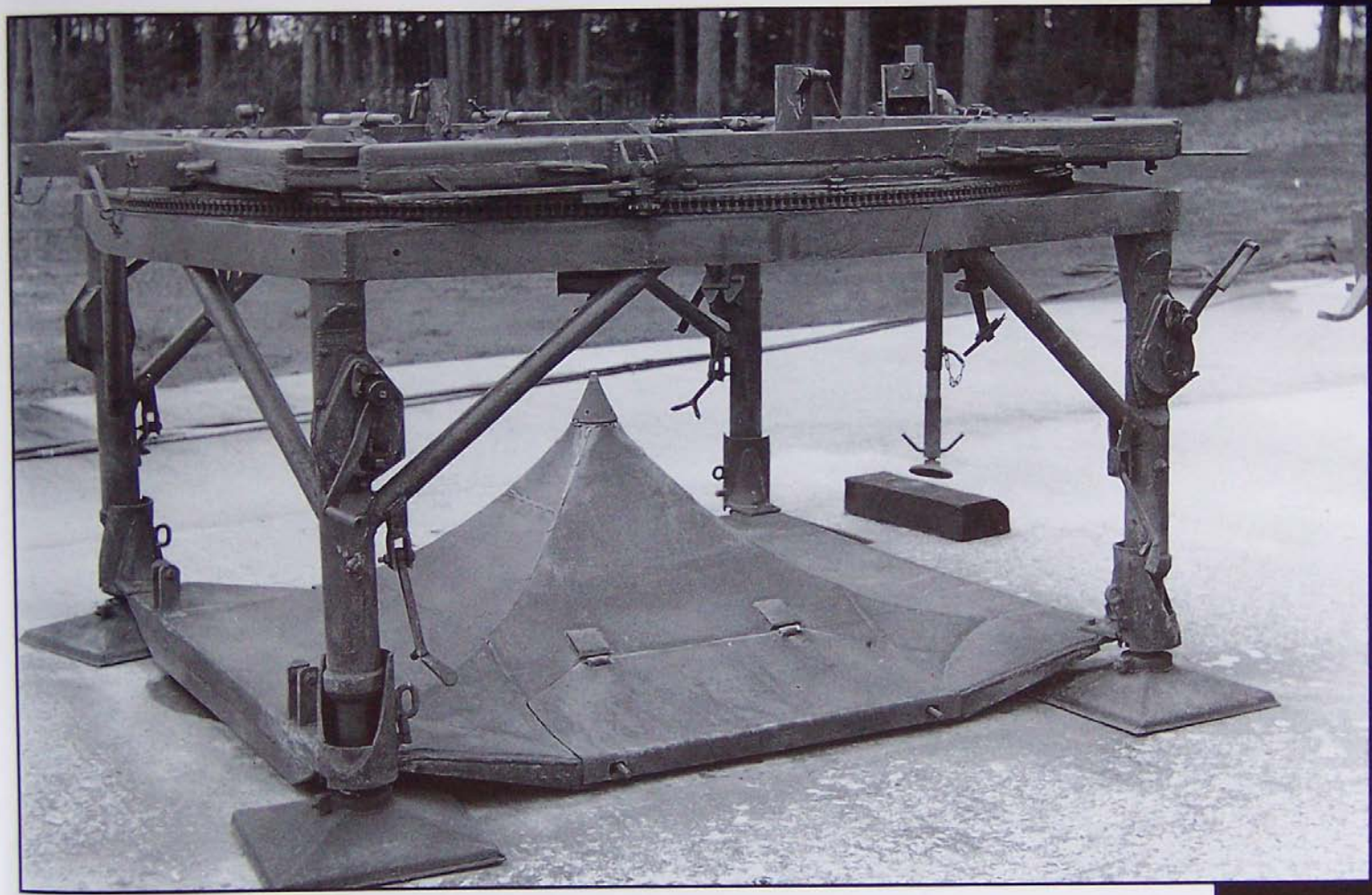
The fueling column for each V2 missile consisted of several vehicles. In this typical column, the first vehicle was an SS100 towing a trailer loaded with B-Stoff (alcohol/water mix). Second was a 3-ton tank truck also loaded with B-Stoff, towing a service trailer. Next was another SS100 tractor towing the A-Stoff (liquid oxygen) trailer, followed by an Opel "Blitz" tanker carrying T-Stoff (hydrogen peroxide and water) for the V2 motor's turbine fuel pumps. All V2s were towed to the launch sites empty and fueled after being raised to the vertical position. **Inset:** The B-Stoff trailer had a pump and fittings to transfer the alcohol/water mixture to the missile's upper fuel tank. The A-Stoff (liquid oxygen) filled the lower tank. The large handle seen at the bottom controlled the shutoff valve. Similar fittings were present on the B-Stoff tank trucks as well. The perceived difficulties of handling these volatile and dangerous fuels in the field convinced many scientists and SS officials (the SS controlled the V2 production program) that large underground reinforced launch complexes should be built to fire the V2s. Two such complexes were started in France, but after they had been bombed and destroyed, it was obvious that no fixed installation would ever be safe. Thus, the mobile launch system was developed and used successfully. (IWM)



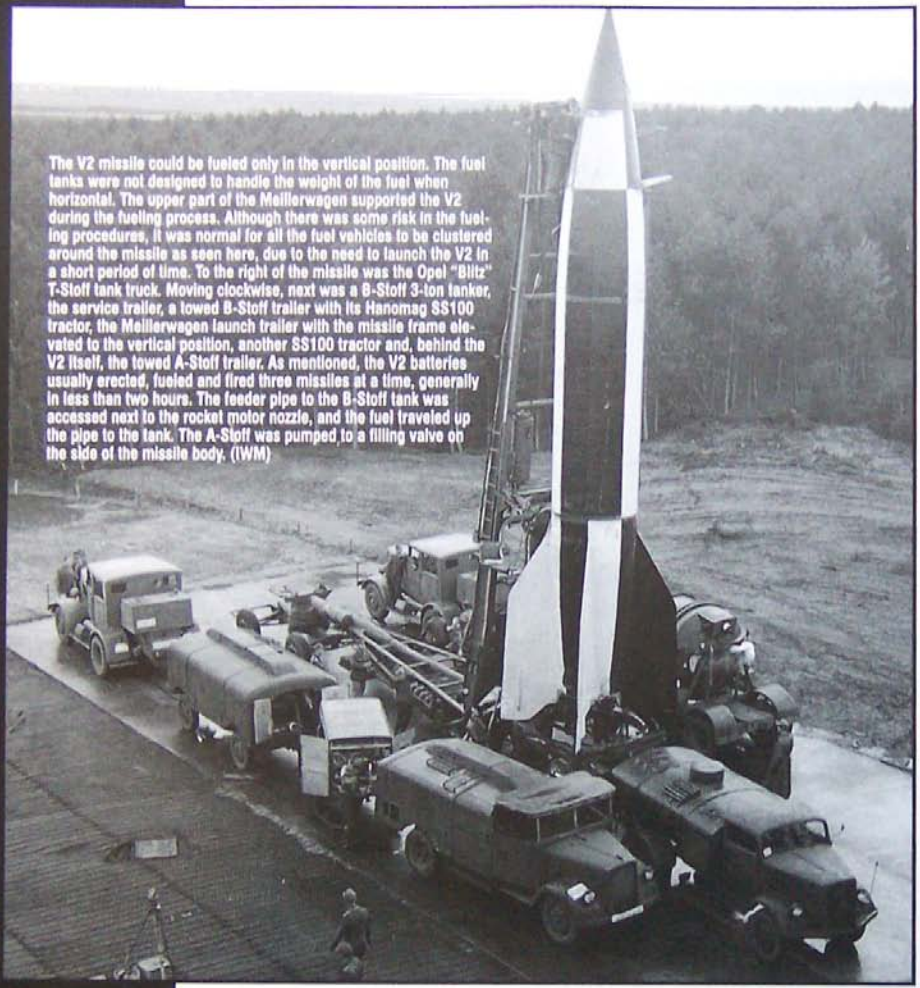
Launching the V2 missile required a control vehicle to carry the firing crew and launch control equipment. The Germans chose the 8-ton Krauss-Maffei SdKfz 7 artillery tractor as the basis for the V2 control vehicle. A light armored superstructure was added to the rear bed of the tractor, containing basically a mobile missile launch blockhouse. There were armored glass viewing ports, ignition/firing controls and equipment to send final guidance data to the V2 immediately prior to launch. The armored superstructure protected the firing crew from the blast of the rocket motor exhaust. This vehicle was called the "Feuerleitpanzerfahrzug fuer V-2 Rakaten auf Zugkraftwagen 8t (SdKfz 7)." These vehicles were allotted to each battery, normally one for each Meillerwagen launch trailer. (IWM)

Seen from the front, this is the same vehicle from the previous photo. Note the lack of the engine section hood. The British had to scour Germany to find all these items of equipment, and some of them were much the worse for wear. The sheet metal in the front of the vehicle was not damaged by the rocket exhaust since the armored rear end was placed closest to the missile during firing. This control vehicle often towed the "Bodenplatte" firing table, as seen here. The Bodenplatte was used to support the missile during fueling and launching. (IWM)

The "Bodenplatte" launch firing table was designed to be towed to the launch site using a detachable trailer dolly. At the launch site, the Bodenplatte was lowered to the ground, the trailer dolly towed away and the wheel doors in the bottom cone were closed. After firing was over, the trailer dolly would be attached, the Bodenplatte table raised, and the assembly could then be towed to a new launch position. It was a well thought out and efficient design and proved very successful. (IWM)



This close-up view of the Bodenplatte firing table shows the basic design. The center deflector cone was steel with a hardened tip. It was designed to disperse the blast from the rocket exhaust at launch. The steel framework and jacks allowed the Bodenplatte to support the 12.8 ton (13,000 kg) firing weight of an armed and fueled V2 missile. The jacks on the corner struts raised and lowered the deflector cone and also adjusted the table to ensure it was level. Since the V2 rested only on the Bodenplatte during firing (the Meillerwagen was lowered and moved before firing the rocket motor), the table had to be as level as possible. Fine adjustments could be made to the upper part of the table as well, to align the table supports that bore the weight of the loaded missile. (IWM)



The V2 missile could be fueled only in the vertical position. The fuel tanks were not designed to handle the weight of the fuel when horizontal. The upper part of the Meillerwagen supported the V2 during the fueling process. Although there was some risk in the fueling procedures, it was normal for all the fuel vehicles to be clustered around the missile as seen here, due to the need to launch the V2 in a short period of time. To the right of the missile was the Opel "Blitz" T-Stoff tank truck. Moving clockwise, next was a B-Stoff 3-ton tanker, the service trailer, a towed B-Stoff trailer with its Hanomag SS100 tractor, the Meillerwagen launch trailer with the missile frame elevated to the vertical position, another SS100 tractor and, behind the V2 itself, the towed A-Stoff trailer. As mentioned, the V2 batteries usually erected, fueled and fired three missiles at a time, generally in less than two hours. The feeder pipe to the B-Stoff tank was accessed next to the rocket motor nozzle, and the fuel traveled up the pipe to the tank. The A-Stoff was pumped to a filling valve on the side of the missile body. (IWM)

Right: Hydraulic cylinders elevated the upper part of the Meillerwagen and the V2 missile to the vertical position, until the missile was centered over the Bodenplatte firing table. Raising the missile before fueling had the additional advantage of allowing the Meillerwagen to be lighter and more reliable than it would have been lifting the full weight of the fueled missile, and was considerably less risky, as well. The A-Stoff flowed through the insulated hose, seen passing up the Meillerwagen frame. The engine-driven pump was required to lift the liquid oxygen up to the V2 lower tank. Outriggers on the Meillerwagen stabilized the trailer as the V2 was raised to the launch position. The lower part of the Meillerwagen was a welded tubular structure; the upper frame was largely channel and beam construction. Both were easy to build and strong for their weight. (IWM) **Opposite left**: Before igniting the rocket motor to launch the V2, all support equipment was withdrawn to a safe distance. The Meillerwagen was returned to the forward preparation site to load another missile and fuel vehicles would be sent back to be refilled. At the launch site, the firing crew entered the armored control vehicle. The control vehicle was positioned a distance away from the V2 on the firing table in case of a malfunction or accident. The launch crew could view the missile firing through the glass block vision ports and, after a successful lift-off, they

could observe through the top hatch as well. The armored superstructure was a complex design, but easily installed on the frame of the SdKfz 7 half-track. (IWM) **Right:** A successful launch, one of several conducted by the British Army during "Operation Backfire." In spite of the successful recreation of the wartime use of this sophisticated weapon, the British didn't gain as much information from their research as the United States did later on, using the German scientists who had conceived and operated the V2. Immediately after the war, Britain considered the chief architects of the V1 and V2 programs to be war criminals because of the extensive damage to civilian areas caused by these weapons. The United States prevailed, however, and the majority of the German scientists who had worked at Peenemuende, including General Walter Dornberger and Wernher von Braun, went to the U.S. to work first for the Army missile program and then for NASA. The technology from the V2 program led directly to the development of the Saturn V, which carried several teams of astronauts to the moon. (IWM)

Panther Attack in Alsace-Lorraine, 1944

After the successful breakout from Avranches and the Normandy area, the Allied armies moved across France so quickly that by late August 1944 they had secured the area between the Seine and Loire rivers, ten days ahead of the original schedule. By September, they were across the Loire, threatening the western border of Germany. The 4th Armored Division of Lt. Gen. George Patton's Third Army got across the Meuse river near Commercy and the 7th Armored Division established a bridgehead across the Meuse at Verdun. Only the Allies' decision to concentrate the main thrust against Germany in the north, using Montgomery's 21st Army Group, and the cutting of supplies to Patton's forces, brought the Third Army drive to a halt the first week of September 1944.

In response, Adolf Hitler directed an offensive operation intended largely to drive back the American forces and give the Germans time to restore and reinforce the Westwall defenses protecting Germany itself. An armored force would be assembled to strike at the eastern flank of the American units. 5. Panzerarmee headquarters was moved south from Belgium to command the attack. The new commander of 5. Panzerarmee was General Hasso von Manteuffel, the famous commander of "Grossdeutschland." Heeresgruppe G in 5. PzArmee was to mount the attack on the flank of Patton's forces on the Meuse. Initially, two Panzer Divisions, three Panzergrenadier Divisions and a total of six new Panzerbrigades were to be part of the attacking force. A number of units were under strength and others had to be given up for other operations.

The units selected for the offensive included 3. and 15. Panzergrenadier Divs, 17. SS Panzergrenadier Div., 11. and 21. Panzer Divisions, and Panzerbrigades 106, 107, 108, 111, 112, and 113, three of which were being brought in from Germany. 3. Panzergrenadier Div., 17. SS Panzergrenadier Div., and Panzerbrigade 106 were not available when the attack was to start. 21. Panzer Division could put up only a Kampgruppe, and 11. Panzer Division was supporting 19. Armee, and could not be re-supplied or refitted. The remaining half of the attacking force was under strength, having lost tanks and transport, and was only a fraction of what FM Gerd von Rundstedt had requested to defend the Westwall. **Above:** Here, a column of Panther tanks from Panzerbrigade 111 moves toward the town of Bures, 20 September 1944. Travel by day was risky, due to Allied air superiority, and thorough foliage camouflage was very common. There was a shortage of transport vehicles and many Panzergrenadiers rode on the tanks. (BA)

With the opening of Allied supplies, Patton's troops had reached the Moselle river on 7 September. XX Corps of the Third Army crossing the river south of Metz. It now became critical for the Germans to move to stop Patton before he could reach the Rhine, which was his goal. Panzerbrigades 111 and 112 arrived at Epinal, though with some difficulty, and Panzerbrigade 113 was at Belfort. Due to the heavy vehicle losses, Panzerbrigade 111 was partly equipped with Holzgas (wood-gas) trucks for the Grenadier regiment. Nonetheless, things began to move. **Above:** Here, a Panther of Panzerbrigade 111 enters Bures on 20 September 1944. This vehicle, as it approached the town, was also in the previous photo. The heavy foliage cover was a standard precaution in the French campaign. Along many of the major roads, hundreds of pull out air attack positions had been prepared. Tanks, trucks and other vehicles would pull off the roads during an air attack, or when Allied fighters had been sighted, and pre-positioned foliage would hastily be packed around the suspensions and wheels. If available, foliage was also piled around the superstructures. As seen here, foliage was often attached to soldiers' helmets for better concealment. (BA)

Panzerbrigade 112 had suffered the loss of most of its Panthers on 13 September in a battle with part of the French 2ème Division Blindée (2nd Armored Division). A similar fate had befallen Panzerbrigade 106 a week earlier, and that unit had few tanks remaining. Panzerbrigades 107 and 108 were sent to reinforce 1. Fallschirm Armee and 7. Armee, further weakening the German forces. All of the units on hand were in poor condition, with missing equipment and second-class transport in some cases. The brigade staffs had no command tanks, nor were there any recovery vehicles to retrieve damaged equipment. On 16 September, Panzerbrigade 111, with elements of 11. Panzer Division, attacked the French units east of the Moselle. Though driven back, the Germans were relieved when the French withdrew across the Moselle. The tactical situation forced a change in the German plans, and a smaller offensive in the Lunéville sector was proposed, with the intention of cutting off American units moving east from the Moselle. **Above:** This photo shows a Panther of Panzerbrigade 111 entering Bures on 20 September. The tank is painted in the standard mid-war three-color scheme, with the usual foliage cover. Many of the transport trucks had broken down or had been destroyed. Carrying the Panzergrenadiers on the tanks solved a number of problems, including having an infantry escort for the armor. (BA)

Panzerbrigade 111 didn't take part in the battles on the 19th of September. The brigade was deliberately misdirected by a farmer and didn't rejoin the LVIII Panzerkorps until late afternoon. Patton's XV Corps had broken 5. Panzerarmee's defense line and Panzerbrigade 113 had lost over 30 tanks, nearly half of them Panthers. As a result of its own losses, Panzerbrigade 111 was ordered to change direction again, toward Blanche-Eglise. However, von Manteuffel sent a Kampfgruppe into Bures as a ploy to make it appear he was following the original plan. The tanks carrying the unit's Panzergrenadiers arrived in the town on 20 September. **Left:** This is a close-up of the Panzergrenadiers on the engine deck of the Panther shown in the last two pictures. The nearest individual wears a sleeveless jerkin made from Italian shelter quarter material, a popular alternative to the standard German camouflage clothing. He also still wears high jackboots, though the standard in 1944 was the low shoe and cloth gaiters. Older pieces of uniforms and equipment were prized, since the quality of German uniforms and equipment declined during the war. (BA) **Right:** The Panzergrenadiers on this Panther show the variety of uniforms and equipment commonly seen in the later war period. Note the paint or mud daubed on the soldiers helmets. This was a common practice, although the cloth camouflage helmet cover was also widely used. (BA)

The 4th Armored Division task force under Col. Creighton Abrams started its drive in the afternoon of the 20th, and moved south. A Kampfgruppe of Panzerbrigade 111, detailed to protect the flank of the brigade as it prepared to move to Blanche Eglise, met the Americans near Ommeray and stopped the first unit, knocking out several Shermans. Positioned on a hill, the Panthers had a good view of the area and made the most of it. When the rest of the American force had arrived, they engaged the PzKpfw IVs of the brigade, knocking out 8 German tanks but losing 12 of their own. The American forces turned toward Moncourt in the late afternoon and took that town in a night action. **Above:** This shot was taken as the troops prepared to move out as supporting infantry. The machine gunner in the foreground has thrown the ammunition belt over the top of the gun as he carries it, to reduce the strain on the feed mechanism from the relatively heavy belt. Some of the troops here have their gear stowed in non-standard ways. Initially, wearing of equipment was very much regulated. As the war progressed and combat experience dictated what worked and what didn't, many soldiers wore their uniforms and equipment to suit their needs. Occasionally, as with the strapping of gas cape pouches to the gas mask canisters, these practices violated standing regulations. (BA)

The main body of the American 4th Armored Division had advanced during the day of the 20th as well, and had reached beyond Dieuze and Château-Salins, which created a large gap between 1. Armee and 5. Panzerarmee. Heeresgruppe G was ordered to close this gap, and the commander, Generaloberst Johannes Blaskowitz, ordered both 1. Armee and 5. Panzerarmee to attack together to repair the lines. Progress was slow, and the gap could not be closed. Blaskowitz wanted von Manteuffel to press 11. Panzer Division into action to relieve the Panzerbrigades, most of which were exhausted and down to only a few serviceable tanks. The lack of progress led Hitler to replace Genlobst. Blaskowitz with General der Panzertruppen Hermann Balck on 21 September. **Above:** This Panther ausf G has come to a halt, and the crew has quickly covered the tank with foliage. The foliage was very successful in breaking up the tank's distinctive shape and making it hard to see from the air. This tank, from Panzerbrigade 111, has the three-color camouflage seen at this point, and white turret numbers. The camouflage here is fairly elaborate in that the gun barrel has been carefully painted. This view shows the one-piece side armor, which distinguished the ausf G and improved the side protection of the Panther. Tool stowage for the ausf G was based on that of the earlier ausf A. (BA)

On 21 September 1944, Gen. Patton's forces advanced into the Lunéville sector, intent on driving past the German flank defenses south of Lunéville. The 313th Infantry Regiment of the U.S. 79th Infantry Division took Moncel, just east of Lunéville. Its advance was stopped at the main German line of resistance in a wooded area east of the Meurthe river, as was the 314th Infantry's 3rd battalion near Saint-Clément. The Germans, meanwhile, had a commanders' meeting at 5. Panzerarmee HQ at Vasperviller. An assault was planned for the following day, although Gen. von Manteuffel said he would have to wait for 11. Panzer Division to arrive before starting a major offensive. It was decided to send Panzerbrigade 111 from Bures to move through Blanche-Eglise and seize high ground west of Juvelize. The move would start early the next day. **Above:** During the initial assault in the Lunéville area, Panzerbrigade 111 had captured a number of American vehicles from the 42nd Cavalry Squadron, including this M8 armored car. The original U.S. olive drab color scheme was quickly altered with strokes of what may be German dark yellow paint, or possibly mud. It is also possible that this color scheme was an American original. The large crosses are the mark of the new owners. Virtually all the stowage on this armored car is American, and the Germans have had to do little to put the M8 into service. (BA)

