PROFILE
AFV WEAPONS
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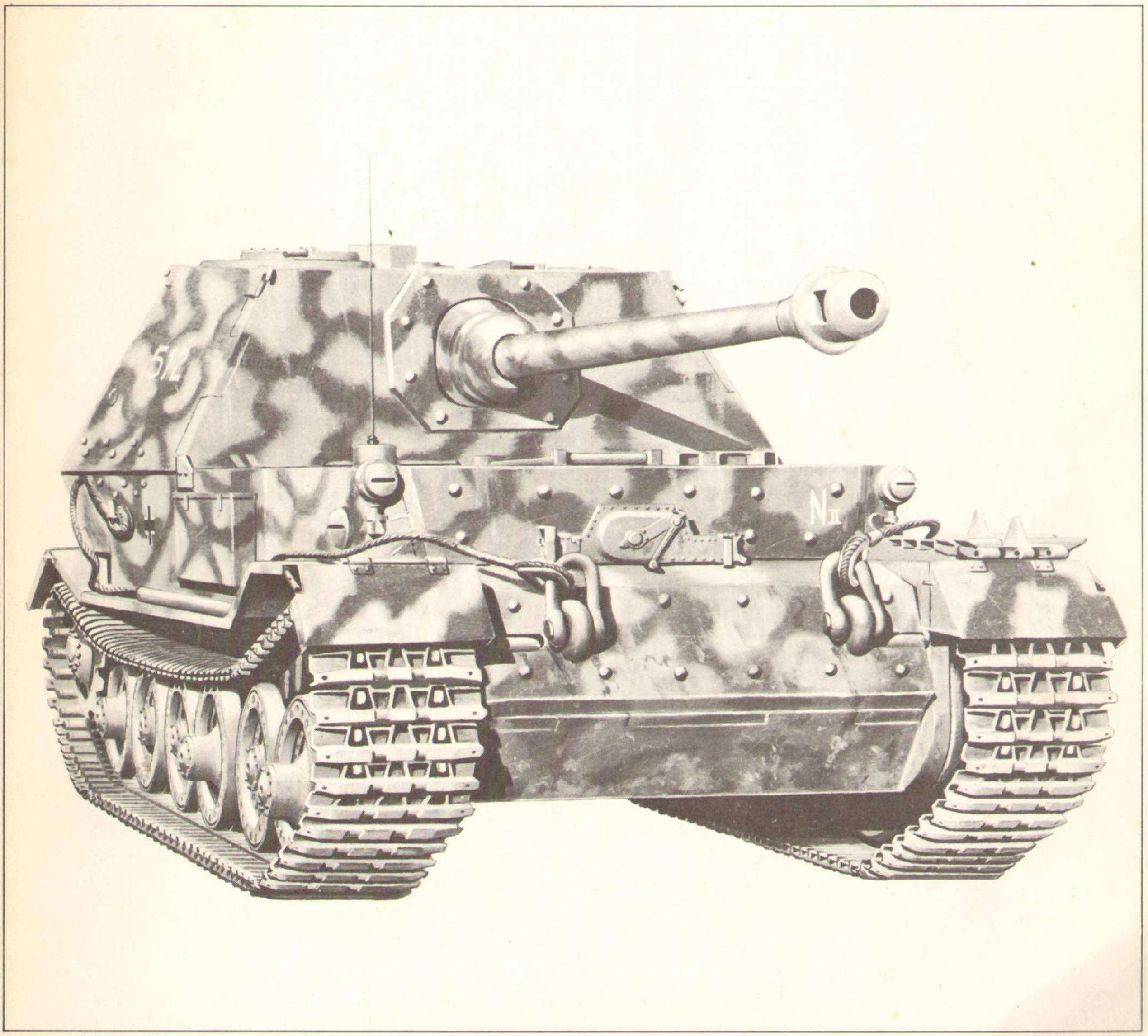
# Elefant and Maus (+E-100)

by Walter J. Spielberger and John Milsom



# AFV/Weapons Profiles

## *Edited by DUNCAN CROW*

Almost since the invention of the tank there has been what might be called a super-heavy tank complex – the urge to design and build enormous tanks that could withstand all punishment and overcome all opposition (it was hoped!) by sheer brute force. Many of these dreams of gargantuan tanks never materialized. But others almost reached completion, and others again were actually built. The British started it with The Flying Elephant in 1916 – not the Elephant that is one of the subjects of this Profile incidentally. The Germans built a K-Wagen in 1918. The French built the Char 2C after World War I and during the war had carried out trials on a 141 ton monster that would carry a crew of 28 – this was comparable with the K–Wagen in weight and crew numbers.

In World War II the super-heavy complex was still in evidence. General Martel even suggested tanks as big as battleships that could swim the Channel and advance on Berlin like monstrous Juggernauts. The largest tank ever built, however, was the German Maus, which, together with its rival design, the E100, is scrutinized by John Milsom in the second half of this Profile. The first half, appropriately (for the Maus was the culmination of Porsche technical development in the Tiger field), deals with the Elefant (also known as the Ferdinand) which was the conversion of the original Porsche tank design into a self-propelled tank destroyer. "The Elefant" is by Walter J. Spielberger who was the design engineer on the Elefant project and who fought in this AFV in Russia.

Those who share the Editor's fascination in the super-heavy tank complex will find more evidence of it in AFV/Weapons Profiles 17, 32, 38, and 41 – especially in 38.

The complete list of AFV/Weapons Profiles already published is:

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2 PanzerKampfwagen III
3 Tanks Marks I to V
4 Light Tanks M1–M5 (Stuart/Honey)
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10 PanzerKampfwagen V Panther
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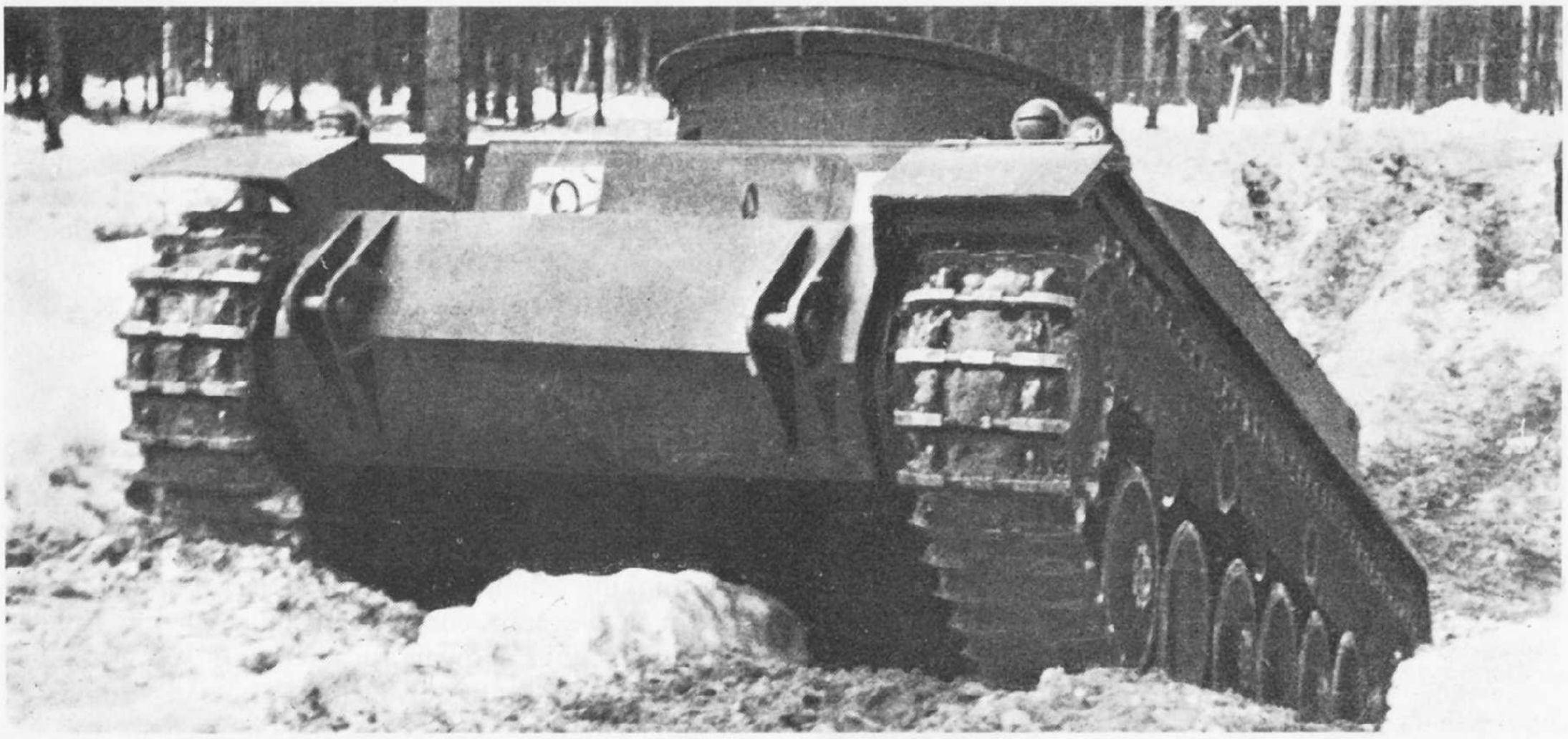


*Professor Porsche's first attempt to create an armoured fighting vehicle resulted in two prototypes of the Porsche Type 100 or, as it was internally called, the "Leopard".*

# Panzerjäger Tiger (P) Elefant

by Walter J. Spielberger

DURING the battle north of Orel, Russia, in 1943, a Russian tank column marched far out of reach of conventional German anti-tank fire on a northerly course towards Karatschew. The tanks were barely visible at a distance of more than three miles and the Germans seemed unable to interfere with this troop movement, which was threatening their exposed flank.

Then, at this critical moment, a company of German self-propelled anti-tank equipment, using a vehicle called "Ferdinand" was called up to intervene. Fire was opened against the Russian vehicles in spite of the distance and soon eight of them were destroyed. Another victory for the incredible German 88 mm. gun was ready for the history book. This long-barrelled 88 mm. anti-tank gun, or "8,8 cm. Pak 43/2 L/71", as the Germans called it, was one of the most outstanding weapons of World War II. Intended originally for anti-aircraft purposes, it was soon recognised as a potent anti-tank weapon and was eventually mounted, slightly modified, in the turret of Tiger II.