The morning of 22 September was foggy, initially giving the Germans an opportunity to advance safe from the dangers of Allied air cover. The reality was that the attack started late due to late arrivals, and many German units became lost or disoriented in the thick fog. Panzerbrigade 111 had traveled from Bures to Blanche-Eglise earlier, but the men were exhausted by the recent engagements. The advance toward Juvelize began in mid-morning, and the lead elements of the German force engaged the 25th Cavalry Squadron defending the town. Seven U.S. light tanks were destroyed, although a company of tank destroyers of the 704th TD Battalion also knocked out three German tanks. The Germans pushed on, and Panzerbrigade 111 had taken Juvelize by midday, though now under attack by 9th A.F. fighter-bombers. **Above:** Seen in the town of Parroy, southeast of Bures, this is another of the M8 armored cars captured in Lunéville on the 18th. This example has an olive drab color scheme with a heavy layer of dust lightening the entire car. The 37mm main gun was a bigger weapon than most German armored cars carried. It was capable of destroying many light armored vehicles at ranges of up to several hundred yards. Often these captured designs were used just as they had been acquired, but some were modified to carry German armament. (BA)

The German attack on the Juvelize sector had ended in almost total failure, with heavy losses in equipment and troops. On 23 September Panzerbrigade 111 had only 7 tanks and 80 men in combat ready condition, though the situation improved later in the day as the recovery crews were able to repair a number of tanks and other vehicles. Nonetheless, the loss of so much equipment and men had seriously affected the unit's fighting abilities. The local situation was so confused that, in spite of its greatly depleted strength, the brigade was ordered to hold a line from Blanche-Eglise to Guéblange. A Kampfgruppe from Panzerbrigade 113 was detailed to hold the road from Ley to Bourdonnay, but it too was recovering from its heavy losses three days earlier. **Above left and right:** The bulk of the German soldier's personal gear was hung from the suspender harness in order to distribute the weight better. The major disadvantage of the German infantry gear was that the belts and suspender harness had to be adjusted to prevent as much noise as possible. Equipment could bang together and give away a soldier's position. The belt could be worn without the suspender harness. There were metal hooks in the M1941 blouse that hooked under the belt to support the weight, which was much more comfortable for the soldier. One of these hooks can be seen on the man with his back to the camera in the right-hand photo. (BA)

As XXXVII Panzerkorps was forming its defensive line from the Parroy forest to the 19. Armee flank, the U.S. 4th Armored Division was also taking a rest to refit and prepare for further action. 9th A.F. P-47 Thunderbolts were directed to German targets by 4th Armored observers, and casualties included the commander of Panzerbrigade 113, Oberst von Seckendorff, who was killed. The German commanders tried to reorganize their units to make some offensive action possible. The 559th Volks-Grenadier Division moved south from Metz and reinforced 1. Armee's left flank, along with what was left of Panzerbrigade 106. **Above left:** These Panzergrenadiers are part of a heavy machine gun team. The standing grenadier to the right has a folded heavy tripod mount for the MG34. Note the wire frame added to the helmet in front. This man also has managed to keep his early-issue jackboots. (BA) **Above right:** These infantrymen are wearing the M1943 blouse, and the man in the foreground has a nearly standard layout of his personal equipment. On his left hip is an older non-folding model shovel. This shovel carrier is canvas with leather straps. The early war carrier was all leather. Next to the shovel is the bayonet and scabbard. This was usually worn on top of the shovel, held in place by the strap that secured the shovel in the open frame. This is a good view of a painted 1942 helmet with the wire frame for foliage. (BA)

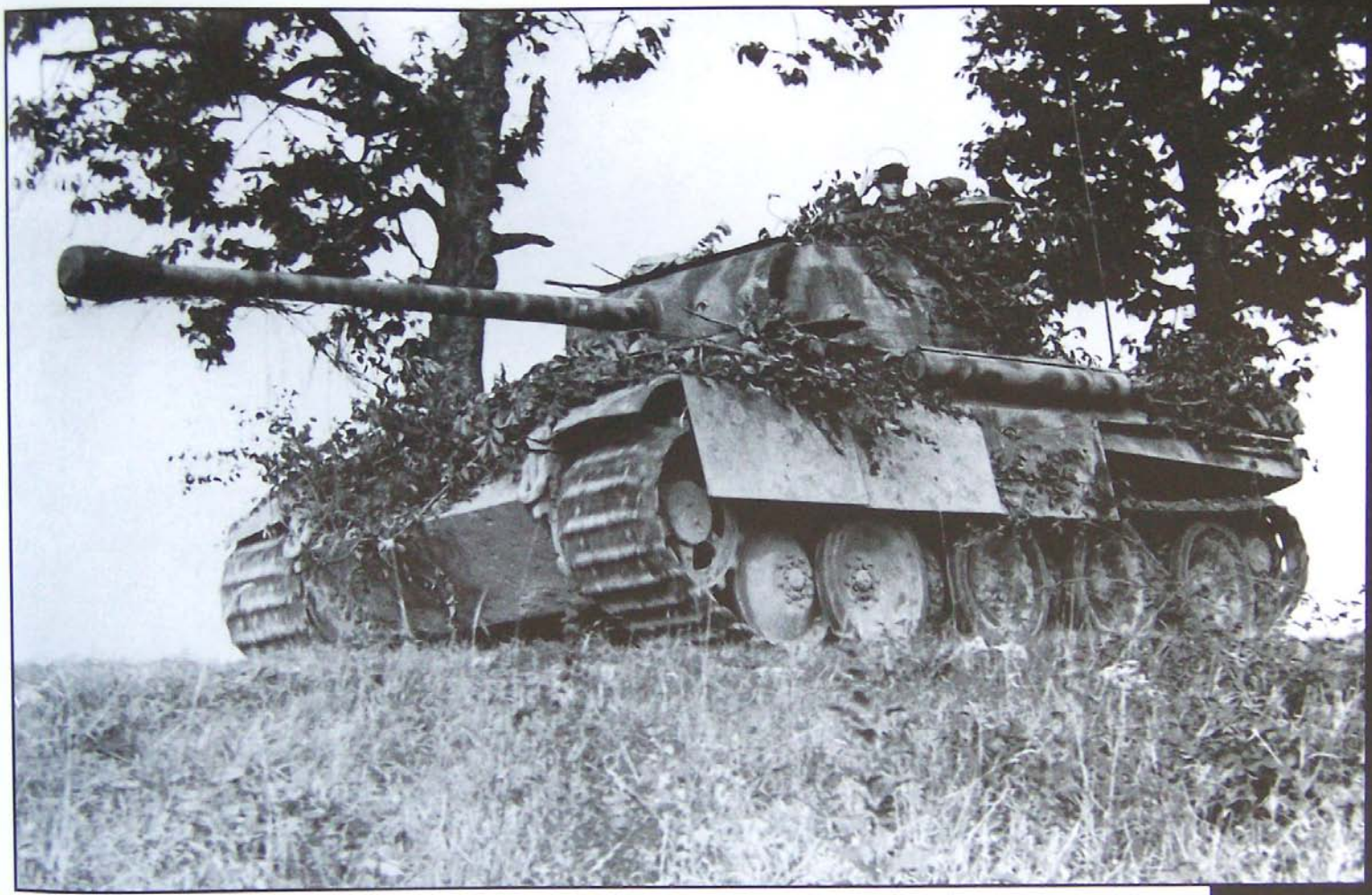
Germany designed and fielded a number of excellent light artillery pieces. Among the best of these during the early war years was the fine 5cm PaK 38 antitank gun. It was a popular weapon, but became obsolescent at the end of 1941, with the introduction of the T34 and KV series of tanks on the Eastern Front. However, the gun carriage was an excellent design and the Germans went to considerable lengths to find other weapons that could be mounted on it's lower carriage. One avenue was to modify heavier guns so they could be fired safely from the lighter platform. One such design was the 7.5cm PaK 50. This was a cut-down 7.5cm PaK 40 with the L/46 barrel being shortened to only L/30. While antitank performance would suffer, the PaK 40 had such a good kill margin that it was felt this less powerful variant could still knock out or disable the most common Allied tanks. Very few PaK 50 guns were issued to troops in the field and photos are quite rare. Among the few that did see service was this example seen in the Alsace campaign, September 1944. The carriage is almost exactly the same as the 5cm PaK 38. The gun itself retains the PaK 40 style breech and rear barrel with recuperator. The forward barrel was cut down and a large 3-baffle or 5-baffle muzzle brake was fitted to control recoil on this lighter mounting. (BA)

The 7.5cm PaK 50 was a very low gun and it was handled much like the PaK 38 on which it was based. The lower velocity reduced armor penetration, but the gun was still useful against medium armor at moderate ranges, and it could also fire against other targets using HE. The PaK 50 used the same ammunition as the PaK 40. In general, the German light antitank guns were the most technically advanced weapons of this type during the war. Here, the entire lower carriage and upper gun shield of the 5cm PaK 38 is almost unchanged, except for very small details. The shortened 7.5cm PaK40 barrel and its recuperator have been fitted to the PaK 38 carriage and lower mount. Though the tree branches obscure it, this gun is fitted with a 3-baffle muzzle brake to reduce recoil. A crew of 5-6 men was usually all that was needed to handle the gun and fire missions. Antitank guns were most often used from heavily camouflaged positions in ambush. Because of their low silhouettes, guns like the PaK 50 were very dangerous to enemy tanks and other vehicles. The only major disadvantage to low antitank guns like the PaK 50 was the effects of the considerable muzzle blast. The gun here is hidden in a heavy cover. Foliage on a fairly powerful gun doesn't last long; the muzzle blast is usually enough to dislodge most light camouflage type foliage. (BA)

During the fighting around and in Lunéville, the advance elements of Panzerbrigade 111 captured a number of American vehicles, including this M3A1 infantry half-track. The M3 series was rugged, reliable, easy to maintain and generally capable of long periods of use without breaking down. All of these advantages endeared it also to the Germans. This example, captured during the early fighting around Lunéville, again has been well garnished with the usual foliage cover. The overall olive drab paint scheme hasn't been changed, except for the addition of a German word, part of which is hidden. This half-track has the front-mounted winch, which made it even more useful to the Germans. It could retrieve most unarmored vehicles with little trouble. Though the M3 was much simpler than the Sdkfz 251 SPW used by the Germans, in fact its performance was fairly comparable. The SdKfz 251's major design failing was the lack of a driven front axle. The M3's driven front wheels allowed it to negotiate terrain that even the '251 could not handle well. Cross-country performance was similar, in spite of the SdKfz 251's sophisticated torsion bar suspension and steering differentials. The M3 also had considerably more interior room, always hard to find. Both sides seem to have had some fascination with the equipment used by the other army and both used captured vehicles and weapons as often as it was practical to do so. (BA)

On 23 September 1944, 11. Panzer Division was moved up to reinforce 5. Panzerarmee, and moved toward Dieuze. This photo gives a good impression of the terrain in the area. Here, a column of Panther tanks advances toward Dieuze from Sarrebourg. Note the tanks are well spaced, which allowed them maneuvering room if attacked and made it difficult for the enemy to destroy all the vehicles in a column. This particular Panther is a new ausf G, and having come from a railhead, hasn't yet been festooned with the usual foliage cover. On an open road like this, the Panthers were capable of good speed and could move quickly. The camouflage scheme is the early 1944 type, dark yellow base with olive green and red brown overspray. The lack of extra stowage, except for the bucket and milk can hanging off the rear, was not uncommon. This trip was made without two dozen Panzergrenadiers packed onto the engine deck, although most of the crew rides outside the tank. There were never enough Panthers to meet the needs of the Panzer Divisions and many Panzergrenadier Divisions had to make do with the smaller PzKpfw IV. A few Panthers could have more effect on the battlefield than many more of the PzKpfw IVs because their very accurate and lethal main guns could break an enemy advance and allow the Germans to regroup and even counterattack. (ECPA)

11. Panzer Division moved into Dieuze during the latter part of 23 September, after refitting at Belfort. The plan was to join up the division units to form the strongest force possible with the division's weakened state, and then mount a new offensive. Gen. von Manteuffel believed that achieving surprise for the assault could result in a victory for the German forces. The remainder of the 23rd and most of the 24th were spent trying to get as many tanks and vehicles repaired and returned to the line companies for combat. Panthers of 11. Panzer Division pulled into the center of Dieuze on 23 September. The town served as a gathering point for the division's troops during the preparations for the upcoming offensive. These two Panthers are older ausf As, still in use (as were even older ausf Ds that had survived combat). The muzzle brakes were covered to keep the bores cleaner during road marches and rail transport. Note the gun travel lock and the netting on the glacis plate. Netting like this was one of the most common ways to secure foliage and other camouflage materials to a tank or other vehicle. On the Panther ausf A, the hull hatches for the driver and radio operator were the "lift and rotate" type and were often left open for ventilation. They could be opened or closed using a handle inside, avoiding the necessity of exposing the crew members to enemy fire if they had to be closed quickly. (ECPA)



German intelligence prior to the planned assault had indicated that the sector around Moyenvic and Marsel, to the north, was lightly held. In a heavy rain, the attack by LVIII Panzerkorps began mid morning of 25 September. The U.S. cavalry units in front of 4th Armored Division were quickly pushed aside and the German move continued against light opposition. The advance elements reached Marsel in less than an hour and entered Moyenvic soon after. Vic-sur-Seille was reached by 10:00, and 5 Panzerarmee had joined up with 1. Armee, achieving the first strategic objective. After the battles of the 25th, 11. Panzer Division returned to the Bures area. There was a great deal of movement over the same ground, as Germans and Americans prevailed in individual actions. This is the first of two views of this particular Panther ausf G as it approached the town of Bures during the day on the 26th. Although it's likely that the photos were taken by the same photographer, the negatives for this shot reside in the Bundesarchiv in Germany, while the following one resides in the ECPArmees in Paris. The foliage, though apparently simply draped over the tank, was actually carefully applied so as not to interfere with any of the critical systems of the vehicle, or any of the entry hatches. The side skirts were removed for maintenance of the suspension and when replaced often didn't match, as shown. (BA)

The second phase of the German offensive was to use the remaining tanks of 11. Panzer Division and the remnants of Panzerbrigade 111 and 113, to reach Bauzemont and Bezange-la-Grande, then turn to join XXXXVII Panzerkorps and trap CCA of the 4th Armored Division in a pocket west of Arracourt. XXXXVII Panzerkorps was ordered to hold its left flank in position and was to bombard the American artillery positions supporting CCA east of Arracourt, but there weren't enough guns to do this. To the right of 5. Panzerarmee, 1. Armee was to resume the attack in the Château-Salins area to try to reach Moncel-sur-Seille, which was west of Bezange-la-Grande. The plan was well thought out, but the weak state of most of the German formations made it essential that all the attacking units perform at the highest level. This second picture of the Panther was taken shortly after the first. After the recent rains in the area, this Panther carries the usual load of mud and dirt on its suspension. The Panther's interleaved roadwheels tended to pick up large amounts of mud and dirt. The foliage on this tank has apparently been arranged to break up its distinctive shape. When foliage was placed over or around tanks hidden this way, they could be very hard to see from the air. In rear areas, the hatches were usually left open for better ventilation. (ECPA)

The next day, 26 September, both sides regrouped again and reformed their forward lines. Gen. Wood, commander of 4th Armored Division, had moved CCB south, moving to connect with CCA from Réchicourt to the Marne-Rhine canal. Patton decided to put 4th Armored on the defensive for the moment, and so Gen. Wood withdrew part of CCA from its extended positions. As the Americans moved out, German troops of LVIII Panzerkorps moved into Lézey and Coincourt. Gen. von Manteuffel ordered a number of the German armored units to regroup in the Bures area, and 11. Panzer Division began to move toward the town. Here, Panthers of 11. Panzer Division gather in Bures. Here they would be formed into a Kampfgruppe for the forthcoming assault on the 4th Armored positions. The tanks were again used to transport the division's Panzergrenadiers, who had no SPW halftracks for their unit. The shortage of SdKfz 250 and 251 SPWs meant that relatively few Panzergrenadiers were able to fight from these specially designed vehicles. Only a very few divisions had both regiments of Panzergrenadiers mounted in halftracks. Even in Panzer Divisions, only the first regiment had SPWs. The second regiment had to use trucks, and fight as dismounted motorized infantry. As important as the SPWs were in carrying the Panzergrenadiers to action behind armor, their role as fire support vehicles was even more valuable. (BA)

The Kampfgruppe formed as the center of LVIII Panzerkorps attack was put together on the 26th. It consisted of 11. Panzer Division's "Panzer-Aufklarungs-Abteilung 11" (the division's armored reconnaissance battalion), about two dozen tanks and assault guns left from 11. PD, Panzerbrigade 111 and 113 (both in much weakened condition) and 15. Panzergrenadier Division. Moving from Bures, this group would press the Americans back from the high plateau of hills west of Bathelémont, where they had command over the local area. The chief targets on the plateau were Hills 293 and 318 (height listed in meters). Taking these two hills would open this part of the campaign area and allow the Germans to move to their objectives. At 8:00 in the morning on the 27th, LVIII started several diversions against CCA and CCB of 4th Armored Division. At the same time, a strong force tried to break through the 10th Armored Infantry Battalion near Bezange-la-Petite, but they could not break the line, only force a bulge in it. The Americans made excellent use of the terrain and were able to withstand the assault. **Inset:** The light machine gunner was the heart of the standard German infantry unit and tactics. These gunners were well trained, especially those who used the MG34 or the later MG42. Both these weapons had a high rate of fire (900 rounds per minute for the MG34, 1200-1500 rounds per minute for the MG42). (BA)

West of Bezange-la-Petite, hard fighting flared around Hill 265, and then Panzergrenadiers managed to capture Xanrey. They were attacked by the Shermans of the 4th Armored Division, who gained the village with artillery support. This ended this part of the German advance, as the Americans still held their positions. The German drive south of the Bezange-la-Petite area initially went better, but the 11. Panzer Division tanks moving west from Bures couldn't cut through the lines held by 4th Armored's CCB. Heavy U.S. artillery fire stopped the tanks west of Bures and the advance stalled. At night, a force from Panzergrenadier Regiment 110 (11. Panzer Division) went north and did take Hill 318, one of the main objectives in the Bathelémont plateau area. Panthers moved through Bures to join the attacking units to drive the Americans out of the Bures and Bathelémont areas. This Panther ausf G, probably of 11. Panzer Division, has the unusual "disk" style ambush camouflage pattern on the front of the turret and gun mantlet. This scheme was painted by spraying the base color of dark yellow over the secondary colors (olive green and red brown at this point in time) through a cutout stencil. This scheme has also been applied to the cupola as well. Combined with the extensive foliage seen here, this camouflage scheme would make this vehicle extremely hard to see under any sort of tree cover. (BA)

On 28 September, the American 51st Armored Infantry Battalion of 4th Armored's CCB retook Hill 318, setting up a series of fierce battles to control this strategic high spot. The Germans again attacked, but this time U.S. artillery broke the assault and the attack failed. In addition, P-47 Thunderbolts from the 9th Air Force flew a number of devastating missions against the troops in Bures and destroyed most of the town. By the time the actions of the afternoon had ended, the lead Kampfgruppe had lost all its tanks. **Left:** This Panzergrenadier is walking along the embankment that marks the southern edge of the lake at Parroy. This was an artificial lake that had been drained due to damage. It was still partly full, and the rest was a huge marsh totally unsuitable for vehicles. A Panther trapped there was recovered after the war, and now is in the museum at Saumur. The M1936 Feldbluse and high jackboots, along with the leather pouches for the MP40 magazines, give this Panzergrenadier the appearance of a soldier from the 1940 French campaign. (BA) **Right:** This Panzergrenadier is much more typical of the period with his later blouse and gaiters. He is toting the long-handled shovel often seen stowed on armored vehicles and is ready to dig in quickly. The 8.8cm Raketenpanzerbüchse 54 he carries was a German development of the smaller American 2.54" (57mm) bazooka captured by German troops in Italy. (BA)

On the morning of 29 September, a Kampfgruppe made up of Panzergrenadier Regiment 110 and Panzer-Aufklärungs-Abteilung 11 went on the offensive and managed to take Hills 293 and 320 on the way to Arracourt. They attempted to take the town as well, but could not advance further. The Americans countered with Shermans and the ever-present air cover. German units caught in the valley between Hill 293 and Hill 318 suffered heavily. The Kampfgruppe that had taken the two hills was trapped when the Americans retook Hill 320. The Panzergrenadiers in the Kampfgruppe managed to straggle back through the thin American lines during the rest of the day and evening. The few tanks from Panzerbrigade 113 had set up a new defensive line near Parroy. As the situation around the Bures area became fluid, the Germans had to move units around to counter American movements. What was left of Bures was still the center of the German forces. The tanks of 11. Panzer Division and Panzerbrigade 113 were all in or around the Bures-Parroy area. Here, the Panther at the left provides cover for Panthers moving back into Bures. These tanks are at the outskirts of Bures. This photo and the next 2 constitute another fascinating sixty-year old jigsaw puzzle. Although taken only a few seconds apart, the first and the third are from the BA, while the second is from the ECPArmées in Paris. (BA)

The bitter fighting continued through the day and evening of the 29th. Though many of the trapped German troops had managed to return through the American lines and rejoin their units, the many casualties suffered weakened the German position, and reinforcements were not available. This led to Gen. D. PzTrp. Balck meeting with FM von Rundstedt to request major reinforcements. The Field Marshall's hands were tied. Hitler had decided to send what forces there were to support 15. Armee to the north and there was nothing to give to 5. Panzerarmee. As the tanks and other troops of the withdrawing German forces approached Bures, the town filled with vehicles and men. It thus became a prime target for American fighter-bombers, who did attack the town several times, burning much of it to the ground. In this second photo of these two Panthers, note the better view of the foliage placed around the Panther at the left. By running the branches from the ground up, it was possible to conceal the most distinctive parts of a tank, its suspension. This vehicle is exposed to have a better line of sight to see incoming enemy aircraft. The tank on the right appears to have a simplified form of the dotted "ambush" camouflage scheme. Though damaged, the front flip-up mudguards still have their Zimmerit coating intact. (ECPA)

Genl. D. Pztrp. Balck was forced to place 5. Panzerarmee on the defensive. Without reinforcements, there was no way his exhausted troops could prevail against a stronger and better supplied American force. The three divisions, four engineer battalions, artillery and dozens of new tanks and assault guns didn't exist and this sector was no longer considered important enough to warrant further men or equipment. The last units to move into Bures signaled the end of the Germans' offensive against the 4th Armored Division. Not only were the Americans much better equipped, but the Americans had learned the hard lessons of war, and now were well-led and much more aggressive in action. They had proved to be estimable foes, and at little cost, had achieved a clear victory. 4th Armored Division was put into a defensive posture for a time, remaining in its location around Arracourt. It was later relieved and sent to the rear. As the Panthers moved through Bures, the Americans were refitting and preparing to hold their lines. The Panther to the right was one of the tanks withdrawing from the fighting on the Bathelémont plateau. In this view, note the very extensive foliage on the Panther in the background. Parked in a tree line, this tank would have been very hard to see. Since the Americans could not maintain constant air cover, the Germans managed to move large amounts of materiel when the fighters weren't around. (BA)

On 22 September. The Allied high command decided to initiate a push to liberate Antwerp in Belgium to finally give the Allies a deep water port. This required reducing support for the drives in the southern part of the French campaign, and Patton's Third Army was directed to go to the defensive. This decision would have no effect on the tail end of the fighting around the Bures area, but it did result in a more stable sector. The German high command had also changed its focus. "Wacht am Rhein," the huge offensive in the Ardennes, now occupied the time of the senior German commanders. The requirements for the massive undertaking resulted in the best units on the Western Front being pulled back and replaced. This reduction of forces was the final blow to any possible German drive in this area. The 3. And 15. Panzergrenadier Divisions were still in reasonably good shape, so they were relieved. All the staffs from 5. Panzerarmee, XXXVII Panzerkorps and LVIII Panzerkorps were also relieved, and replaced by the LXXXIX (99.) Armeekorps. During the final stages of the campaign, Bures was the town where the various German divisions passed through on their way to parts of the campaign area. These Panthers of 11. Panzer Division are seen here passing by a farm in Bures, part of the town that had not been destroyed by the U.S. fighter-bombers. Both vehicles are in the three-color camouflage scheme. (ECPA)

The campaign to turn the flank of Patton's Third Army had failed. The primary result had been the destruction of most of the armor reserves available to the Wehrmacht in the French sector of the Western Front. Well over 150 valuable tanks, many of them Panthers, were lost, and many more damaged. Von Rundstedt was forced to fight a defensive war on a broad front with a total of 500 tanks and assault guns. That the Americans may not have realized how large their victory had been did not reduce its effect on German fortunes. This is another photo of the two Panthers in the previous view. Although all appears calm in these two photos, other shots from the same roll indicate heavy air-to-ground activity only a few hundred yards from this position. At the end of the fighting, Panzerbrigade 111 was disbanded and its tanks and armored vehicles turned over to 11. Panzer Division. There were only 20 Panthers and 10 PzKpfw IVs left in the brigade to deliver to 11. Panzer Division. The men in the brigade were then assigned to other units or sent to replacement centers to be assigned to still other groups. Such was the end of many of the smaller German fighting units. Sometimes even Panzer and Panzergrenadier Divisions suffered the same fate, though most of these were rebuilt from other formations and retrained. For the men of Panzerbrigade 111, the Alsace-Lorraine campaign was the end of their unit. (ECPA)

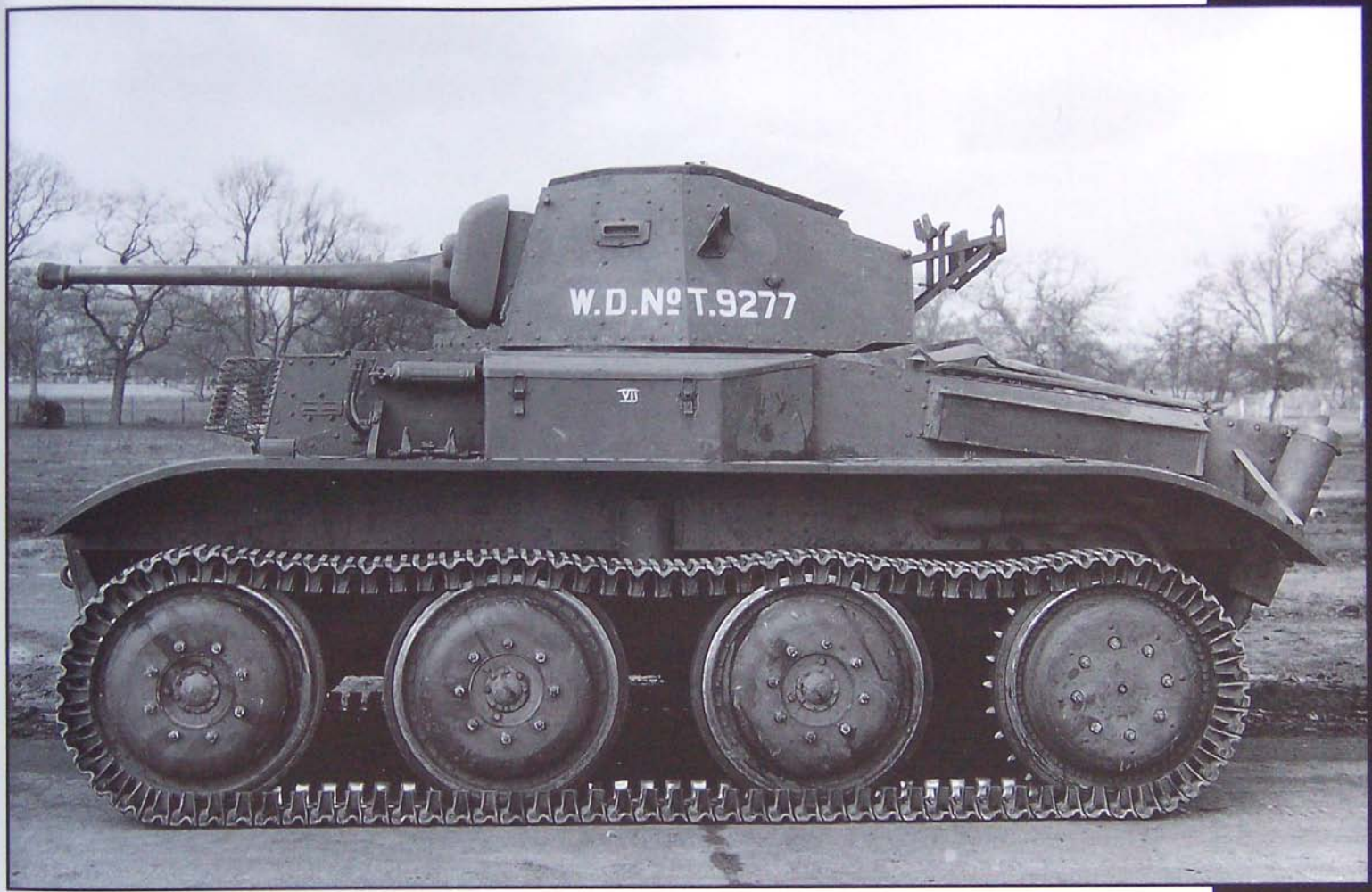
Tetrach: Airborne Tank

The stunning success of German airborne forces during the campaign in the West in 1940 provoked a desire by the Allies to field their own air-mobile units. This spawned more effort to support these troops with light-weight artillery pieces and, eventually, tanks.

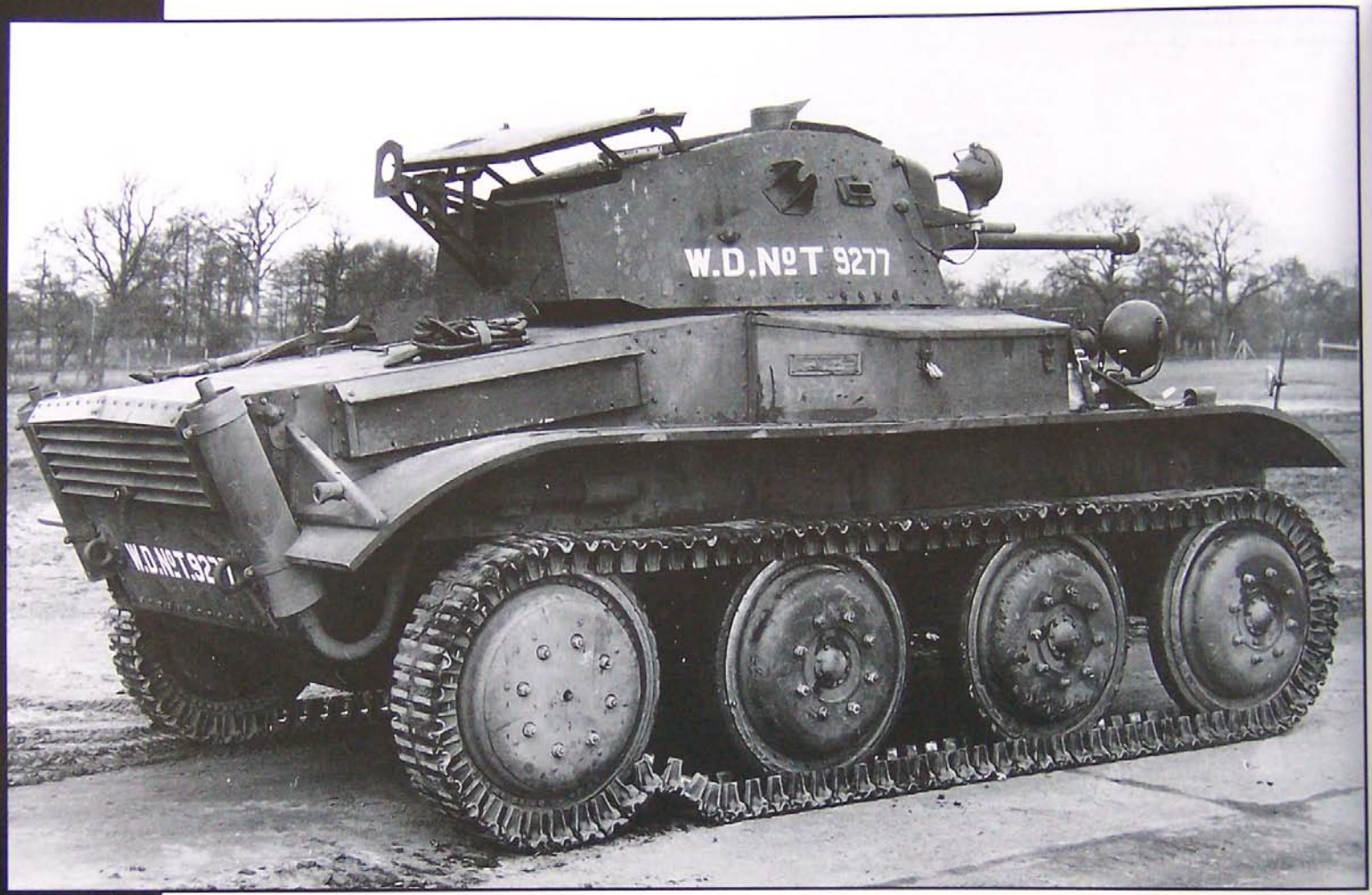
The Yanks and Brits weren't alone in this. The still photos and the movies of a Pz38(t) being loaded into a Messerschmidt "Gigant" are well-known. The focus of this article is on one of two tanks actually fielded in quantity. One was British and one American, but both were used by the British. These were the Tetrarch, a Vickers design; and the M22 Locust, built by Marmon-Herrington. The little Vickers was already being built (as a light or recon tank) when the need for an airborne tank became evident.

Just how effective could these vehicles have been? At the stage of the war when fielded, the two-pounder/37mm main guns were virtually useless against German armor; the newer German armored cars, like the Puma, could outrun and out shoot the little tanks. Apparently the airborne staffs acted on the supposition that any tank was better than none, especially in the hectic early hours of a parachute and glider-borne attack.

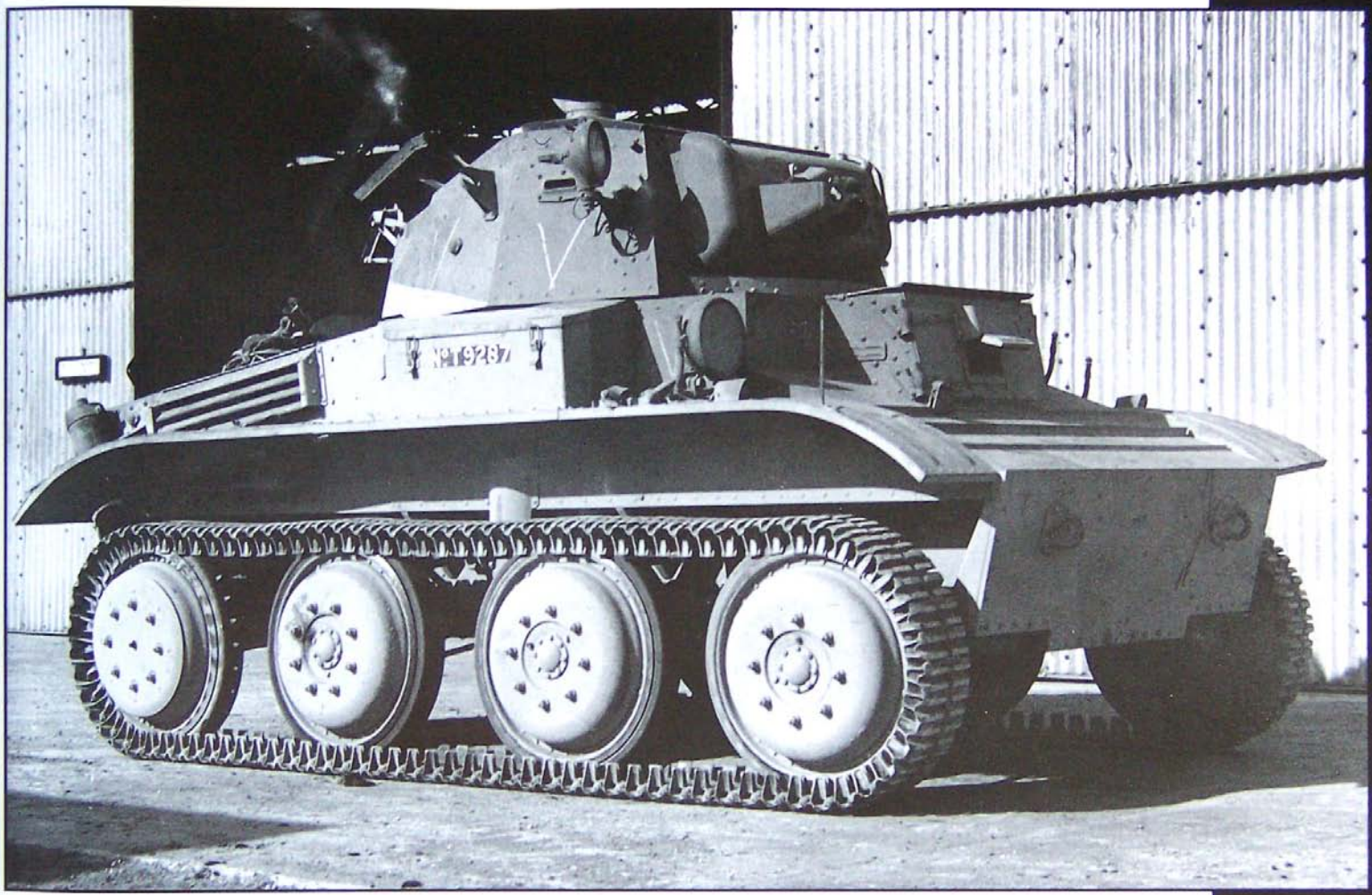
Tetrarch, originally called "Purdah," was a private venture by Vickers and was conceived in some secrecy. Comments made at the time include [Vickers is] "...most reluctant to sell this machine..." and "...manoeuvring (sic) for some hidden ends." The original armament was only a couple of machine guns (and the ubiquitous Boys antitank rifle), and it even came as a surprise when the tank was revealed to have been redesigned to take the two-pounder gun, then the main armament of all British tanks (some, designated "CS" for 'close support', got a 3 inch howitzer). **Above:** Any vehicle considered for service by the British army in the Second World War, even a Lend Lease item, was first extensively evaluated. Early on in this process, a series of photos was taken to assist in training and familiarizing the troops with the vehicle. The following photos are of the initial delivery of the Tetrach, and they all depict the same vehicle (IWM).



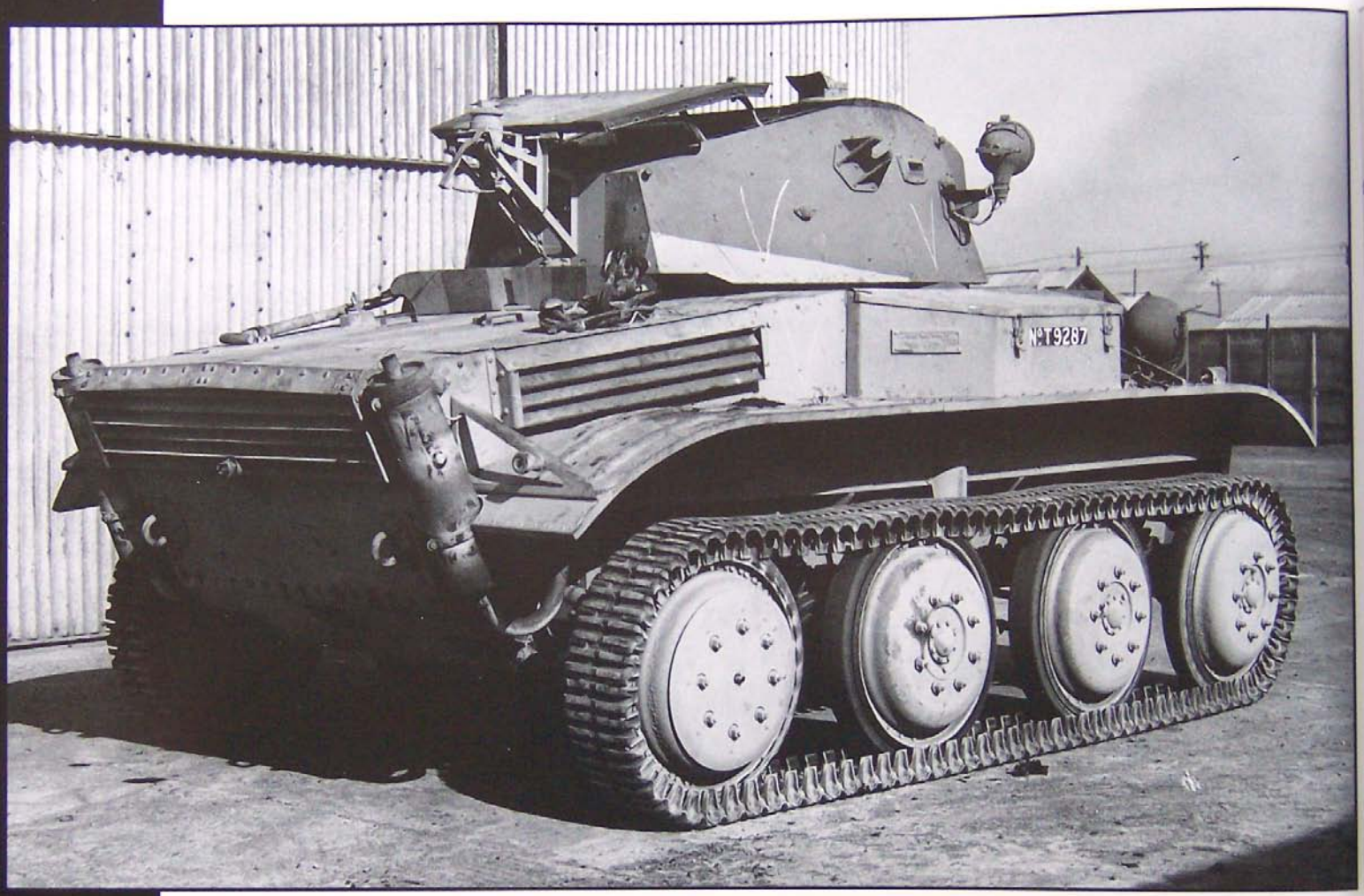
The Tetrarch broke new ground with its suspension, at least for British tanks. Four large road wheels carried the vehicle, and steering was accomplished by tilting and turning them, thus warping the tracks. Skid turns were only used in lower gears and at lower speeds. The wheels added to the side protection by virtue of their armored construction. Power was provided by a 165hp Meadows, giving the respectable road speed of 40mph. **Above:** 9277 again during evaluation. Interesting here is that the cooling vents on the engine deck sides are closed off, indicating very cool weather (the Tetrarch was refused for use in North Africa because of inadequate cooling). Also noteworthy is the screen guard applied to the driver's position (IWM).