An earlier version of the gun, the Flak 36, with a barrel length of L/56, had already been modified and mounted in the turret of the original Tiger I model as early as 1941. In the meantime, Heeresflak units, unprotected and towed by soft-skinned, half-track tractors, had attempted to protect infantry and other units against the numerous Russian tank attacks. They had suffered unbearable losses. Only if able to engage their enemies at the proper distance could their success be assured. But the towed gun with its awkward and time-consuming positioning problems was no solution and soon attempts were made to provide the weapon with a self-propelled mount. The only chassis readily available at this time were Panzer III and IV. Since neither of them was originally intended and suitable for SP use, a composite chassis was designed, utilising chassis and hull components of both vehicles. An anti-tank version, called "Nashorn", mounted the 8,8 cm. Pak 43/1 L/71. Despite their open and only thinly-armoured superstructure, these vehicles were quite successful. They were replaced by an excellent vehicle, the fully-enclosed and adequately-armoured "Jagdpanther" in 1944. This unit was beyond a doubt one of the most versatile and effective tank destroyer vehicles of its time. It remained in production until the war came to a close.

The vehicle described in this *Profile* also mounted the same weapon. It was a direct outgrowth of the "Tiger" development. Never intended originally as a self-propelled mount for the long-barrelled 88 mm. gun, it turned out to be a technically most complicated and unreliable vehicle. It came into existence almost by a freak of nature and it should only serve as an example so far as its unique chassis design is concerned. As a complete unit, the "Elefant" must be considered a failure. This is said despite the fact that your author was engaged as design engineer on this project and that he participated actively in the action in Russia, described at the beginning of this *Profile*.

## DEVELOPMENT HISTORY

Professor Porsche's first attempt to create a military vehicle dates back as far as the days of World War I. Then working for the Austrian Daimler factory, he motorised the heavy Austrian artillery with four-wheel

*This unit was intended to replace the Panzer IV and was equipped with two air-cooled V-10 engines which drove electrically the two front sprockets.*

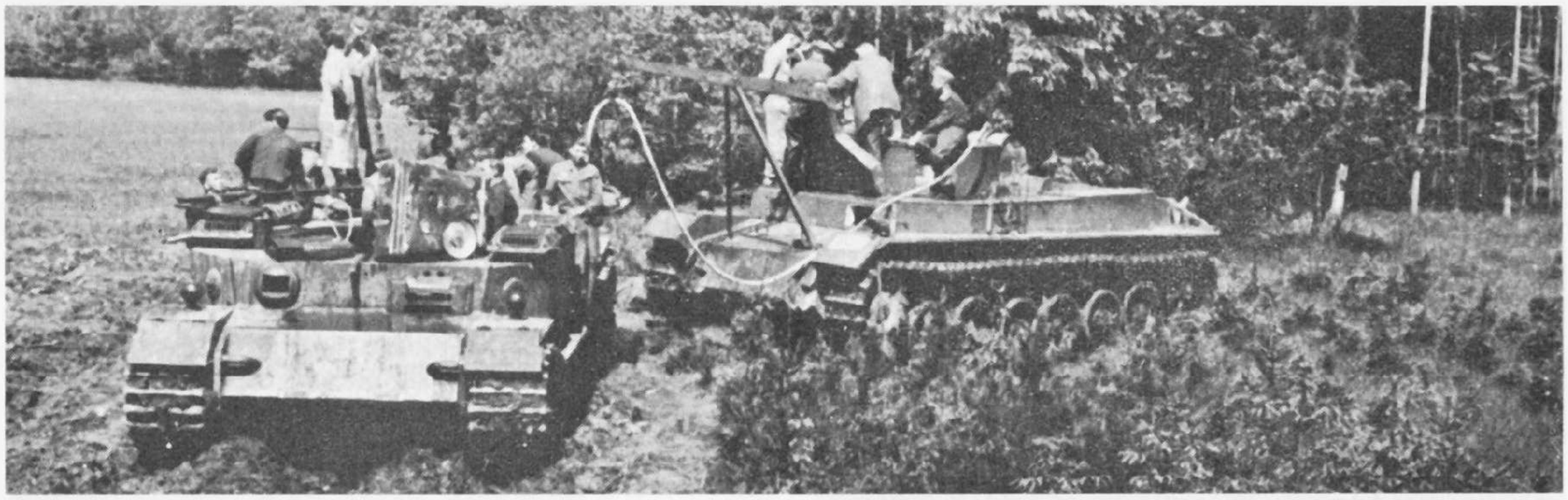
*During intensive field trials the Porsche Type 100 was also used to supply the Porsche Type 101 with electric current during the initial field testing of the Porsche Tiger.*

tractors capable of pulling enormous loads. They incorporated mixed petrol-electric drive systems, a solution which later became the trade mark of Porsche armoured fighting vehicles. His independent company, created in 1930 in Stuttgart, acted as a design office for various international automotive concerns. Among others, he received, in 1939, an order from the Ordnance Department to participate in an attempt to find a successor vehicle for the standard Panzer IV. A vehicle was required which, having a total weight of 25 to 30 metric tons, had to be capable of carrying either the 75 mm. tank gun or a 105 mm. high velocity weapon. Porsche's solution produced a vehicle with two parallel installed air-cooled petrol engines, coupled to an electric dynamo supplying electric motors driving the front sprockets. Steering and gear-shifting were effected electrically. The suspension incorporated torsion bars in a new and unique way. Two prototypes were built at the Nibelungenwerke of St. Valentin in Lower Austria. They carried the internal designation "Leopard", or Porsche Type 100, (Ordnance designation VK 3001 (P)).