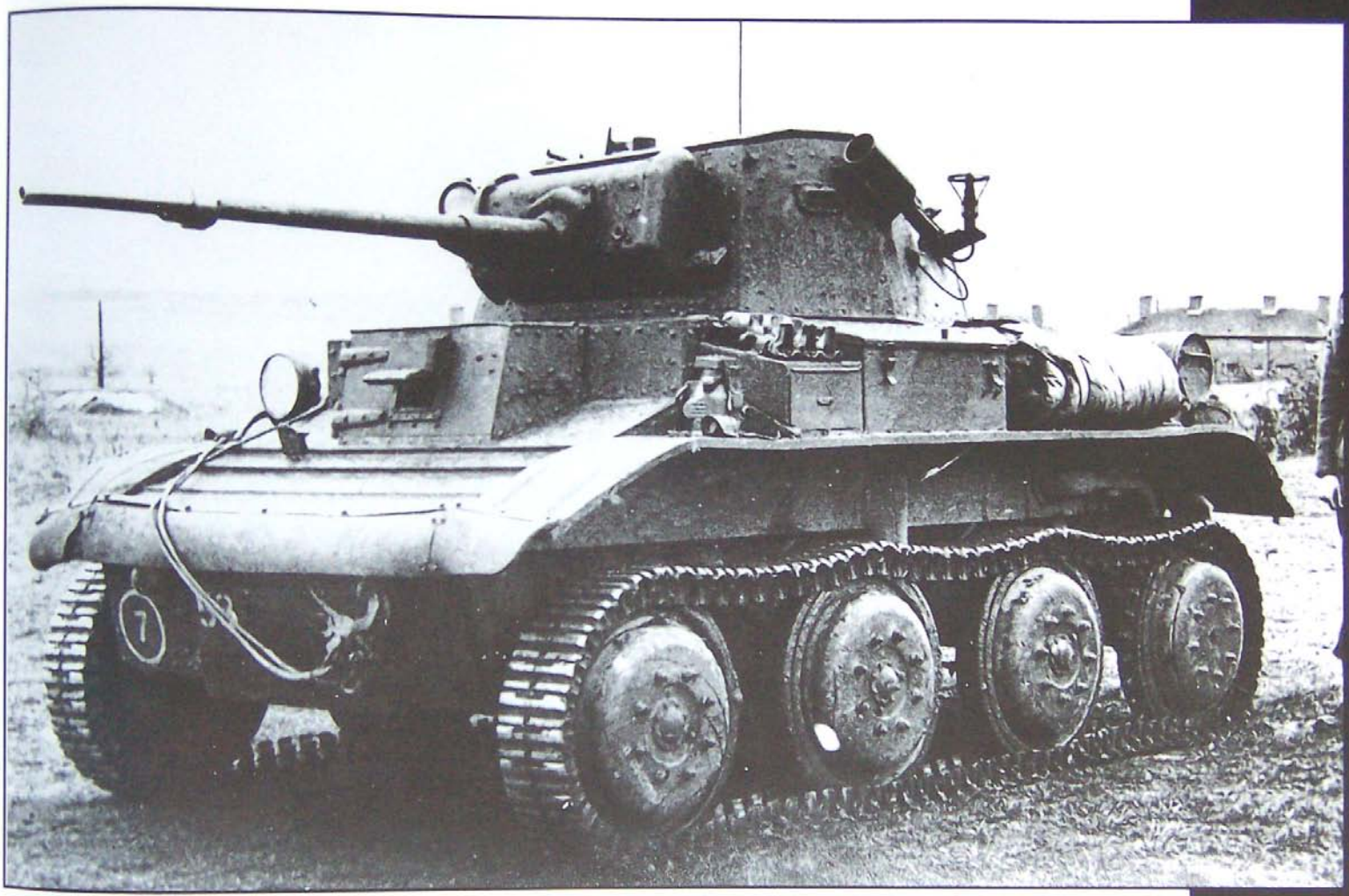
Sources vary on the number of Tetrachs built; some say 100, some 177. Regardless, they were used in action first on Madagascar. Some were provided to the Russians as lend-lease. There'd always been some uncertainty on the part of the armored staff on just how this AFV was to be used, and it dropped right into the airborne niche by virtue of its dimensions and weight (seven and a half tons). A large glider, the Hamilcar, a story unto itself, was designed just to haul it. **Above:** The third shot of the series. The vehicle's T-number carries the additional prefix of "W.D.," for War Department. Technically, this was to appear on all vehicles, but it is rare in service. This 3/4 view shows the Tetrach's unusual toothed roadwheel well. Also note the small all-weather cover for the gun. (IWM)



This and the following photo show the Tetrach during its evaluation at Bovington Camp. This Tetrach has not yet been fitted with armament. All exterior stowage is conspicuously absent. The vehicle appears to have the two-tone wedge type camouflage often seen on British tanks in North Africa. (IWM)

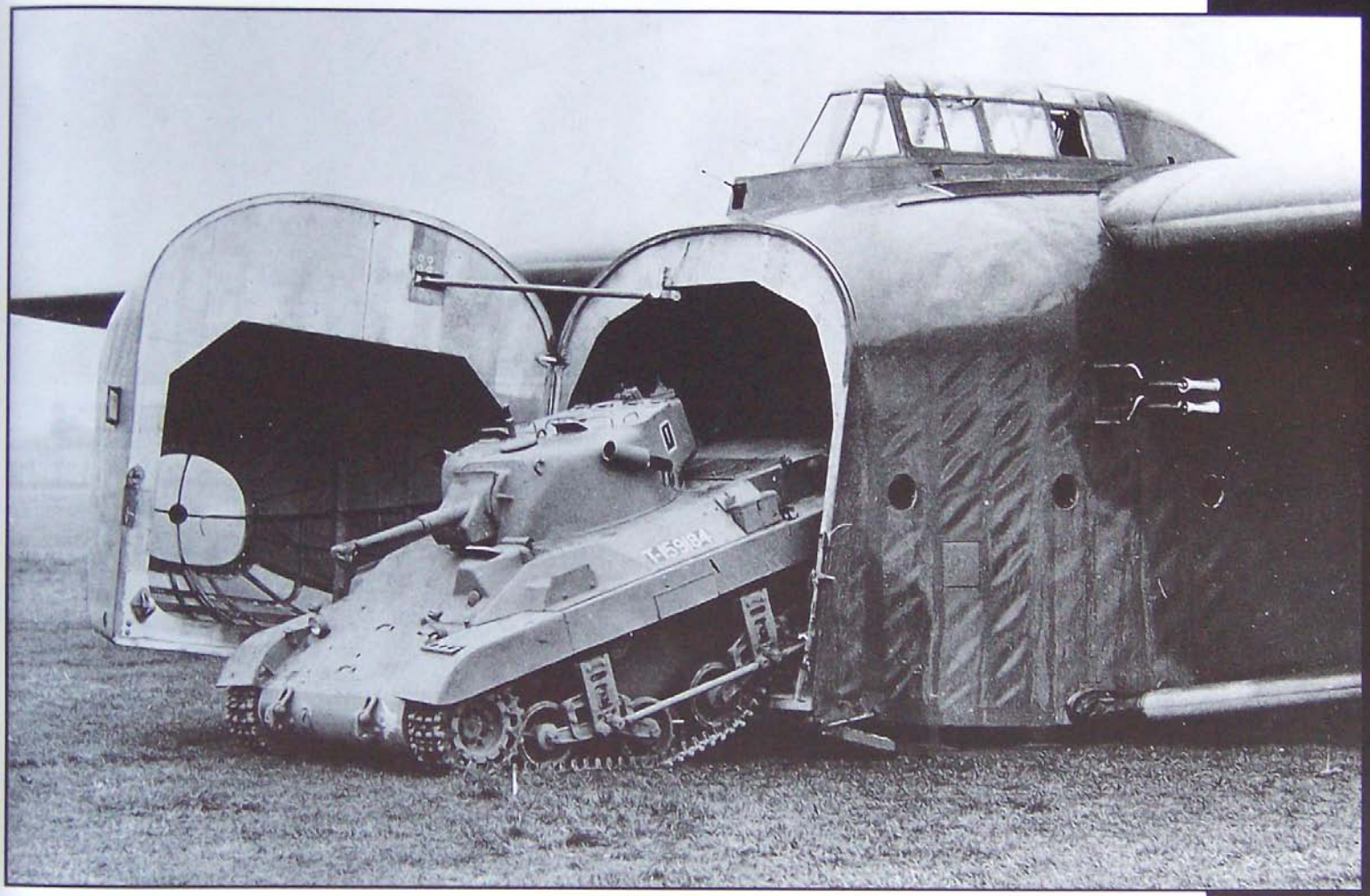


The same vehicle as the preceding photo. In this rear view the turret hatch is open and note that it raises up and then slides to the rear to rest on the back of the girder arrangement. Notice also the smoke launcher mount. The chalked "Vs" on the turret are a curious addition. Note the manufacturer's plaque on the right side stowage box. (IWM)

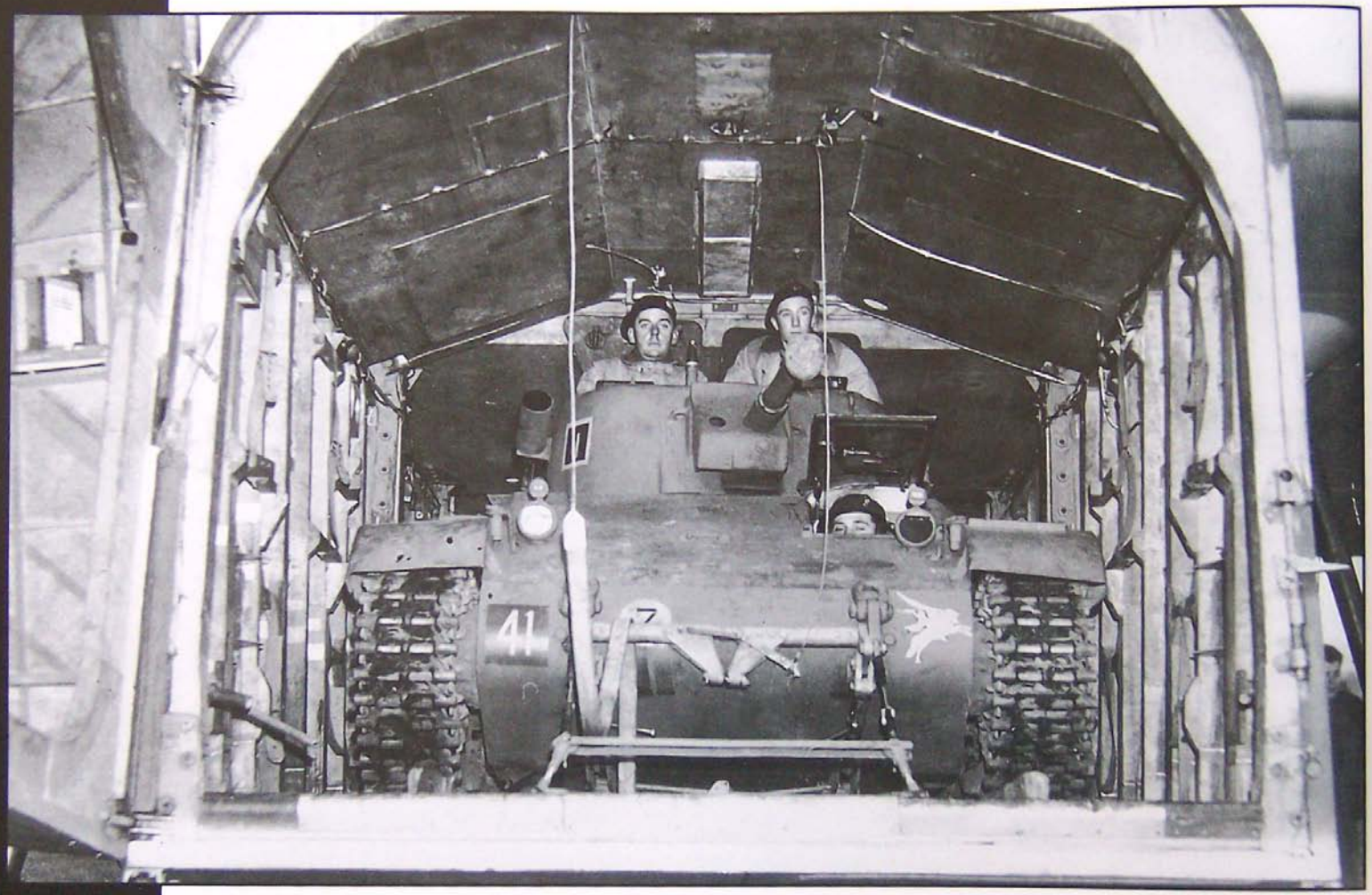


Vehicle 9333 fully stowed and ready for action. The equipment includes a Bren gun strapped on the turret. This tank is fitted with the Littlejohn squeeze bore attachment. Many Tetrachs were fitted this device, which increased the muzzle velocity of the anemic main gun to 4,000ft/sec. (IWM)

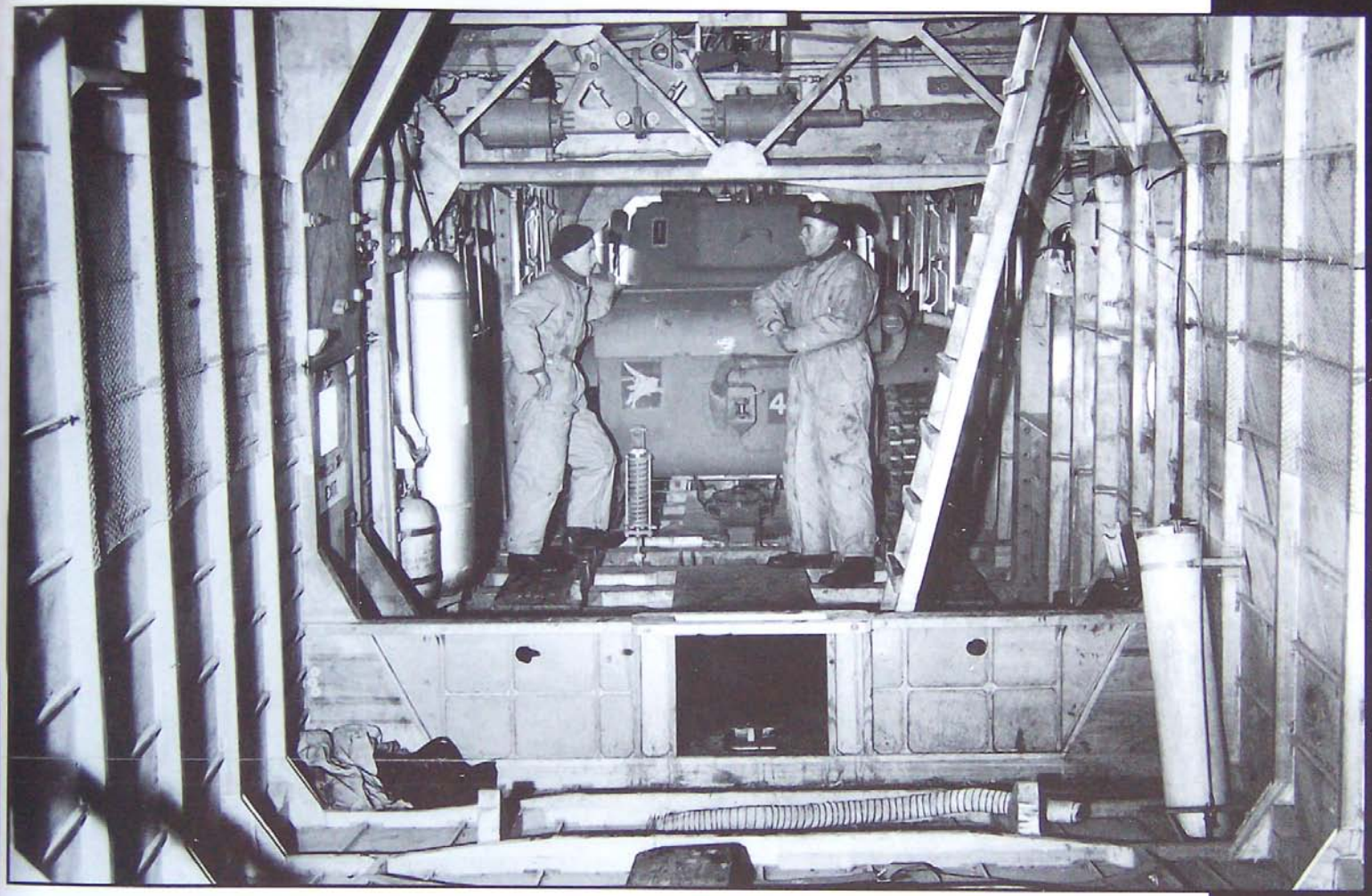
This photo and the preceding one could very well represent a portrait of a vehicle about to be loaded into its Hamilcar glider. The crew has already tied down its tarps, and the rear fuel tank and smoke launchers are fully rigged. The only airborne use of the Tetrach was in Normandy, when a squadron was deployed via Hamilcar. One of these tanks fell out of its glider on the way. Since the crew had to ride in the tank while in the air (there was no way to get in or out), they and their tank are still on the bottom of the Channel. (IWM)



By contrast to the Tetrach, the Locust was designed from the outset for the airborne role. Production of the Locust began at Marmon-Harrington as the M22 in April of 1943. Originally designated the T9, a soft-steel version, it evolved into the lightened and ballistically improved T9E1. Of the 830 tanks produced, 260 were supplied to the British under lend-lease. The suspension of the Locust bore a strong resemblance to the M3-M5 series of light tanks, utilizing the American favorite vertical volute suspension with a trailing idler. Armament was the standard M6 37mm gun with one 30cal. mounted coaxially. **Above:** A Locust debarks from a Hamilcar. The landing gear would "kneel" to lower the load floor, but notice that there's still quite a step down. This is a Brit Locust, fitted with grenade launchers and sand shields. (IWM)

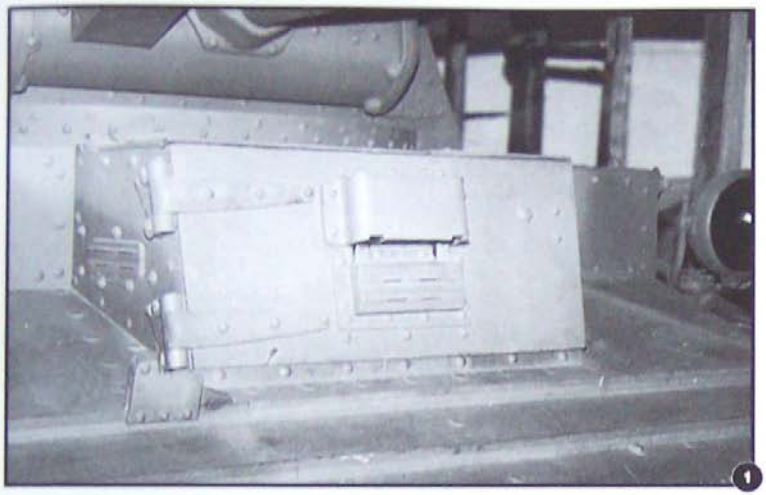


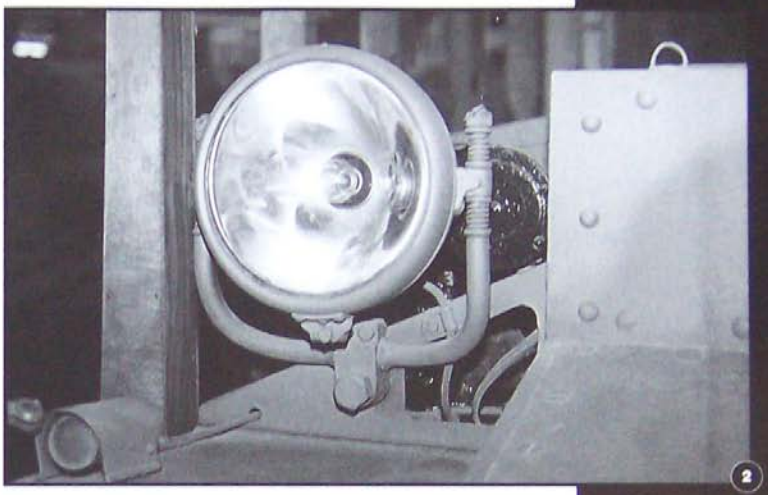
The Locust supplanted the Tetrarch in the airborne Rhine crossing on March 24, 1945. By this time the Tetrarch was long in the tooth and numbers (if only 100 were built) had reached the critical stage; the American tank was available in quantity. The Locust was powered by a flat six Lycoming aircraft engine offering 162 horsepower. This could drive the eight-ton tank at 35mph on roads. Strangely enough, almost nothing has survived in print about the Locust in action, just as nothing much was said about the Tetrarchs in Normandy. **Above:** Locust ensconced in the Hamilcar. The Pegasus sign of the British airborne can be seen on the bow. (IWM)

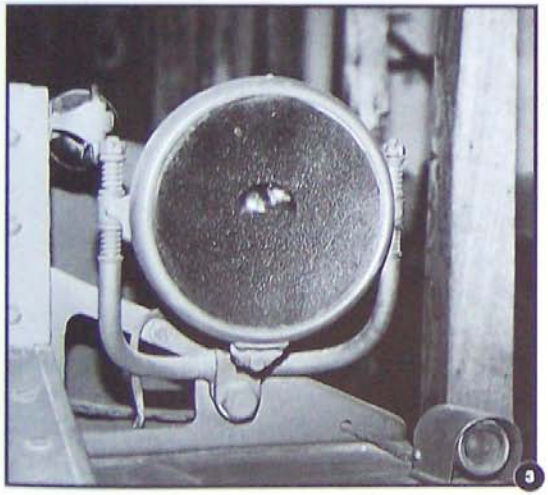


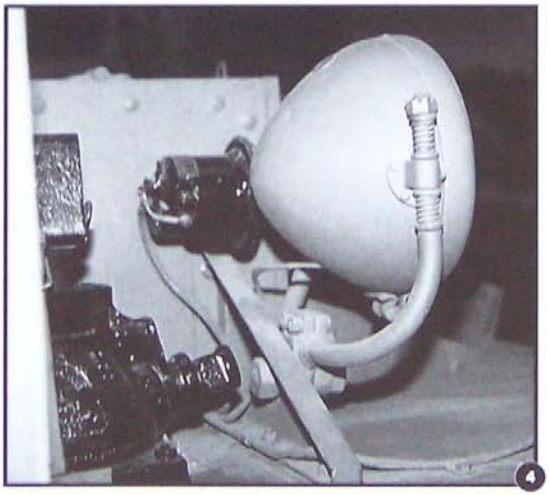
The aircraft proposed as the carrier for the T9, as the Locust was designated, was the C-54. The idea was to remove the turret and carry the hull slung under the belly of the plane. On landing at a suitable field the crew would disembark, unsling the tank, drive it up to the cargo door, and somehow manhandle the turret onto the vehicle. This is such a ludicrous idea that it is hard to imagine anybody going for it. The tank would of course fit the Hamilcar, and that is how it was finally used. It would also fit, fully assembled, in the C-82, the twin-boomed forerunner of the C-119 Flying Boxcar. **Above:** This and the previous photo show how the vehicle was secured in the glider. The Tetrach would have been secured in a similar fashion. Note the springs on the rear tie downs. The ladder in the foreground leads up to the flight deck. The Pegasus emblem of the British airborne forces is more clearly visible on the rear of the tank in this photo. (IWM)