The appearance of the Russian T-34 rendered most of these attempts useless and forced Porsche to abandon this project in favour of a heavier vehicle, capable of mounting the 88 mm. gun. This was done in anticipation of even heavier vehicles expected to appear from the arsenals of both the Russians and the Western Allies. The outdated tank weaponry used by the Germans at the beginning of the Russian campaign called for a drastic reappraisal, with a demand for an armour penetration of at least 100 mm. from a distance of 1,500 metres. The selection of gun calibre was left to the manufacturer. But, meanwhile, the 88 mm. gun had established itself, to such an extent that it appeared most likely to be considered as the standard tank weapon for new German tank designs.

The Waffenamt insisted, however, that lesser calibres of 6 cm. or 7,5 cm. should be afforded the same opportunity, provided they achieved the same performance. The thinking behind this order was based upon the fact that such weapons could be installed within smaller turret rings, thus allowing for a reduced overall weight. Given frontal armour of 80 mm. and side armour of 60 mm., a reduction in turret ring diameter from 1,850 mm. (73 in.) to 1,650 mm. (65 in.) would have lowered the weight of the turret by almost 2·2 tons. Equal armour penetration with smaller weapons, however, called for utilisation of tapered bore designs using tungsten steel ammunition. These were in too short supply and could not be considered. Conventional weapons had to be used. Thus, Krupp of Essen received an order from the Ordnance Department, in July 1941, to develop a tank gun derived from the 88 mm. anti-aircraft gun with a barrel length of 4,930 mm. (L/56). This was originally intended only for the Porsche vehicle VK 4501 which was ordered as a parallel design to the Henschel VK 3601 on 26th May 1941. It appeared for a time that two distinct vehicles would emerge from these orders—passed down from Hitler himself—both with production beginning May-June 1942, namely a Porsche type (VK 4501 P) with an 8,8 cm. gun and the Henschel vehicle (VK 3601), with the tapered bore weapon 0725. But, since tungsten steel was no longer available, the Krupp turret, originally intended for the Porsche vehicle only, had to be used for the Henschel, the pressing timetable allowing no other solution. Thus, the Henschel vehicle was also developed as a 45 ton unit (VK 4501 H) and eventually became the Panzerkampfwagen VI Tiger I (H)—later (E).

Porsche relied to a large extent upon his experience gained during the development of the VK 3001, the Type 100. Additional new ideas were incorporated, but petrol-electric drive was retained. The design of the air-cooled power plants created almost insurmountable difficulties. Hitler, however, had insisted that both vehicles were to be developed side by side, a common practice of the Waffenamt. Pronounced controversies developed between Dr. Porsche and the Ordnance Department over these years, and were never entirely resolved. Interesting as Porsche's technical solution for such a heavy vehicle may have appeared, the actual vehicle turned out to be most complicated. And, because it had to be put in production without the benefit of extensive trials, it could only be put into service with combat units after costly re-development and basic changes. In fact, only a few of the 90 vehicles originally authorised and put in production were actually completed as battle tanks. They were designated Panzerkampfwagen VI, VK 4501 (P), Tiger (P).



*Because of the difficulties with the air-cooled engine and in order to meet set deadlines for presentation of the Porsche Tiger to Hitler field trials were conducted of the electric components without the main engines installed. Power was supplied from a Type 100 unit.*

## THE PROTOTYPE TRIALS

On 19th March 1942, Armament Minister Speer reported to Hitler that, commencing in October 1942, 60 Porsche and 25 Henschel Tiger tanks would be completed. Prototypes of both vehicles were demonstrated before Hitler on 20th April 1942. Only twelve months had gone by from the moment the order was received to the date of completion of the prototypes. It was an extremely short time in the development of such a sophisticated weapon, and it is perhaps not surprising that the simpler, more conventional Henschel vehicle was chosen as the basis of the new battle tank.

Dr. Porsche never believed in the reliability of a mechanical transmission for such a heavy vehicle. Two alternative transmissions were therefore envisaged, one electric and the other hydraulic. The hydraulic unit was rather large and had a poor efficiency compared with a mechanical transmission although it was expected to equal the electric alternative. It was to be built by Voith of Heidenheim. However, serious troubles with the air-cooled engines delayed installation and caused a complete lack of interest in this unit by the time it was actually completed.

The production of the Henschel Tiger was already in full swing at this time. The unit designed by Porsche had a fighting weight of 57 metric tons, after its belly armour had been increased to 100 mm. Its main armament, originally the 8,8 cm. KwK 36, was changed to a 15 cm. KwK L/37 or a 10 cm. KwK L/70. But both developments never materialised and the Porsche Type 101 never saw action as a battle tank.

Eighty-five of the 90 chassis assembled at the Nibelungenwerke were shipped in 1942 to the Altmaerkische Kettenfabrik GmbH (Alkett) of Berlin-Spandau. There they received new superstructures and additional armour and were equipped with the long-barrelled 88 mm. anti-tank gun mounted in limited traverse. A new tank destroyer vehicle was thus created. It was demonstrated for the first time on 19th March 1943 at Ruegenwalde. Instead of the two air-cooled Porsche engines, two standard Maybach HL 120 TRM tank engines were installed. The new unit received the official designation Panzerjäger Tiger (P) Elefant (SdKfz 184). Originally called "Ferdinand" after its designer, Dr. Ferdinand Porsche, its official designation was "Elefant". These vehicles proved to be more of a liability rather than an asset to the units finally receiving them.

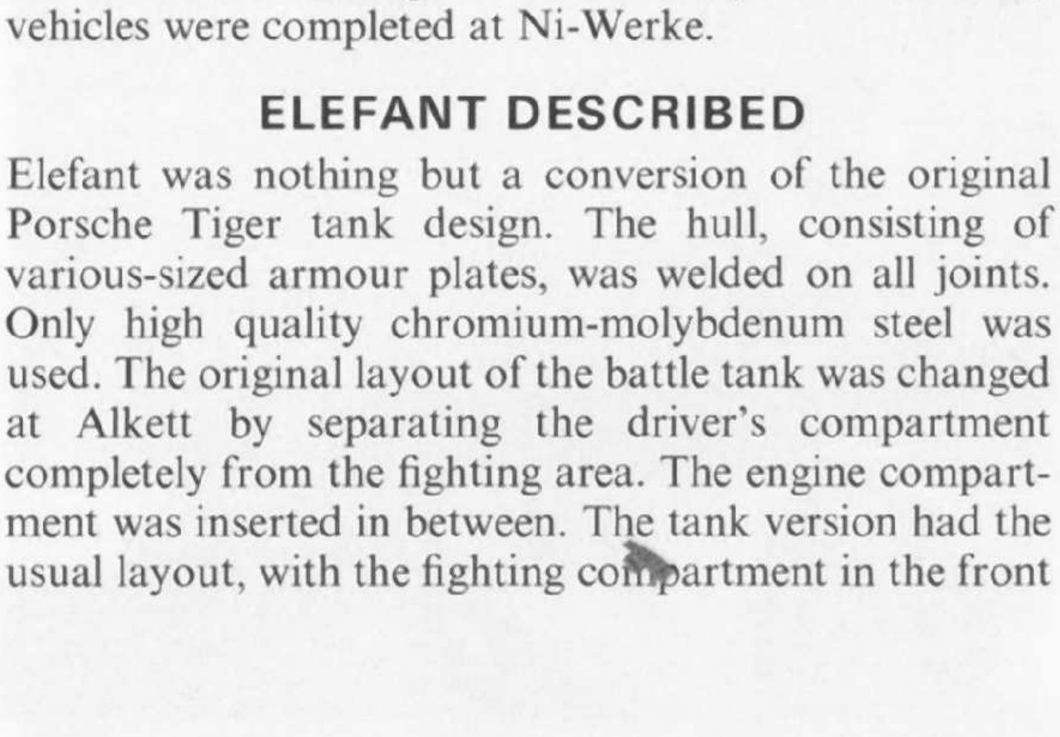
## PRODUCTION

Only a grand total of 90 vehicles were produced. Professor Porsche's association with the Steyr-Daimler-Puch AG., which owned and operated Nibelungenwerke, put the production of all of his designs and prototypes in this location. Originally intended for mass production of the Porsche Type 100, this factory served until the end of the war as the main source of Panzer IV. It carried out extensive research work and built, among other fighting vehicles, the Jagdtiger. Component parts and hull assemblies were supplied by Eisenwerke Oberdonau of Linz and assembly of the chassis continued at Ni-Werke until a final order relocated the production line to Alkett, in Berlin-Spandau. Serial Numbers ranged from 150001 through 150090. Only five recovery vehicles were completed at Ni-Werke.