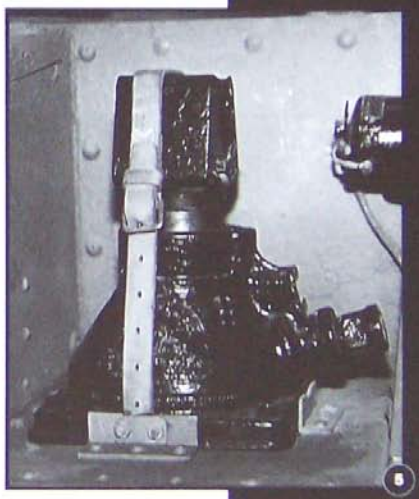
This very rare photo depicts a Hamilcar with a loaded Tetrarch. This photo was taken April of 1944, while General Montgomery was visiting the 12th Yorkshire and 13th Lancs of the Para Regiment at Bulford camp. Very few pictures of the Tetrach in combat exist and even fewer are known to exist of the vehicle in Normandy. This photo is especially interesting in that this is most likely the way the Tetrach appeared upon landing in France. (IWM)



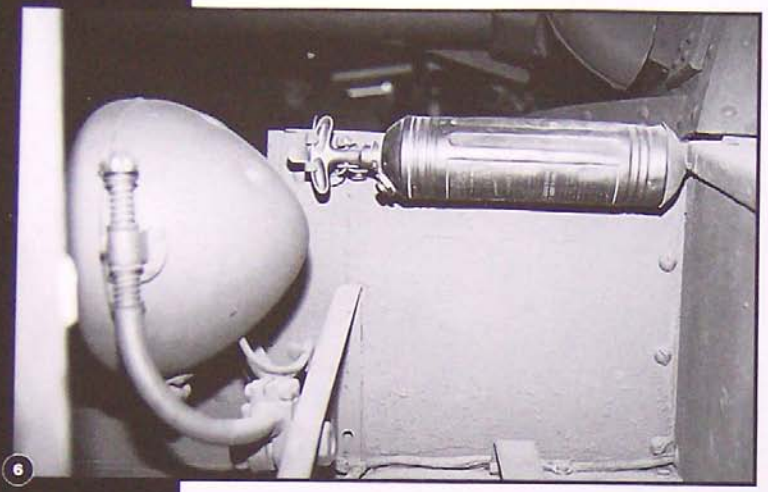


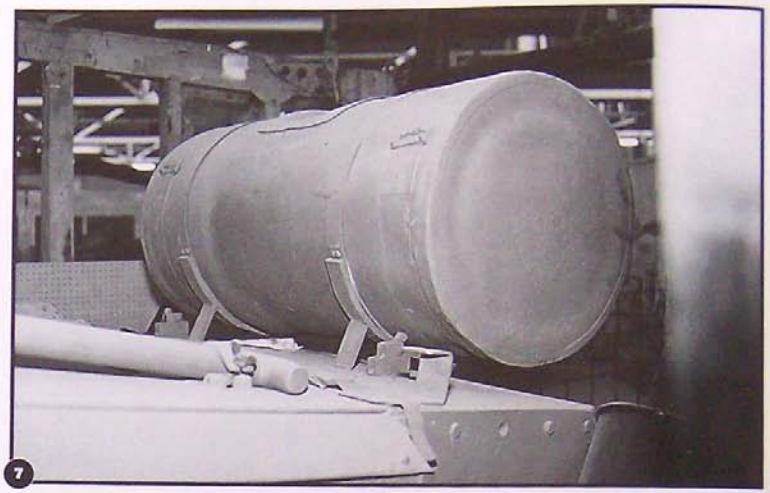


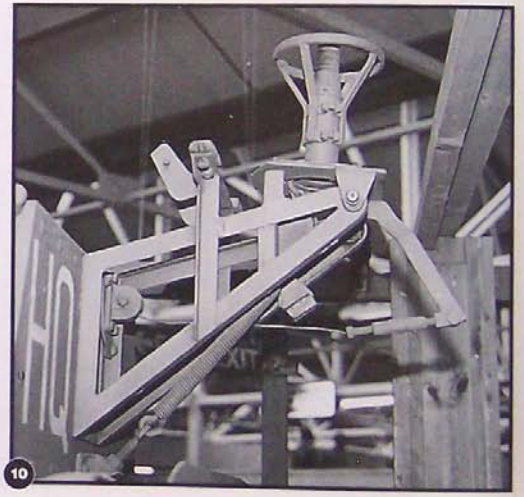




The following photos are close-up views of the Tetrach currently preserved at the Tank Museum at Bovington Camp. It is a fine example that is pristine in most respects. **1)** Driver's head cover on the Tetrarch. The large hinges and the bullet splash strips on the hull are evident. Contrast the ballistic qualities (or lack thereof) with the Locust. **2)** Right side headlight of a Tetrarch. This was bolted to the front fender bracket. Also visible is the small night time running "convoy" light. Notice that while the front plate of the tank is riveted, the glacis seems to be secured with screws. **3)** A blackout light on the left side. It appears that most vehicles did not carry a light on this side and this may be a museum addition as the "blackout" portion of the light is simply paint. **4)** A more rearward view of the right side light detail, showing the attachment point and the wiring for the light and the convoy light. The horn is the black cylindrical object. **5)** An excellent view of the Tetrarch's jack and its mount.







6) This is the left side light detail, showing the fire extinguisher and its mount. Typically, the extinguisher is unpainted brass. **7)** The diminutive size of the Tetrarch (and the Locust) made an auxiliary fuel tank a necessity. These could be jettisoned. **8)** The spotlight mount on the Tetrarch's turret. **9)** The smoke grenade launcher on the Tetrarch turret. These were made using the breech of the Enfield rifle and indeed the opening for the magazine in front of the trigger guard is still there. **10)** Antenna mount on the rear of the Tetrarch turret. The involved and elaborate arrangement of girders is the hatch rest.

Sherman Flail

Mines have been used by the armies of the world for over two hundred years. The original purpose of a mine was and is to inflict fatal and catastrophic damage to a soldier or vehicle. In twentieth century warfare, as the use and location of mines and minefields became more well known, the mine has also acted as a way to direct and ensnare quick moving bodies of men and vehicles. By placing large mine-fields in the path of the enemy's advance, the defender could direct his opponent into well-placed fields of fire. Even if the mines could be detected, the delay caused was still of benefit.

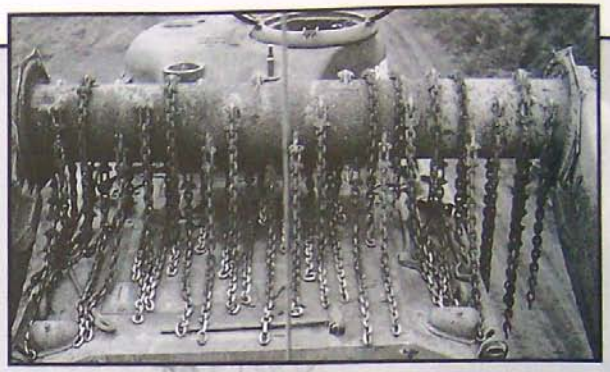
German anti-tank mine technology was well-developed at the outset of the second world war. Given the defensive nature of German military strategy in the latter half of the war, they were the largest user of the land mine, sowing millions throughout Russia, North Africa, Italy and Northwest Europe.

The primary German anti-tank mine was the Tellermine, which was manufactured in several variants. All were relatively simple disk-like devices, measuring between eight and 12 inches in width and only a few inches in depth. Built of thin metal casings, they were equipped with handles, and were quickly and easily set-up by an infantryman.

Standard detection technique was to use a magnetic detector or bayonet probe to locate the mine, then remove it by digging—an extremely laborious and time-consuming process. However, the Tellermine 42 and 43 were both equipped with anti-lifting devices, which automatically detonated them if there was any attempt to remove them.

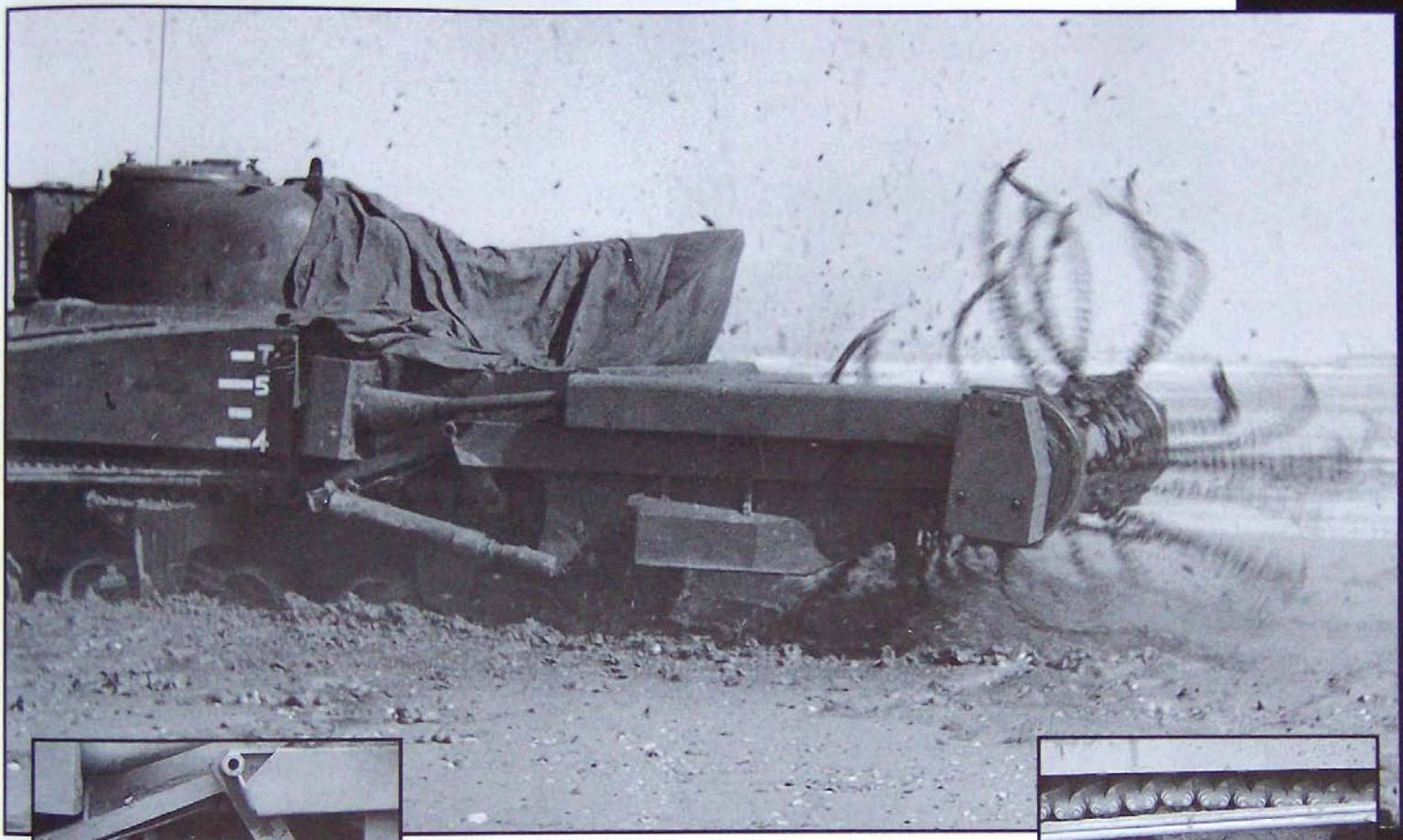
As magnetic detection became more prevalent, the Germans even developed non-metallic mines, such as the Panzerschellminen, which was a large box-like mine made of wood. Late in the war, the Topfmine or ToMi, became quite prevalent. It was completely non-metallic, with a body made from plastic.

It became clear to Allied planners that the most efficient way to clear a mine field was to simply detonate as many mines as possible. Since a minefield uncovered by fire is more of a nuisance than obstacle, a way to clear mines under armor was a priority. The wide-open spaces of North Africa lead to an ever-increasing use of mines and a South African engineer officer on duty there, Major A.S.J. Du Toit, was responsible for developing the most effective means of clearing mines by use of an AFV. **Above:** The Crab concept was tested extensively in England prior to its deployment. At the time of its development, the Crab was considered Top Secret. The vehicle depicted in this photo and the next is a Crab I and it was among the first produced. It carries the first style of chain, which was very simple conventional heavy-duty towing chain. This type of chain was very unstable. The ordinary chain strands had a tendency to sway from side to side. They would strike each other and the rotor, and often become entangled. More importantly for the success of the vehicle, the sway created large gaps in the clearing path. The jagged circles on the ends of the rotor were designed to sever and clear wire obstacles.

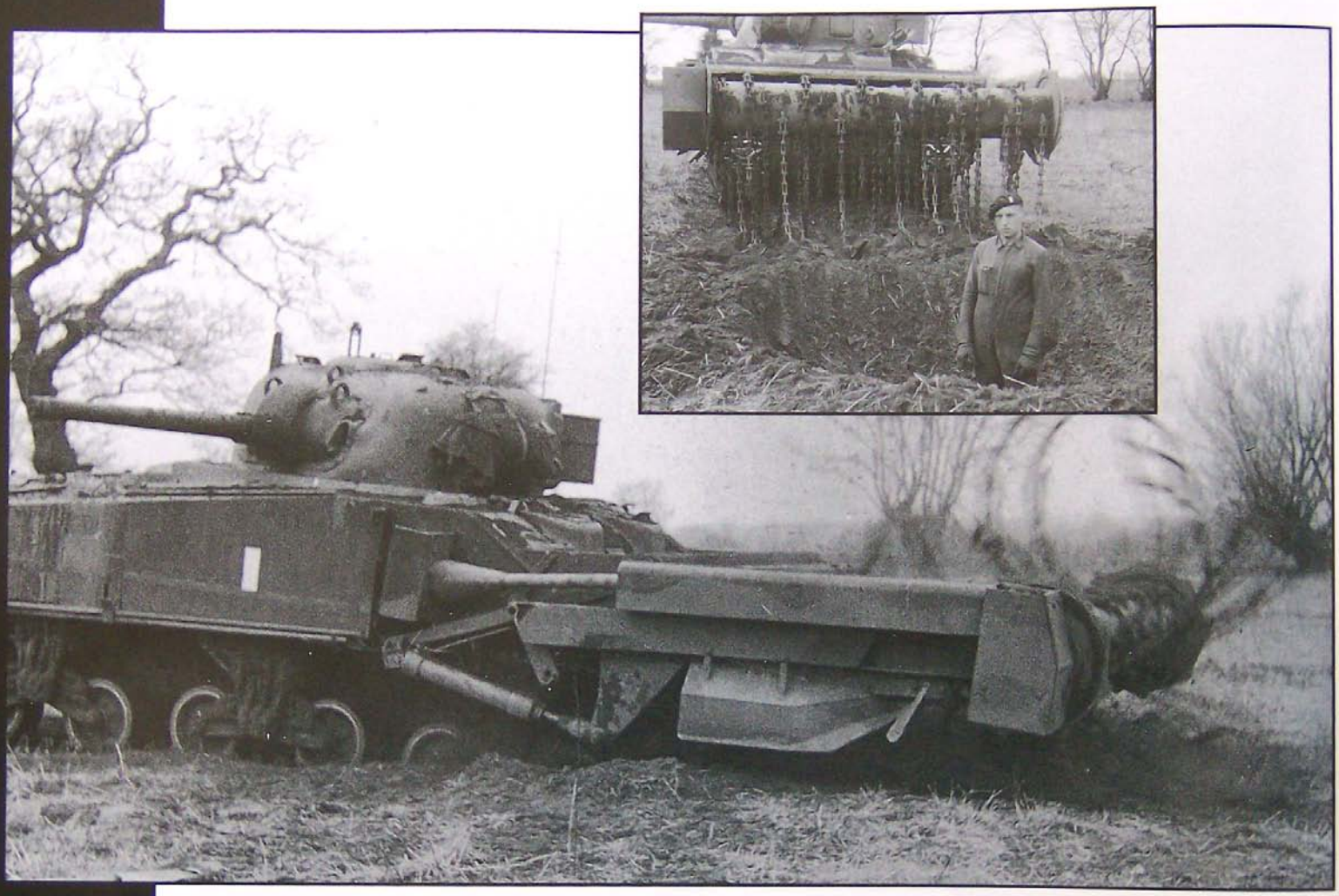


Inset: This Crab has been driven up to another M4A4 until the rotor covers the engine. This would allow easy access to the chains. This again shows the early chains and their mounting points.

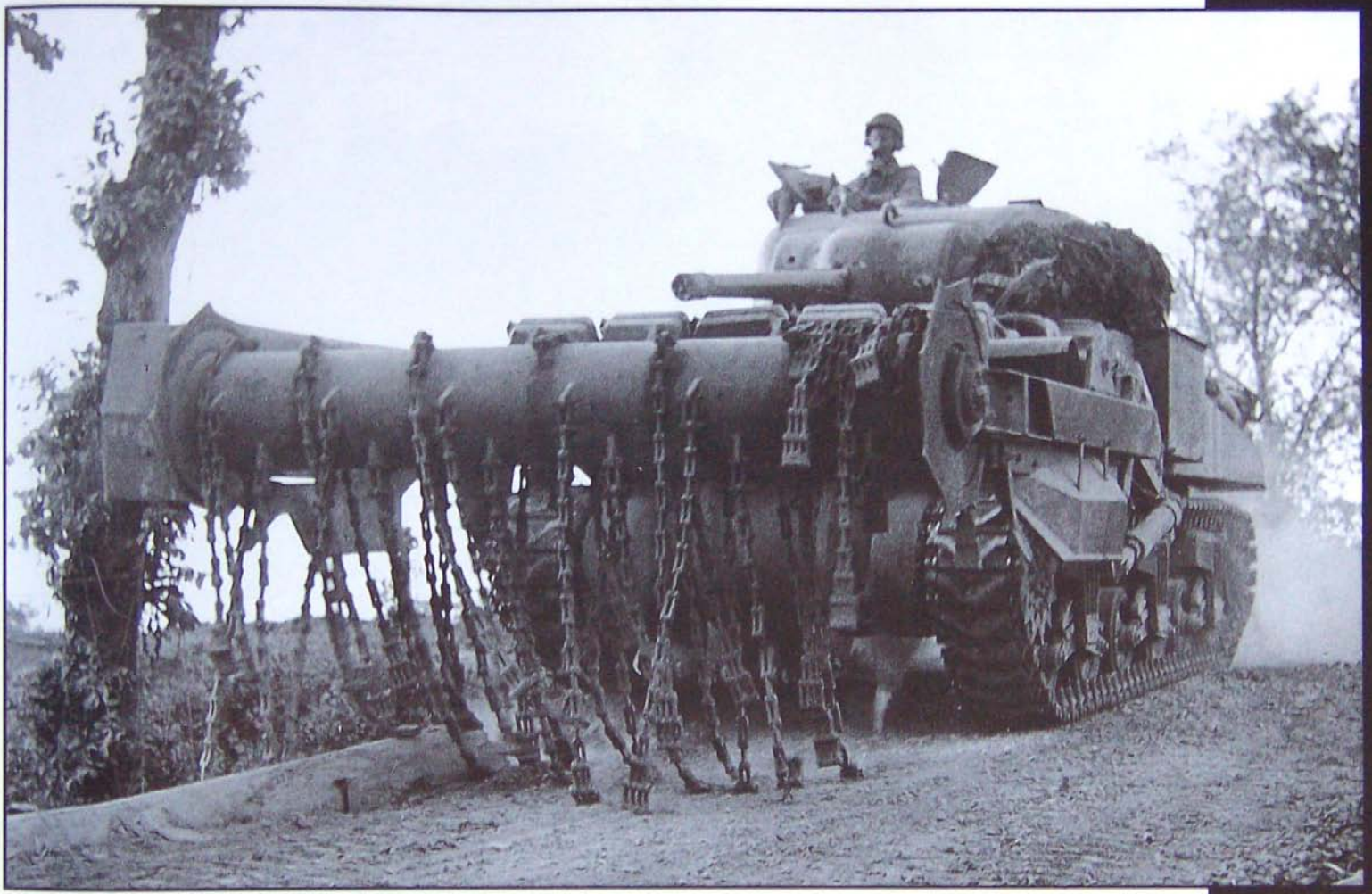
Major Du Toit's initial designs resulted in the Matilda Scorpion or flail. A flail consisted of two arms extending ahead of the tank with a roller between them; the roller had lengths of chain attached to it. Driven by an auxiliary engine, the roller would rotate and the chains would beat the earth ahead of the vehicle, thus exploding mines in the path of the tank. Matildas were the early vehicles of choice for this task, perhaps because of their heavy armor. Because the flail engine was hung on the side of the vehicle, they were quite wide, not a consideration in Africa where bridging was relatively unknown, but a very real factor in planning for the invasion of Europe to come. **Above:** The right side of the early Crab I. A power takeoff from the transmission was devised, which drove the flail drum through a chain drive to a gear-box at the right of the rotor at around 285 horsepower and at about 142 rpm. This shows the drive shaft as it emanates from the side hull. The drive transfer case on this example appears to only be partially armored. Later models had a complete box made of armored plate surrounding the transfer joint. Note the hole in the bracket just above the hydraulic arm. This hole lined up with a fitting on the side of the tank and when the rotor assembly was raised, it supported it during road travel. The device on the turret (here, trained towards the rear) was an early attempt at a station keeping light.



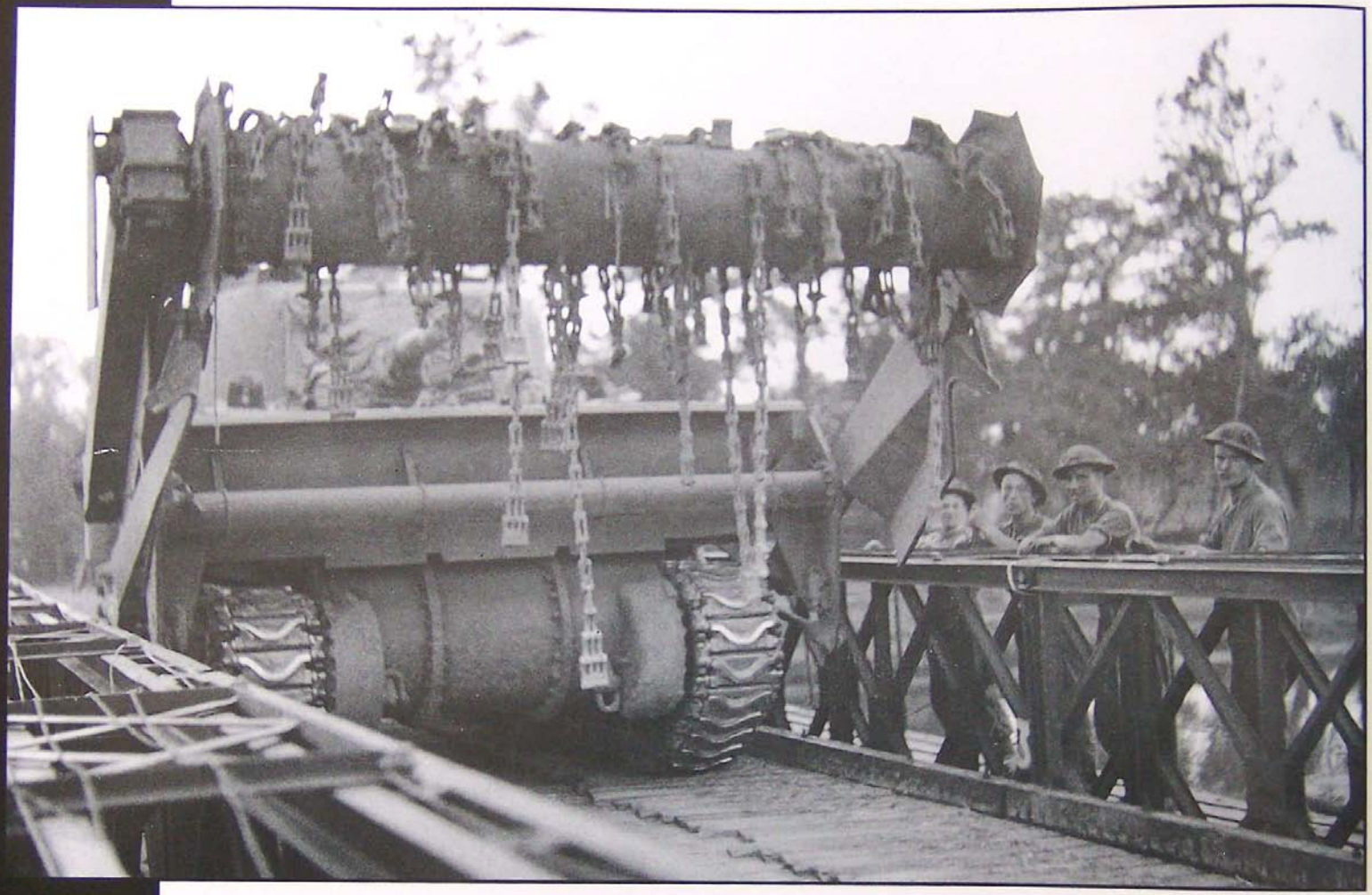
Another early Crab in action, this time during testing on the beaches near Norfolk, England. From the lack of dust it's obvious the ground is damp. Instead of a fitted mantlet cover, this tank just has a tarp draped over the front of the turret and the main gun. Notice the rocks being flung into the air. Using the Crab on sand was generally frowned upon as the resulting shallow trench dug by the flail sometimes became an obstacle itself. It must have been difficult for the driver to see and the crew is no doubt navigating by the compass provided. This vehicle has a fully armored transmission joint. **Insets:** Due to its importance in the upcoming invasion, it was eventually necessary to conduct live testing of the flail. British MkIV and MkV anti-tank mines were used for this, but a fair number of captured Tellermines were also utilized, creating a highly realistic testing scenario. Here, it appears as though the flail was traveling too fast. The mine detonated after the rotor passed over it, resulting in damage to the track and running gear of the Sherman. The outside teeth of the drive sprocket have been blown off. The original caption does not state whether the mine was a British or German type.



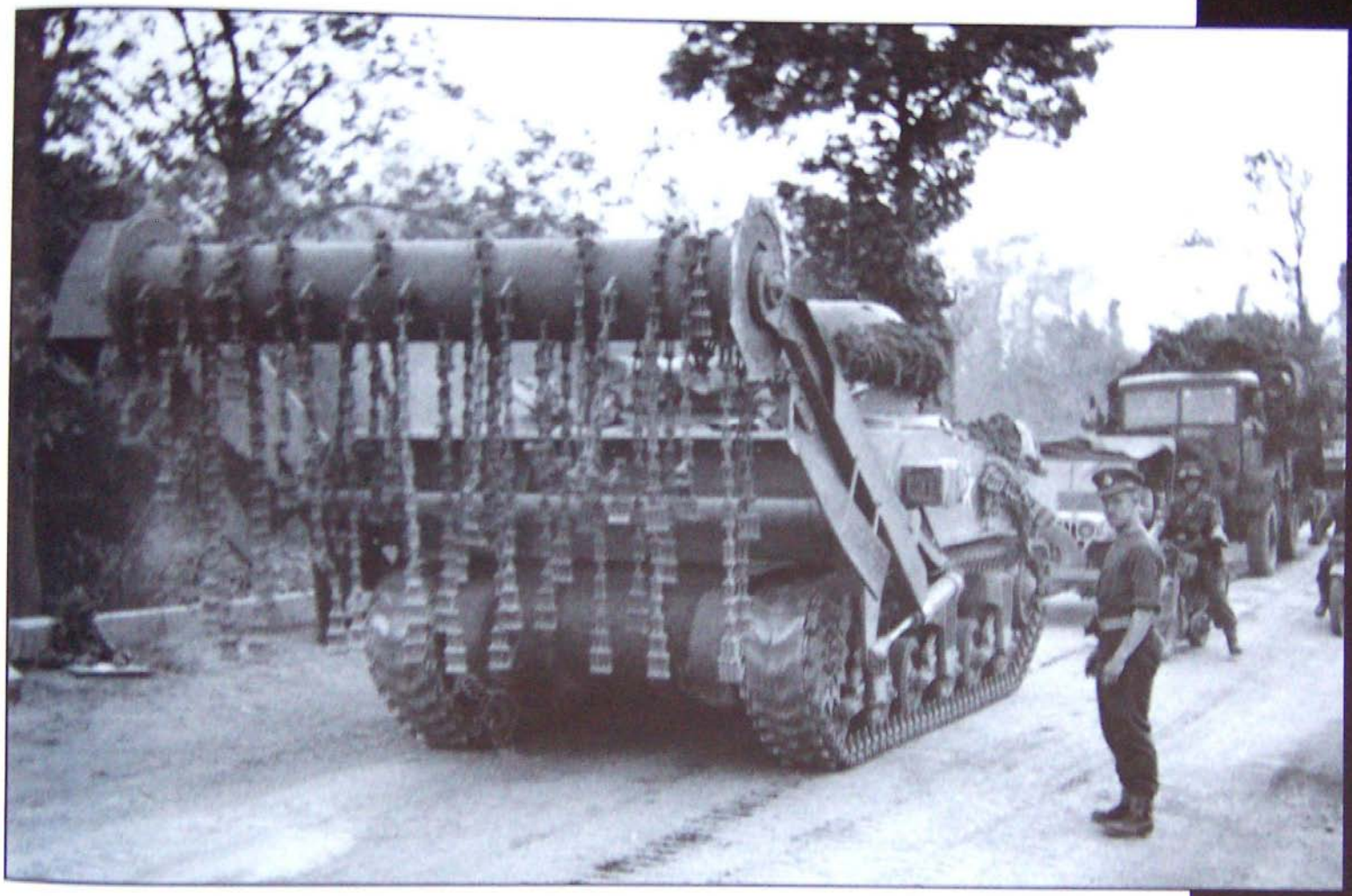
The Sherman was adapted to the flail task by virtue of its availability in numbers and its abundance of power. The type selected was the M4A4, known as the Sherman V in British service. This selection may have been due to the tank's slightly higher power-to-weight ratio. The vehicle was officially called "Crab" by the British, but "Sherman Flail" or simply "Flail tank" are both common terms. The M4A4s used as Crabs were typically the welded hull dry remanufactured type. Most, but not all, had the distinctive 3-piece nose. **Above:** Flailing away; this test involved actual captured German Tellermines. The amount of surface material disrupted by the flail is evident here and the tank appears to be moving into a shallow trench as it moves along the clearing path. This continued to be a major problem with the flail throughout its use. The crater created in the inset photo was the result of 2 Tellermines stacked on top of one another. This was a common practice, as it could result in the complete destruction of a tank, rather than just damage to the tank's running gear. The figure in the hole gives some idea of its size. This photo also clearly shows what would become the standard flail chain.



A small number of Crabs were supplied to American troops and British units were also temporarily attached specifically for mine clearing. Since Crabs were built on the long wheel-base M4A4, these were probably the only Chrysler-engined Shermans used by U.S. troops, besides the few in Southeast Asia. A few American built flails, reverting to the auxiliary engine idea and called T3, were used in the Italian campaign, but they were not a success. **Above:** Taken on July 18, 1944, this photo shows a Crab closing up to the Orne bridges to outflank Caen. Of interest here are the details of the rotor. The flail chains and their individual bolted heavy pieces of metal, getting thicker at the business end, can be seen clearly. The serrated plates at the outer edge of the rotor are also evident. This vehicle is the classic rebuilt welded hull M4A4 with a three-piece transmission housing. It is not fitted with the protective canvas cover for the mantlet, but it does have the small canvas muzzle cover. The crew has stowed extra roadwheels among the rotor arms and oddly, have also stowed four jerrycans on the backside of the rotor. Perhaps the most interesting thing about this photo is that the tank appears to be about to drive off the road!



Troops look on as a Crab passes over a Bailey bridge built over the Orne river and Caen canal. The rotor has been raised to its limit to allow the driver to see. Obviously there's not a lot of room on a Bailey bridge for the wide Crab, as the driver appears to be peering over the rotor. An alternate rotor assembly composed of spaced, open disks was developed to alleviate this problem. Called the Lobster Crab, it was not fielded due to the success of the Crab I and II. This photo affords a good view of the large link ends, which were made up of three and four links each. Again, the tank uses the three-piece transmission housing and this time is outfitted with a full canvas cover for the mantlet. This was a crucial piece of gear given the amount of dirt and debris thrown up by the flail. Like so many British Shermans, this tank uses the T54E2 steel-block tracks.

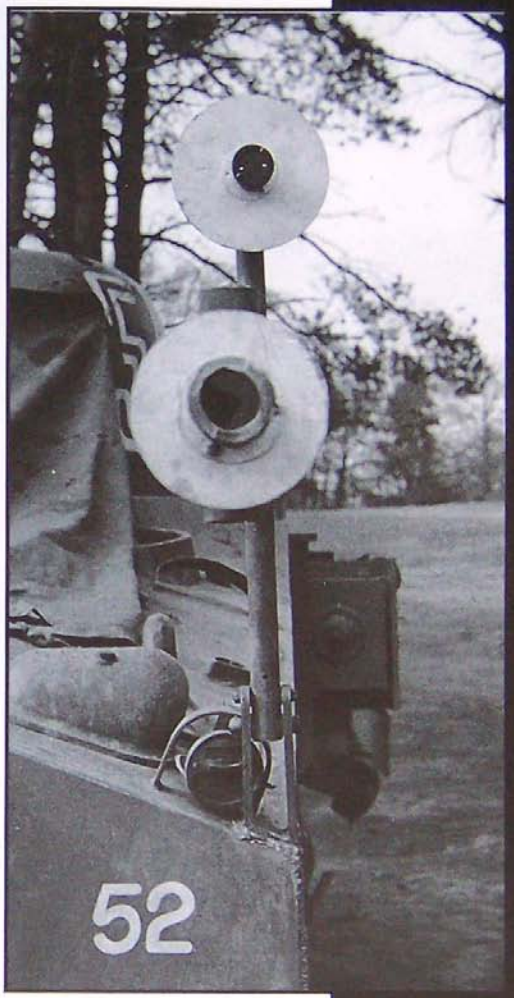


Another Crab on the move, followed by Jeeps and other vehicles. This photo is another from a series taken on July 16, 1944 and it shows troops moving over the old swing bridge at Benouville, about halfway between Caen and the Sword beach head in Normandy. It carries extra lengths of chain on the rear side hull, a detial not seen on test vehicles. Due to the weight restrictions and the large size of the Crab they were only allowed to cross bridges alone and only with the guidance of a crew member. The MP in the foreground has just given the go ahead. Check out the Tommy in the foxhole to the left of the tank.

A Crab of the 79th Armoured Division, as shown by the distinctive division sign on the rear hull, is approaching the ruined church of Escoville, France. Dated July 19, 1944, this photo was taken not far from the famous "Pegasus Bridge," sight of the well-known British glider landings just prior to D-Day. This Crab has the typical British stowage bin on the hull and turret rear. Spare chains are more neatly stowed on the hull side between the arms at the front and station keeping boxes at the rear. The large slanted bins on each side of the rear hull dropped what were described as "lighted pegs" to delineate the cleared path. The large station keeping light arms on the rear hull have been folded down for travel.

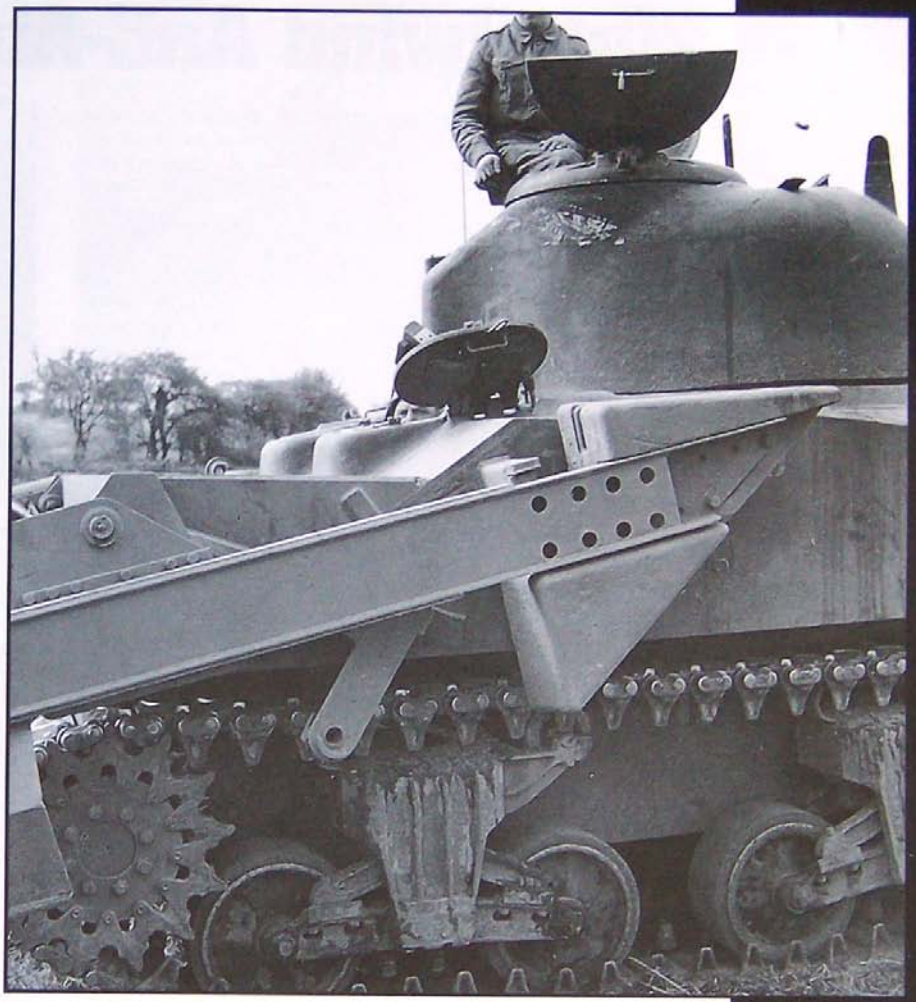
A line of Crabs, perhaps halted for 'char' as Shermans, Flails and a multitude of other vehicles pour out of Escoville. Note the welded attachments to the Hull front to facilitate the rotor mounting. Although it's rarely seen in photgraphs, for long road marches where little clearing was expected, the rotors were often wrapped in canvas sheeting. All the vehicles here appear to have names in red block letters, all of which have been neatly drop shadowed in white. The nearest vehicle contains the name 'CRAIGMILLAR'.

In early August, following a heavy raid by big bombers on the hinge of the German line south of Caen, tanks and artillery were moved forward for a renewed attack. Here a Crab crosses a Bailey bridge constructed over the River Orne within the town of Vaucelles, south of Caen. The whole crew, less the driver, is riding outside. Obviously there aren't many Germans in evidence. The vehicle again carries the full protective canvas cover for the mantlet and a particularly neat arrangement has been made for the spare flail chains on the left side of the hull. It's interesting that the tank is traveling with the rotor chains dragging on the road bed.



Two views of the station keeping lights on the back deck of a Crab I. These were designed to allow other vehicles to follow the Crab while it was clearing mines. The theory was that the lights, shining against a white disk, would still be visible within the cloud of dust and debris created by the action of the rotor. The light arms were hinged and could be collapsed for travel. This vehicle has been fitted with the so-called "Normandy Shroud" on the hull rear. This was a ventilation device fitted to British Cromwell tanks. The purpose for installing it on the back of the Sherman is a mystery, as the engine vents on the M4A4 are located beneath the large rear armored overhang. Perhaps it was simply used to provide extra weatherproofing for the rear stowage box. This photo provides a good view of the moveable mechanism used for attaching a towing clevis mount installed vertically across the left-side engine-access door. The clevis is not installed here, but compare it with the Crab on page 74.

Two different views of unit-made shields installed over the driver's periscope. This was, undoubtedly, to prevent it from being buried under the detritus of the rotor's operation. The left-hand tank is a well-worn vehicle, as evidenced by the tattered condition of the canvas mantlet cover. The right hand photo shows the various fittings welded on the hull of the left side of a Crab to support the flail arms. Obviously, it was no light-weight arrangement. A pin stowed on the beam just behind the pivot point was inserted into the large hole seen in the bracket to support the flail during travel. Both these photos afford excellent close-up views of the front hull details of a typical remanufactured M4A4, such as the driver's hood, the distinctive hatch spring and the various weld seams. The support racks seen on the left-hand tank are typical of British Shermans and are used to store spare track blocks.



Left: An excellent close-up of the flail chains. The chains are secured with 2 flat pieces of steel. These, in turn, are secured to the rotor with bolts and locking nuts. This made it quite easy to replace broken or damaged chains. The chain links are composed of rounded end flat steel stock, alternating one, then two links. The links are permanently secured with steel rivets. Hanging just behind the rotor, one of the widened end links can be seen. These were composed of four links across to widen the contact area of the chain. **Right:** Two marks of the Crab were developed. The first, seen in all the previous photos, had hydraulic rams on each arm so that the arms could be raised for transit. The arms were lowered to horizontal for flailing. The problem with this was that when lowered, the arms were fixed at the horizontal, the rotor could not follow uneven terrain. In the Mark II (or just "Crab II"), the left ram was replaced by a weight and the arms were allowed to float at a consistent height of 4 feet 3 inches, thus allowing the rotor to more closely follow rolling terrain and clearing a more consistent path. Although photos of the Mark I are more common, both were fielded in Europe.

Wirbelwind Anti-Aircraft Tank

The history of German AA tanks is closely linked to the person of Count von Seherr-Thoss. He not only developed and produced the Wirbelwind and Ostwind, plus a variety of sophisticated prototypes, he also designed the first field-serviceable belt-fed German Anti-Aircraft gun, the 3 cm MK 103/38. He helped with this story and other valuable information. This essay is dedicated to him.

As with other fields of military technology, Germany was a leader in the development and production of anti-aircraft tanks. Calibers from 2 cm up to the famous 8,8 cm Flak were mounted on a variety of half tracked or fully tracked vehicles. It is obvious that Germany was forced to do this development, as from early 1943, the strategic initiative was lost to the Western and Eastern opponents. The Luftwaffe was no longer an offensive instrument in either strategical or even tactical respects. Defense of the industrial facilities within Germany itself was regarded as more essential.

The front-line units had only limited anti-aircraft protection. Every formation had AA platoons and these were equipped with only towed light weapons of 2 cm and 3,7 cm caliber suited only for static defense of air fields, etc.

Conventional armored divisions are very vulnerable against air strikes. Not only the tanks themselves, but also the train carrying food, ammo and especially fuel. This fact was already shown during the seizure of Poland and France, where German Stukas performed their work almost unharmed by enemy aircraft. Leading German military planners, among them General Guderian, created new standards for entirely efficient armored units in 1943, requiring not only tanks and armored artillery, but also armored anti-aircraft weapons on fully tracked vehicles. This more reasonable view resulted from the military realities of 1943. The last months of the Afrika Korps were overshadowed by heavy air raids. The allied combined services operations were highly successful and they were improved and carried on in Southern Italy. A significant example of this development was the annihilation of the "Hitlerjugend" division in the summer of 1944 by air raids.

One of the three field modified Pzkw IV of SS Pz.Rgt. 12, seen in France 1944. Photo Buchner.

Alarmed by growing tank losses, the Panzertruppe under General Guderian, commissioned In 6 (Inspektion 6) to create a task force responsible for development and production of AA tanks. Early solutions manufactured by Krupp and Alkett in 1943/44 were simple combinations of Pzkw IV hulls with 2 cm quadruple guns (with only a few built) or with the 3,7 cm Flak 43. These vehicles called "Möbelwagen" (furniture truck) could be called self-propelled

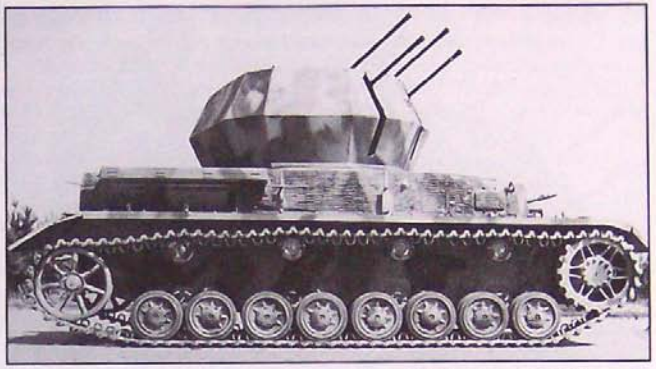
Above and below: The large assembly hall of Ostbau in Sagan. More than 10 Wirbelwind in various stages of production wait for completion. It is evident that different versions of the Pzkw IV were used. In the foreground of the lower photo, two late Ausf. H can be seen; the hulls farther in the back are possibly Ausf G or early H. Note that early style drive sprockets were used. The empty brackets for the side skirts are visible, too. The hull with the number 4015 is already fitted with a turret. The typical Ostbau camouflage was also applied. The 2 cm Flakvierling 38 (Panzerausführung) waits for installation. Photos v. Seherr-Thoss.