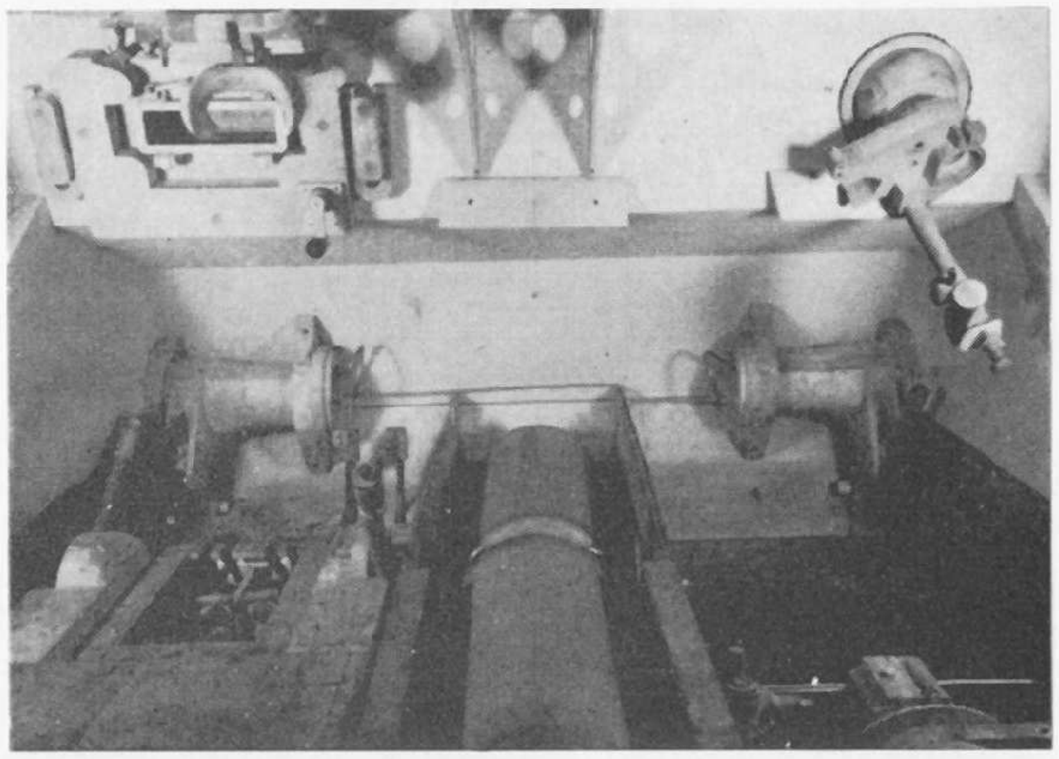
## ELEFANT DESCRIBED

Elefant was nothing but a conversion of the original Porsche Tiger tank design. The hull, consisting of various-sized armour plates, was welded on all joints. Only high quality chromium-molybdenum steel was used. The original layout of the battle tank was changed at Alkett by separating the driver's compartment completely from the fighting area. The engine compartment was inserted in between. The tank version had the usual layout, with the fighting compartment in the front

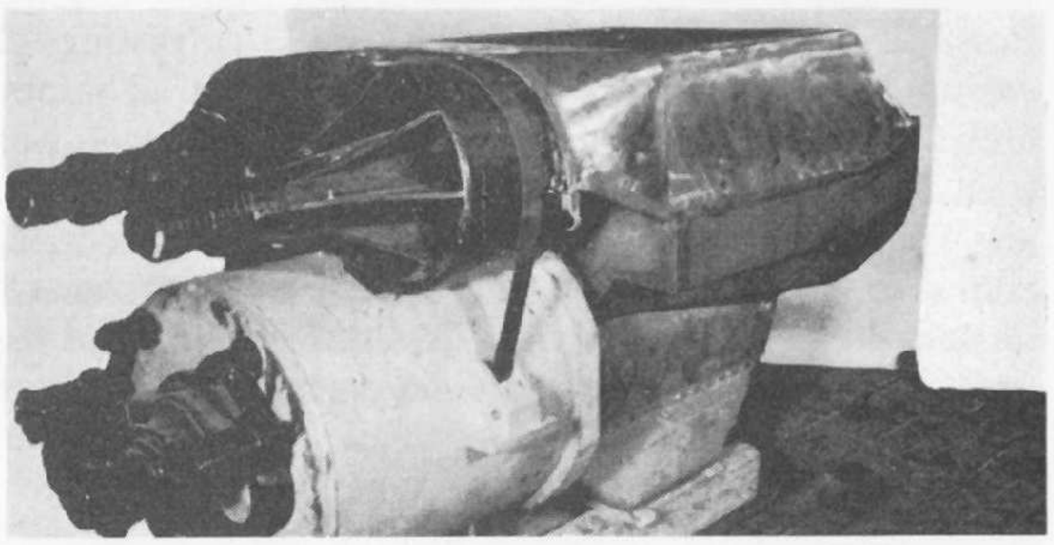
*A model of the Porsche Tiger with the Krupp turret which was later put into production for the Henschel Tiger E.*



*A wooden mock-up of the Porsche Tiger hull with a spacious driver compartment showing the air tanks for the hydro-pneumatic steering system.*



*The rear-driven vehicle allowed for a more spacious driver compartment. This wooden mock-up also indicates the hull machine gun and the tensioning devices for the tracks.*



*Two of these air-cooled engines were coupled with an electric generator and installed in the limited-spaced engine compartment of the Tiger tank. Clearly visible are the two air fans for the engine.*

and the power plants located in the rear section. The space for the driver and radio operator was relatively uncluttered, since the rear drive allowed freedom of movement in this section. Only the air-tanks for the hydro-pneumatic steering were located forward, together with radio equipment. The original fighting compartment was used after the conversion to a tank destroyer vehicle as the engine compartment, accommodating two Maybach engines and the cooling system. Because the engines were the same as those already described in detail in the Panzer IV *Profile* the engine described here is the original Porsche tank engine. Two of these were coupled together to produce, through an electric transmission, an output of approximately 600 net h.p. This particular design was chosen to allow for high power output from the relatively small space available in the Tiger engine compartment. The crankshaft of each unit was coupled directly to the generator concerned and blowers for cooling the cylinders of the engines were mounted on the generator. Some of these engines, which gave satisfactory results during trials, were actually mounted in some of the electrically-operated Tiger tanks, but production of the engine was never started, since official opinion in Berlin favoured a 16-cylinder X Diesel engine.

The Porsche Type 101 engine was an air-cooled, four-stroke petrol engine, with carburettors and magneto-ignition. The cylinders were arranged in "V" form, and the engine was fitted with overhead valves actuated through push rods. Its maximum output was 320 b.h.p., at 2,500 r.p.m. With a bore of 115 mm. and a stroke of 145 mm., total displacement amounted to 15,060 cc. A total of ten cylinders was provided. The five-throw crankshaft was supported in six lead-bronze bearings. The forked connecting rods ran on a common, interchangeable bearing shell. A divided oil sump was incorporated. Engine cooling was effected through a double rotary blower driven from a pinion on the generator shaft through a jointed shaft. An oil cooler was installed. Solex down-draught carburettors of the type 50 JFF II were mounted. Fuel was stored in one tank of 115 gallons (520 litre) capacity, mounted above the generator. It was supplied through two feed pumps directly to the carburettors.

The hull of the tank-destroyer vehicle consisted, after re-arrangement, of a driver compartment, providing seats for both the driver and radio operator, an engine compartment, housing two parallel Maybach engines of 300 h.p. each, and a fighting compartment, where the commander, gunner and two loaders were situated. A separate transmission compartment contained two electric motors, one for each driving sprocket. Both sides of the engine compartment held the two fuel tanks with a total capacity of 240 gallons.

Siemens-Schuckert of Berlin supplied the electrical components, namely the generator and the two electric drive motors. Each track was driven independently. Each of the electric motors was linked to the rear driving sprocket through a geared drive. Steering, while hydro-pneumatic assisted, was effected electrically by means of controls installed in the driver compartment. A reduction ratio for the final drive of 16·75:1 was obtained, allowing for a top speed of 12·5 m.p.h. The gearbox was electrically operated and three speed ratios were available in either direction.

## PORSCHE SUSPENSION

The most interesting feature of the vehicle was, without a doubt, the suspension. It consisted of a rear drive sprocket, six bogie wheels, and a front idler wheel on each side. The Porsche bogie unit embodied some unique features in the application of torsion bars as a flexible medium. The conception of the design was based on the practice of having adjacent wheels straddling the track guide and on the use of steel-rimmed wheels. A short cantilever spindle supported each bogie unit in such a manner that all loads were overhanging in relationship to it. The bearing load at the bogie oscillation point was, therefore, of enormous proportion. A secondary arm,

which carried the torsion bar, was placed under the spindle of the leading wheel, which, in fact, limited the height of the track guides. Difficulties in finding a workable means for mounting a conventional type of track support roller forced the designers to adopt a makeshift track support in the form of a curved spring steel friction plate. One of the main arguments claimed in favour of the Porsche design was the fact that fewer road wheels (six per side against eight per side on the Henschel vehicle) were required. Smaller diameter wheels gave room for larger wheel movement. All these advantages were based on the fact that the road wheels had steel wearing surfaces and could, therefore, carry higher loads than larger wheels with rubber tyres.

Each bogie unit consisted basically of a carrying bracket and a primary and secondary arm, each of which carried one road wheel. The bracket, which was fixed to the tank hull, was integral with a spindle on which the primary arm oscillated. The primary arm carried a fixed shaft, the outer end of which formed the spindle for the leading wheel and the inner end of which was a hinged pin for the secondary arm. This secondary arm was made of a hollow steel casting in which the torsion bar was carried. This torsion bar was splined on both ends. It was anchored to the trailing end of the secondary pin. The forward end of the torsion bar was connected with a torsion cam unit which consisted of a relatively long tubular member of which the load carrying cam was an integral part. This cam unit was free to oscillate in plain bearings, located in the forward end of the secondary arm. The cam reacted against the arm which was splined to a shaft. A tension helical spring was used for holding the bearing surfaces to a reaction arm and the cam. A substantial rubber bumper was mounted on the trailing end of the primary arm.

The steel tracks of a skeleton type (track type Kgs 62/640/130) were in their final form 25 in. wide. The track pitch was 5 in. and 109 links per track were used. Originally, narrower tracks of 20 in. and 23·5 in. width were tested but the ever-increasing total weight demanded a lower ground pressure. It was still too high, since the Elefant had to be content with 3·44 lb./sq. in., a very high figure.

Instead of a rotating turret, the vehicle had a box-like superstructure, with slightly inclined plates. The common practice of interlocking armour plates was utilised. Six escape hatches were provided, two of which were situated on top of the driving compartment. Three appeared on the superstructure roof, serving as entrance and exit for the rest of the crew. One circular hatch cover of approximately 32 in. diameter was located in the rear inclined plate of the body, facilitating the removal and installation of the main armament, while a much smaller opening within the large hatch allowed for ejection of spent cartridges. The basic armour of the Porsche Tiger was increased, and an additional 100 mm. plate was added by means of conical bolts to the front portion of the hull. The superstructure received a frontal armour of 200 mm. thickness. The rest of the vehicle carried 80 mm. plates throughout.

Visibility from the fighting compartment was poor, only forward vision being provided.

## THE 8,8 cm. GUN

The 8,8 cm. Pak 43/2 L/71 was the only armament the vehicle carried. It was mounted in limited traverse. Elevation was from +14° to −8°, while traverse extended to 14° on either side. Fifty rounds of ammunition were carried in the fighting compartment.

The 88 mm. Pak 43/2 mounted on this vehicle was, at that time, the latest in the series of anti-tank guns developed from the 88 mm. anti-aircraft guns. As mentioned earlier, the 88 mm. KwK 36 mounted in the Tiger Model E was adapted from the Flak 36. In order to improve the performance of the anti-aircraft guns of the Flak 36 class, a higher velocity weapon was developed and introduced as Flak 41. This weapon had the muzzle velocity increased to 3,280 feet per second, giving the shorter projectile flight time desirable in an anti-aircraft gun. However, by the time it was introduced, a heavier projectile with a larger explosive content was desirable for anti-aircraft use and interest in this weapon centred on its possible employment as an anti-tank weapon. The original Flak 41 was successfully used in the anti-tank rôle. However, it was designed with a long, narrow cartridge case, which was somewhat awkward to handle and would have been impossible to use inside a vehicle. Development of the anti-tank weapon continued with the appearance of the Pak 43/41, and the Pak 43. These weapons had the same ballistic performance as the Flak 41, but were redesigned with a shorter, fatter cartridge