A small production batch of Wirbelwind ready for shipment to the front. It is interesting that the first prototype of the Ostwind was ready in summer 1944, as evident in this photo. Photo v. Seherr-Thoss.

guns only, since they offered no efficient armor protection to the crew members. They were regarded as not suitable for combat with tank divisions. A new Flakpanzer should be developed having the same armor protection and mobility as the main battle tanks, enabling it to follow up and to protect the tanks when on the move, in position or in attack. Thus Krupp (Werk Druckenmüller in Berlin Marienfelde) quickly developed a prototype with open-top turret, which was completed in May 1944. This first vehicle was sent to the western front in summer, where it received its baptism of fire. Overall performance was regarded to be good, so Guderian ordered production as fast as possible. Since the German industry was not able to offer a quick solution, the first solution was a decentralized production. The workshops of the tank divisions would be enabled to fulfill their own demands. This idea was dropped subsequently. There were, however, always make-shift solutions and improvisations at front-line units done by ingenious engineers. A fine example was the SS Pz.Rgt. 12, which in the summer of 1944, fitted three Pzkw IV hulls with 2 cm quadruple guns, a solution very similar to the later Wirbelwind, but still without turret.

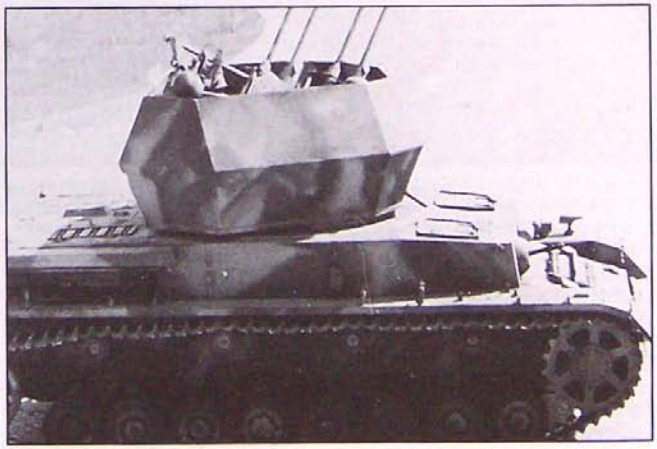
From this moment on, development and production of AA tanks is closely linked to von Seherr-Thoss. He persuaded the army ordnance bureau to establish a centralized production. This decision was backed by General Oberst Guderian, who decided to leave the production of AA tanks to the armored forces, In 6. Consequently, on the 8th of June 1944, In 6 appointed Pz.Ers.Abt. 15, a cadre and training unit, in Sagan, Silesia to establish a production facility.

This close-up shows the crew of the vehicle during final preparations. The private standing in the right of the turret is handing over the ground fire telescope to the driver. Photo v. Seherr-Thoss.



A fine photo for the family album. This is probably one of the first Wirbelwind completed in Sagan. The external equipment is not yet fitted. Note the spare barrel container fitted to the side of the engine compartment and the spare antenna stored under the container. Photo v. Seherr-Thoss.

Von Seherr-Thoss was given command of this development and production facility. Quickly the name Ostbau appeared, Organization Seherr-Thoss. Backed by high military officials, Seherr-Thoss started the search for craftsmen and engineers in the army and concentrated a pool of highly motivated young technicians around him. Pz.Ers.Abt. 15 offered almost perfect conditions. Two large halls suitable for mass production and workshops with heavy welding equipment and turning lathe were already available. Even varnishing halls were at hand.



A Wirbelwind based on a late Ausf. H (no Zimmerit!) standing on the factory yard of Ostbau. The very peculiar camouflage applied by the factory is interesting. Photo v. Seherr-Thoss.

Another view inside the turret of a Wirbelwind prior to shipment to the front. It appears to be rather empty, as no further equipment is visible. Photo v. Seherr-Thoss.

The first order of In 6 demanded urgent production of 80 Flakpanzer Wirbelwind (2 cm Flakvierling 38) on Pzkw IV chassis, with 10 units finished within three weeks. Since the Krupp prototype could not be returned from the front fast enough, a second was quickly made and sent to Sagan. The first Ostbau turret was made from soft steel and after clarifying the terms of steel requirements, production switched to homogeneous steel.

Due to ease of production and the limited time, the Wirbelwind turret was open-topped. Technical problems prevented development of a closed turret. The simple layout of the adapted standard AA guns allowed no specific fume extraction. This problem was aggravated due to the available gun powder of low quality. The gun sight arrangement also claimed a lot of space when moving with the gun barrels. Adequate and easy ammo supply was a problem, too.Von Seherr-Thoss had to face fundamental restrictions. Since German tank production was primarily sent to the front to compensate the heavy losses, he had to resign himself with reworked material. Steel allotments were granted by army offices, and he had to fight for his share all too often. The 2 cm quadruple guns were delivered by Ostmark-Werke in Vienna. Here too, competition with other army and SS offices was rigid. Seherr-Thoss had to "commandeer" his material more than once, to the absolute disapproval of the concerned military, who saw their issued weapons being stolen. Von Seherr-Thoss, however, felt secure under the guardianship of his superiors.

Ostbau received refurbished Pzkw IV hulls by Krupp-Druckenmülller in Berlin. These vehicles were without turrets, but had complete turret rings. The turrets were produced by Thyssen/Deutsche Röhrenwerke in Duisburg and reached Sagan almost complete. Finally the weapons, slightly modified 2 cm Flakvierling 38 quadruple guns (Panzerausführung), were delivered by Ostmark-Werke in Vienna. The radio systems were obtained by Heereszeugamt (army ordnance depot) Breslau, the optics by a company, Schneider, Bad Kreuznach.

After last tooling, Ostbau led through the final production. The vehicles were painted dark yellow and camouflaged in a very typical style. Since demand for the Wirbelwind AA tanks was very high, the troops picked up their allotted vehicles directly at Sagan. During a presentation of the Wirbelwind, a Col. Hellwig of In 6 appeared to be (according to von Seherr-Thoss) "stunned and very delighted."

The Wirbelwind was standardized as Sd. Kfz. 161/3 (the 3,7 cm Flak 43 "Ostwind" AA tank received the same Sd.Kfz number). Ostbau produced around 110 units (other sources speak of 150 units) till the end of the war. In December 1944 a second order of 100 units was launched, which could not be realized.

The Ostwind was produced alongside the Wirbelwind, beginning from December 1944, with 43 units made till the end of the war.

Ostbau had to build with reworked Pzkw IV chassis. All versions from Ausf. G to J were delivered, many still applied with Zimmerit coating. Some original Pzkw IV parts, like slip rings, were used as well. Ostbau removed the ammo stowage completely and prepared the hull for mating the 2 cm Flakvierling. Since the quadruple gun reveled a rather high fire-height, it was decided to sink it into the hull. A suitable gun carriage had to be created, von Seherr-Thoss finally found a solution of ultimate simplicity. Being forced to use cheap and easily available raw material, he combined two U-profile bars to double U-profiles. Two of these double U-profiles were welded transversely onto the side plates of the Pzkw IV hull (inside the superstructure). A square metal plate welded onto this simple frame formed the base for the quadruple gun. Under the center of this square plate a slip ring transmitter was mounted. Via this slip ring, all electric leads were conducted into the gun, as were the lines for the internal

A Wirbelwind at the western front. The vehicle is covered with foliage, the complete crew is anxiously watching the sky. Photo Buchner.

This group of Wirbelwind of an unidentified unit move through Bulgaria in late summer 1944. Again, foliage was used to further camouflage the vehicles. This vehicle, based on an Ausf. G, as evidenced by the separate 30 mm armour welded to the upper hull front. Photo R. Michulec.

communication system. Above the fuel tanks, an easy to remove floor plate was inserted. The ammunition was stored here in standard cartridge cases.Two spare barrel containers were attached to the left and the right of the engine compartment, thus it was possible to make one complete field exchange. Below the right container a spare antenna was stored.

The guns were delivered with modified base plate, but without side floor plates, loader's seats and frontal armor protection. The empty shell case located at the gun's front was shortened. Final production saw the base plate being screwed onto the square shaped plate inside the Pzkw IV superstructure. The gun layer

Another Wirbelwind of the same unit firing. The relaxed position of the man outside the turret allows the speculation that this scenery was feigned for some propaganda film team. Photo R. Michulec.

still had his seat on two parallel arms behind the gun body. Side traverse and elevation were made through the gun laying mechanism's two handwheels.

To house the 2 cm quadruple gun, plus the crew and stand-by ammunition, a nine-sided, multi-angled turret was developed. This turret was welded from 16 mm steel plates, only offering protection against small arms. It was open to the top, which was the best solution with regard to the gun fumes. The turret had a base plate of 30 mm thickness. This plate had a circular opening. The turret was simply fixed onto the existing Pzkw IV turret ring.

Side traverse of the turret housing was not done by engaging the large gear drive incorporated in the turret ring. Instead, a simple assembly was developed to do this. The arm which carried the gunner's seat was linked into a device on the base plate. This was a truly ingenious solution, so any movement of the gun was transmitted to the turret. Due to the heavy weight of the turret, the gun's side traverse gear was reinforced. The loader's seats were mounted laterally on the turret base. Footrests were attached to the weapon's base plate. To the rear of each seat, a rack with eight magazines as stand-by ammunition, was mounted.

Waiting for things to come. This crew seems to enjoy some idle time before the next combat. Photo R. Michulec.

The Wirbelwind used the same wireless system as the Pzkw IV. The arrangement consisted of two UKW E. e receivers and one transmitter 10 W s c, all fixed to the left of the wireless operator. Driver and wireless operator were connected with a joining box (Kst.Pz. Nr. 20). Via the slip ring, all lines of the intercom were conducted inside the turret. The cables led below the gunner's seat to the joining box (Kst.Pz. Nr. 5c), here the gunner plugged in. From this joining box, lines led to the connector extensions (Kst.Pz. Nr. 21) near the loaders' seats.

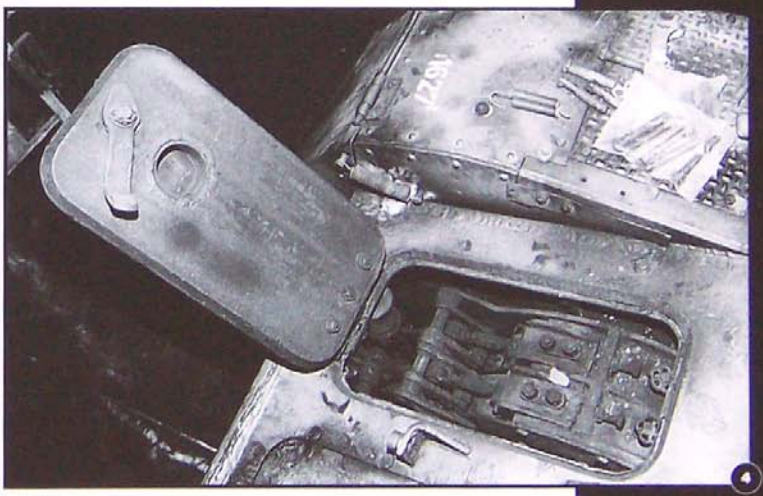
Text continued within photo captions

Acknowledgements: The author wishes to thank Count von Seherr-Thoss, who helped with invaluable information and wartime photos. The photos of the restored Wirbelwind in Germany were taken with kind permission of Cpt. Kosinski, WTS Koblenz and Cpt. Bodo Hartmann, head of the museum of the Heeresfliegerabwehrschule Rendsburg. Further photos were provided by Robert Michulec and Peter Kwok and valuable information on the organization of German AA tanks was submitted by Detlef Terlisten.

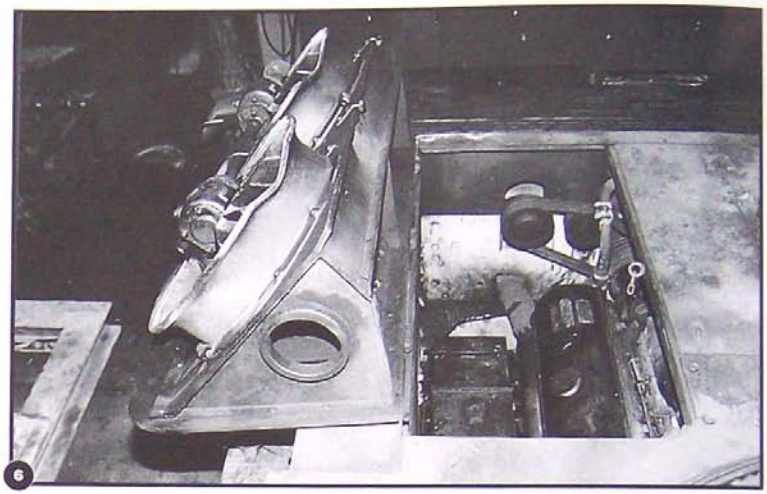
According to the table of organization, each Wirbelwind carried a crew of five. The commander (NCO) was gunner at the same time, driver (NCO), 2 loaders (ranks) and the wireless operator (rank).
The table of organization of 01.04.45 assigned a mixed armored AA company (gem. Pz.-Fla. Kp.). The company had two platoons, the first was equipped with eight AA tanks, either Wirbelwind, or Ostwind, or mixed, plus support vehicles. The second platoon had three Sd.Kfz. 7/1 with 2 cm Flak-Vierling 38/1, plus support vehicles. The armored AA platoon (Pz.-Fla.Zg.) could be found in three versions, subject to demand, or the availability of AA tanks. Version A had 4 Wirbelwind (Sd.Kfz. 161/3) and 4 Ostwind (Sd.Kfz. 161/3). Version B had 8 Wirbelwind and version C had 8 Ostwind. This table of organization was valid, as proved by an U.S. POW interrogation dating from 03.03.45. According to the POW's statement, StuG Abt. 200 used a mixed platoon of 4 Wirbelwind and 4 Ostwind. **Above:** A Wirbelwind of the 111. Panzer Brigade, 2111. Panzer Abteilung, Flakzug rumbles past the camera. This photo and the following two were taken in September of 1944, during the fighting in Alsace-Lorraine (see the previous article for more information on this battle). The vehicle is heavily covered with local foliage, concealment being an essential part of its role. Note the large C-hooks attached to the front towing lugs. (ECPA)

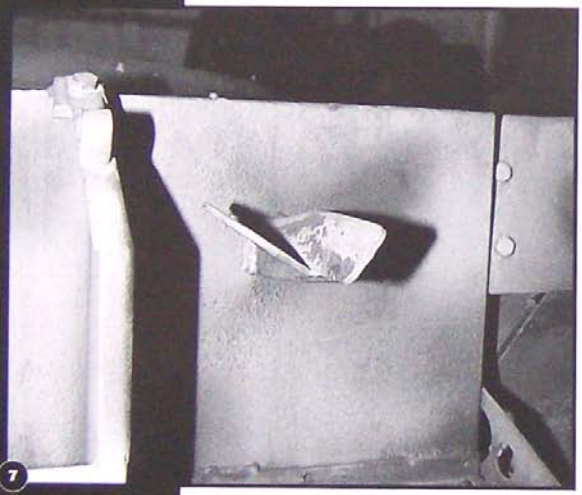
Combat reports of German AA tanks are little known and even Count v. Seherr-Thoss did not receive much feedback. There is just one statement from the army ordnance office, that the Ostbau AA tanks worked satisfactorily. The Flakpanzers were successful, since they carried relatively effective weapons ready to fire under armor protection. The feeling of protection, though deceptive, may have further boosted their effectiveness. Placed in a column, the Wirbelwind could pump quite a lot of lead into the sky and the tracers would have scared, if not blasted away, even bold ground fighter pilots. Carefully following the tanks on the attack and covering their retreat could be performed much better than the earlier SP guns. It can be postulated that the effectiveness of the Flakpanzer largely consisted of deterrence. Allied fighter-bomber pilots flew significantly higher when noticing tracers, thus limiting their own effectiveness. The simple technology used with the Wirbelwind did limit its battle value. Although the quadruple gun offered a high rate of fire, the caliber was considered to be ineffective in 1944. The rounds, when hitting the target, either simply bounced off (in the case of the Soviet Shtormovik) or punched rather ineffective holes. Of course, .50 cal. rounds or air-to-ground rockets could make short work of a Flakpanzer. **Above:** The vehicle has stopped and the driver has emerged to talk with the crew of the Panzer IV seen in the foreground. (ECPA)

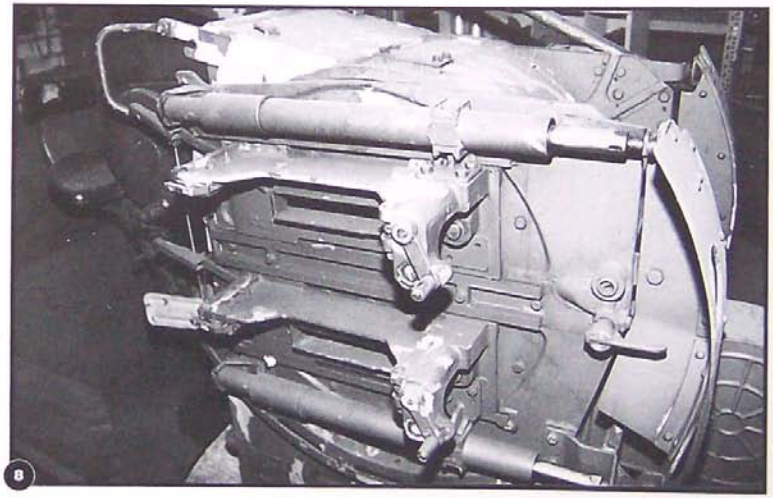
The fact that the gun was fed from limited capacity ammo magazines resulted in two loaders occupying precious space. The gun sight used with the Flakvierling (Schwebekreisvisier) was prone to damage. Even the cartridges, made from thin sheet metal, tended to jam when treated carelessly. The fact that Flakpanzers were used against ground targets all too often and their low numbers further limited their effectiveness. Thus the Army Ordnance Office statement could be a simple paraphrase of "something is better than nothing." It should not be forgotten that the Wirbelwind and Ostwind solutions were realized by very few men in a very short time under extreme pressure and poor conditions. These early Flakpanzers developed by von Seherr-Thoss were reliable and useful weapon systems. They were the first of their kind, the first true AA tanks. They also led to the development of the first belt fed AA gun in German service, the 3 cm MK 103/38. Towards the end of the war, prototypes of the Kugelblitz (twin 3 cm MK 103) and Zerstörer 45 (quadruple 3 cm MK 103) were under troop trials and mass production was planned. **Above:** A close-up of the driver. The variety of uniform items is interesting. At least one of the Wirbelwind crewmen wears the field gray "panzer wrap" jacket, while another wears the jacket in black. The Panzer IV crew all wear the one-piece overall. (ECPA)



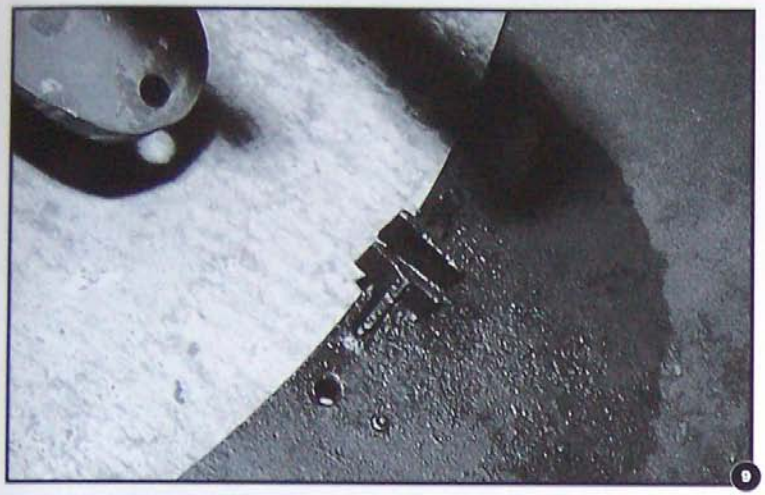
1) The hull of the Wirbelwind in Meppen during restoration shows its turret removed. Originally a late Ausf. H, the towing devices were modified in the U.S. to fit with modern tank towing bars. **2)** The overall state of the vehicle is very good, the engine is still intact. **3)** This photo allows a view onto the hull's top. The turret ring is evident. **4)** The maintenance hatch of the right steering brake is open here.

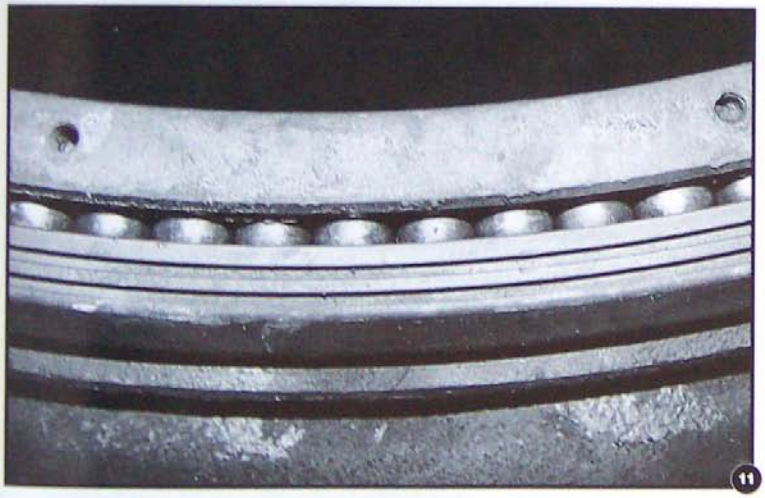




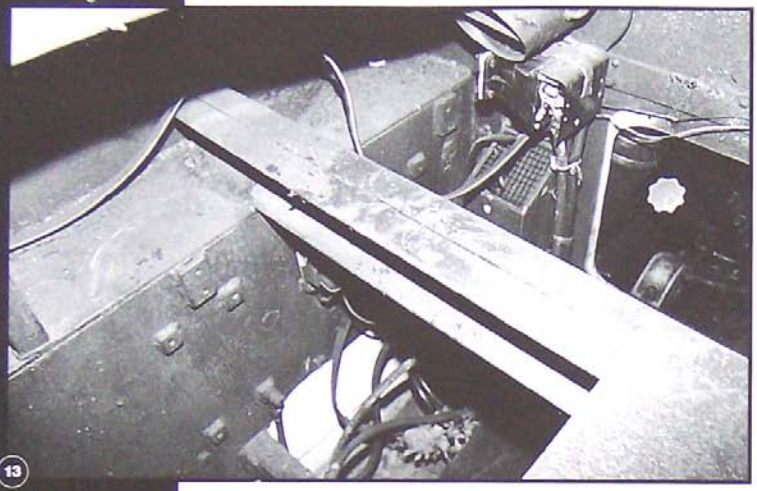


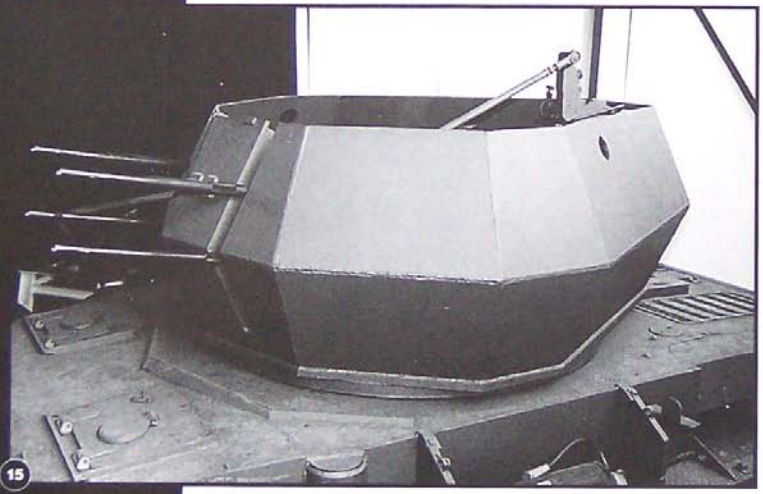
5) Although the hull was a late production Ausf. H, the escape hatches were taken from earlier batches still showing signal ports. These, however, were welded tight. **6)** The right maintenance hatch of the engine compartment shows the large ventilators. **7)** This view shows one (demolished) bracket of the left hand spare gun barrel container. **8)** The 2 cm Flakvierling 38 (Panzerausfuhrung) during overhauling. The guns are removed, the gun mounts and the openings for the empty cases are visible.

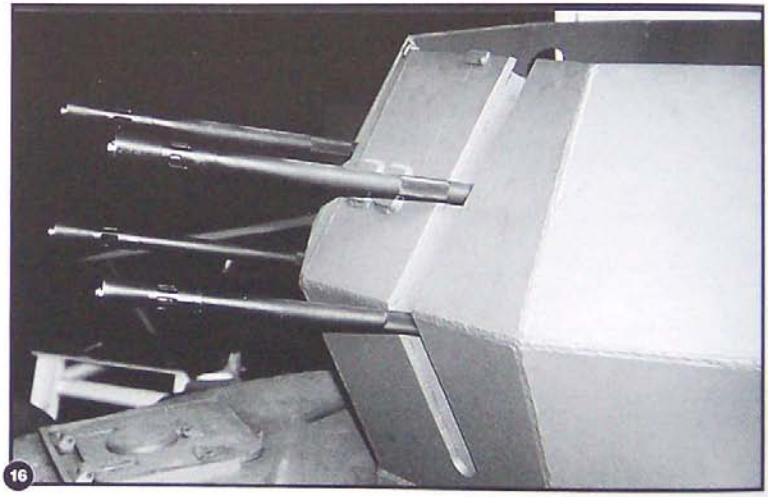




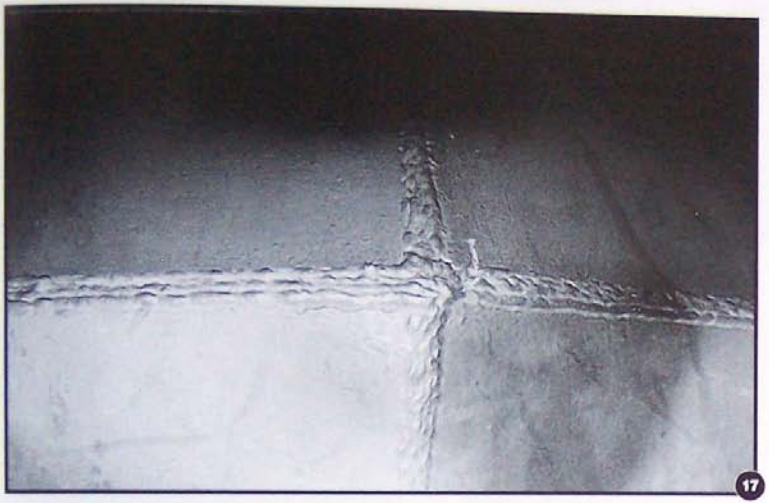
9) This tiny arrangement connects the gun with the turret, thus enabling side traverse. This detail will be shown on another photo. **10)** A fine view onto the turret ring. The simple gun carriage is visible, too. **11)** This close-up shows details of the turret ring. **12)** The carriage arrangement was welded onto the hull sides.



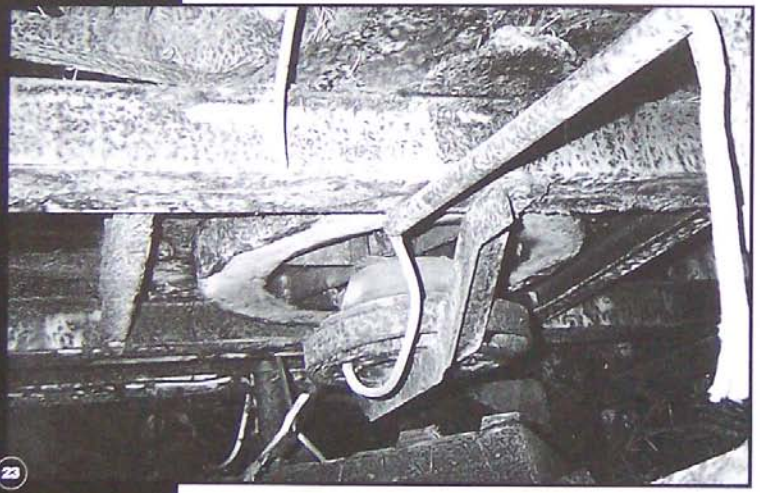




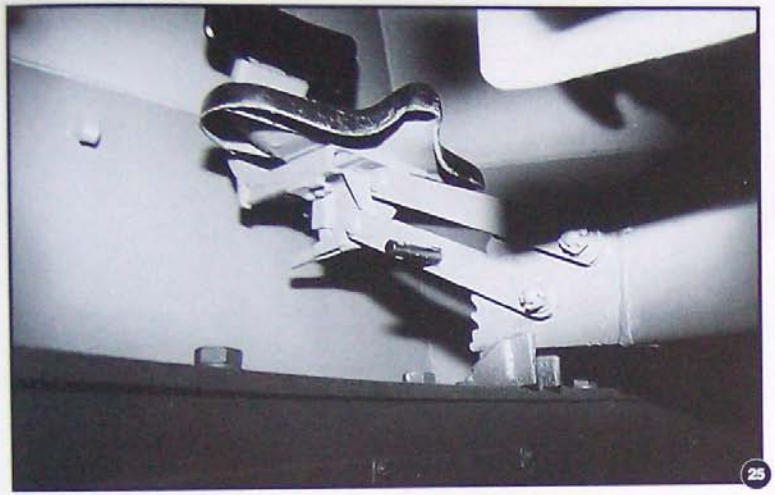
13) This view to the left rear of the fighting compartment shows the carriage and the fuel pump. **14)** The Wirbelwind after its first restoration in Meppen. **15)** The turret shows two holes burnt in, this was necessary because no tool was available to lift it. **16)** This close-up shows the four gun barrels. Note the weld seams.

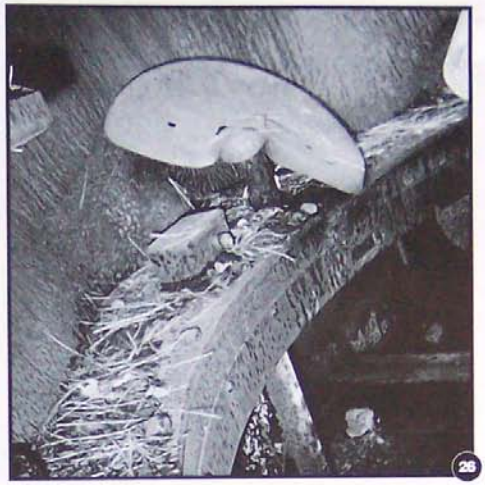


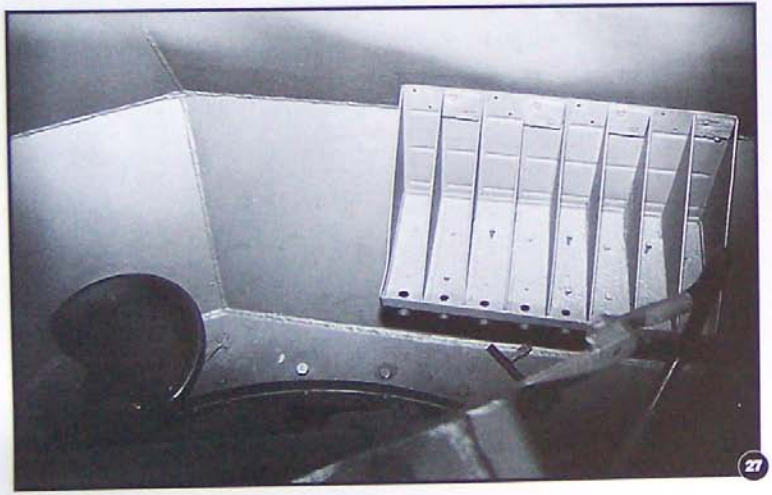
17) Again the welding seams are visible here. **18)** The driver's position. **19)** The tube conducts cooling air to the cardan shaft. **20)** A view between the bottom plate above the fuel tanks and the gun carriage. Note the covered shafts of the two fuel filler caps.



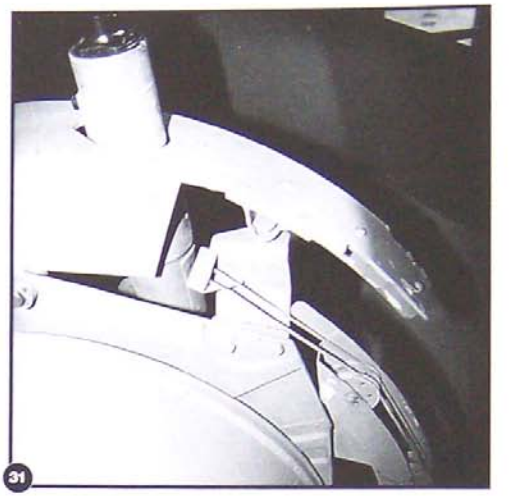
21) The turret turned to 9 o'clock, this view shows the gun mounted onto the carriage. **22)** A round bottom plate was attached to the quadruple gun, possibly the bottom of the gun was shut after the war. The slip ring is missing at the Rendsburg vehicle. **23)** The Ottawa Wirbelwind still shows the slip ring plus electric conduits. The bottom of the gun is open. Photo P. Kwok. **24)** This view above the gun mount shows the intercom joining box (Kst.Pz. Nr. 5c), which was fitted below the gunner's position. Photo P. Kwok.

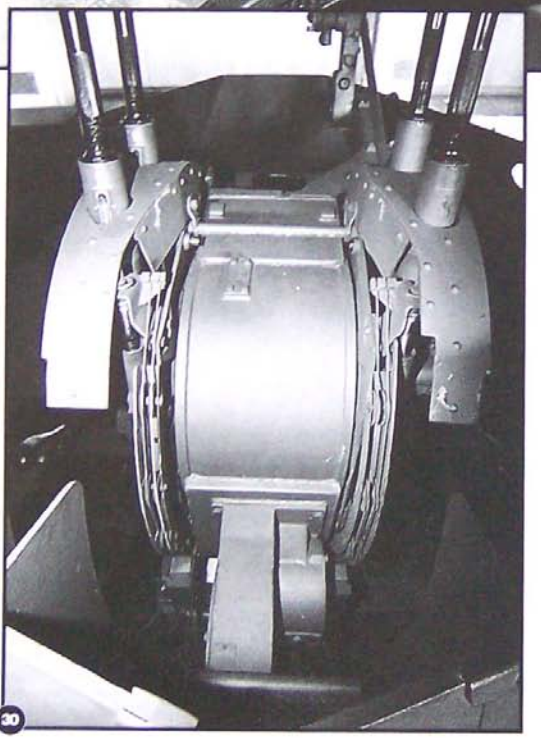


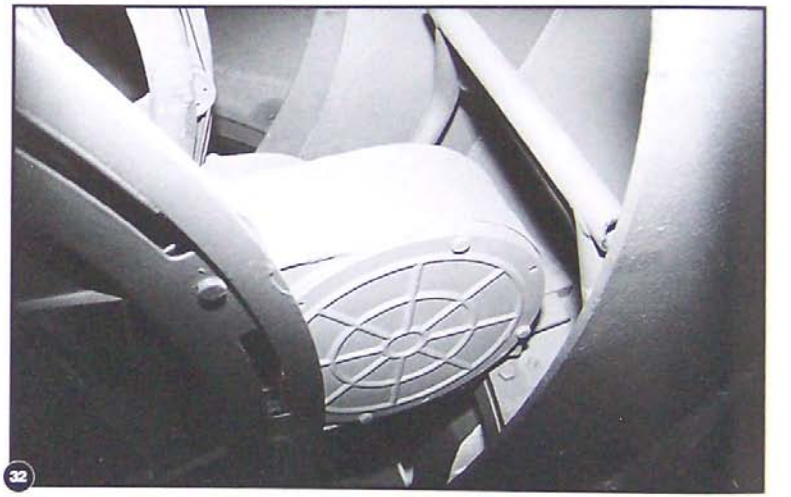




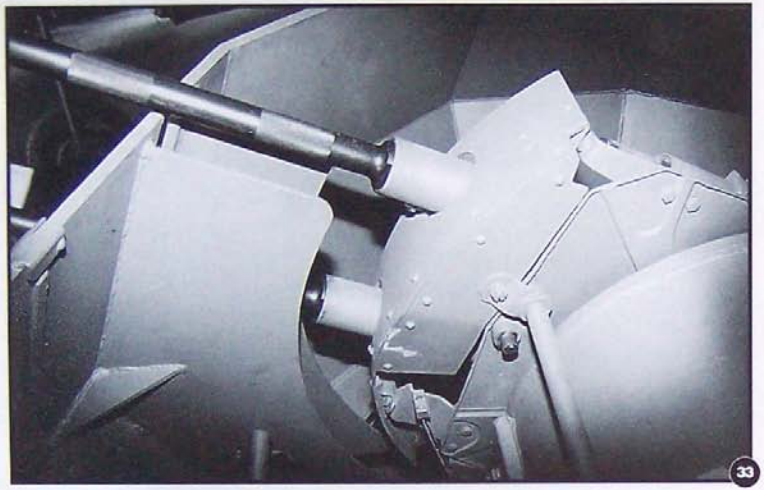
25) This interesting photo shows the coupling of gun/gunner's seat and turret. The arm carrying the seat fits into a simple arrangement. **26)** This is the position of the left loader. Below the seat the intercom extension (Kst.Pz. Nr. 21) was attached. Photo P. Kwok. **27)** The ready-to-fire ammo was stored in trays, eight magazines were stored here. **28)** Another view of the left loader's seat.

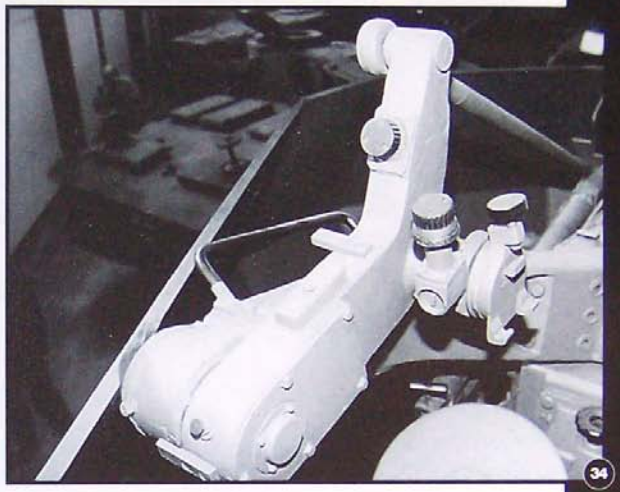


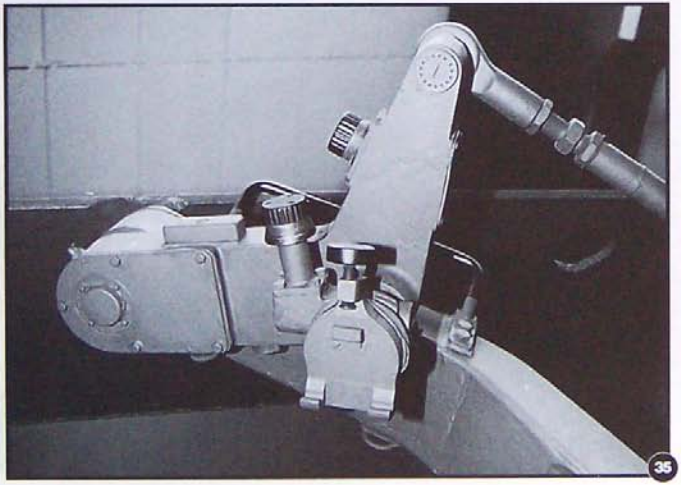


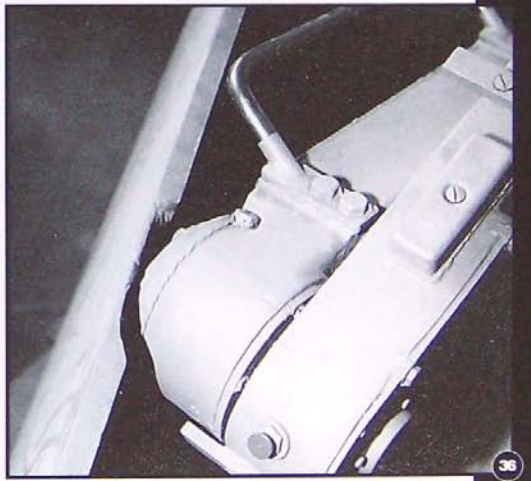


29) Close-up of the loader's seat. The intercom extension is missing here. **30)** A close up of the quadruple gun. **31)** The gun elevation was carried through by steel cables. **32)** The equilibration spring is visible here.

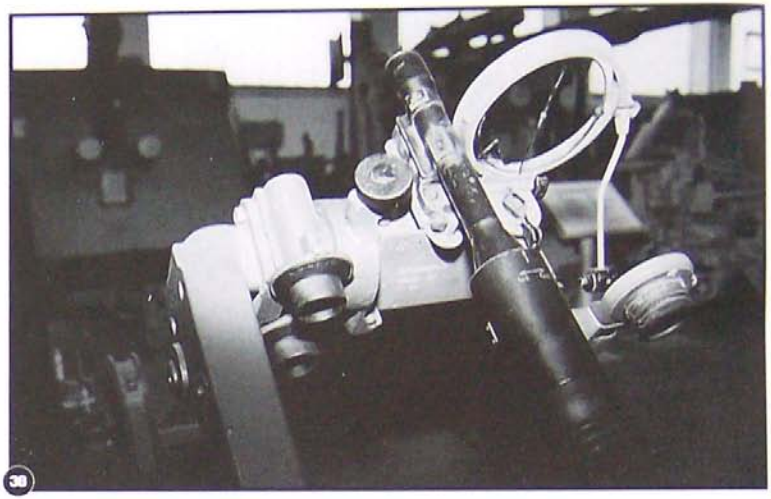


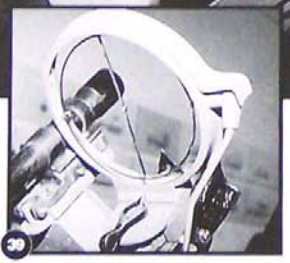


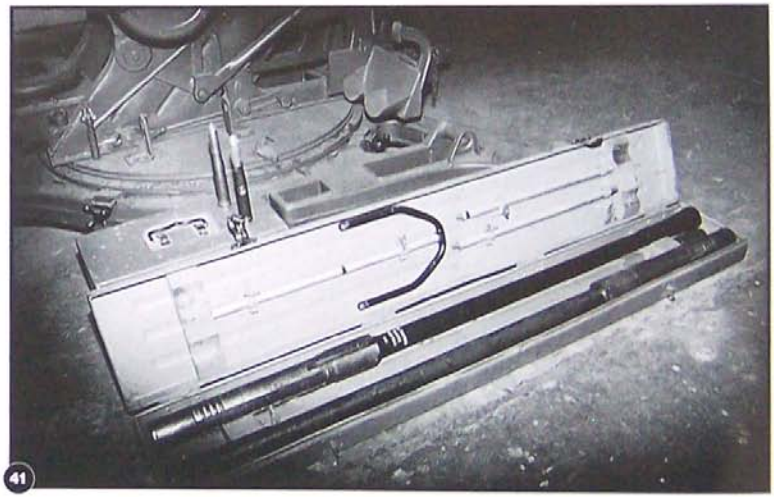




33) Another close-up of the gun. Note the reinforcements welded to the gun guide plates. **34, 35)** The gun sight carrier was attached to a massive arm. **36)** Each Wirbelwind turret was a unique product. Here the wall had to be milled to give way for the gun sight arm.







37) The author gives an impression of the gunner's position. It is obvious that his head was not protected. Additional foldable armor plates were developed, but not introduced. **38 - 40)** The gun sight, the Schwebekreisvisier 38. **41)** The spare barrel container.