*A Porsche Tiger during field trials in Austria in 1942. This is the front of the vehicle, with the turret pointing toward 6 o'clock.*

*The same vehicle from the rear, showing the layout of the engine compartment and other stowage.*

*Two of the Porsche Tiger units during the test period in 1942. The turrets are reversed.*

case to improve the ammunition handling characteristics. The Pak 43/41 was mounted on a split trail carriage, while the Pak 43 was fitted to a low silhouette, cruciform mount. The shorter ammunition of these weapons made them particularly suitable for vehicle mounts, and several were developed. Of these, the Pak 43/1 was fitted to the Nashorn. The Pak 43/2 was mounted in the Elefant and the Pak 43/3 in the Jagdpanther. A similar weapon adapted to Tiger B was designated the KwK 43. These vehicle weapons were slightly longer than the ground mounted anti-tank guns Pak 43 and 43/41. Although they were designated L/71, they were, in fact, 71·6 calibres in length. This weapon was undoubtedly the finest anti-tank gun produced by either side during World War II. With its explosive loaded APCBC ammunition, it could penetrate 137 mm. of 30° slope homogeneous armour at 2,000 yards.

Although APCR ammunition was designed for this weapon, tungsten shortages prevented its use. However, it must be pointed out that such ammunition was neither necessary nor particularly desirable in view of the high performance and greater destructive power of the explosive loaded APCBC. The 8,8 cm. L/71 gun could destroy any armoured vehicle it was likely to encounter at almost any normal combat range, using this standard ammunition. It not only could penetrate its target, but the projectile exploded inside the vehicle, almost always ensuring the destruction of both vehicle and crew.

For self-protection, the crew had only personal arms —one machine gun 34 and two sub-machine guns 38. Since this arrangement rendered the early vehicles almost helpless against close range attacks, remaining units were subsequently equipped with a ball-mounted machine gun 34 in the bow, crewed by the radio operator.

Radio equipment consisted of a receiver and a transmitter (Fu 5 and Fu 2). Internal communication was provided.

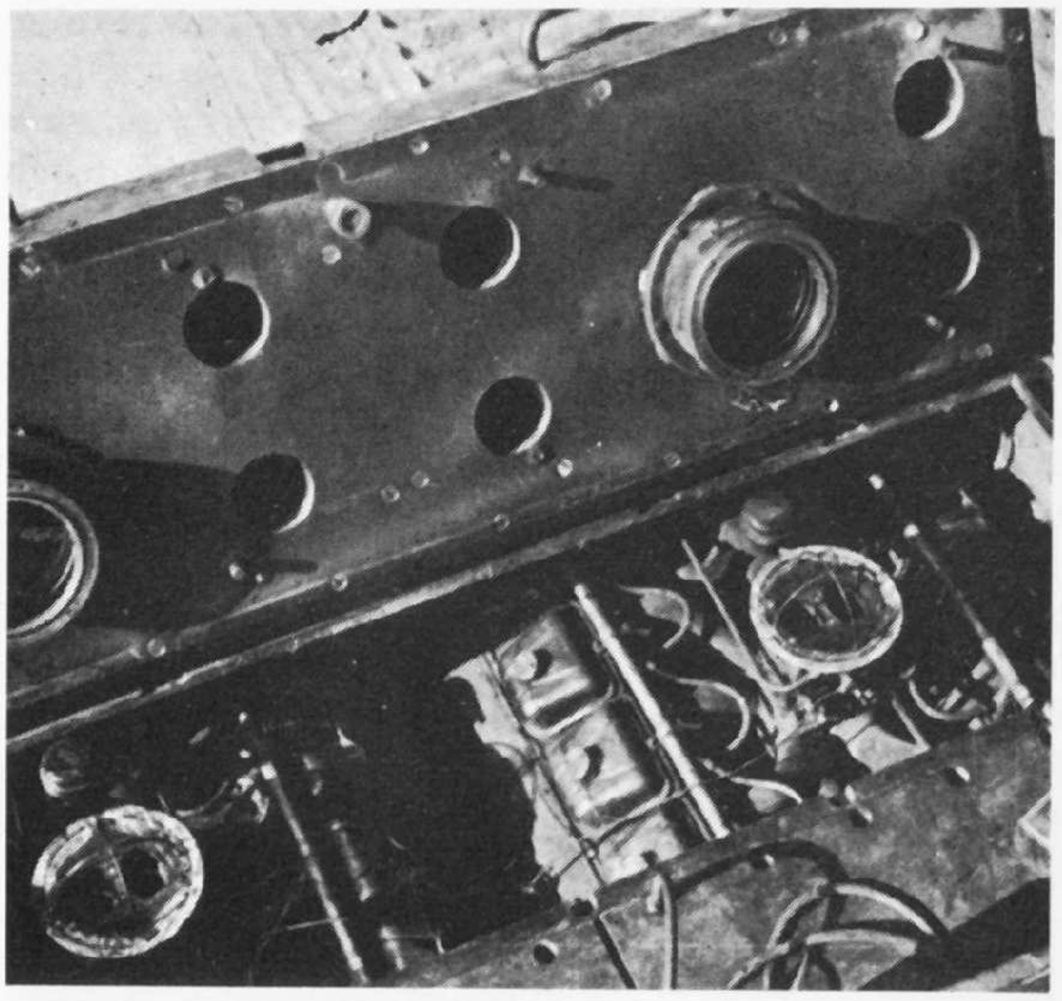
## PORSCHE VARIANTS

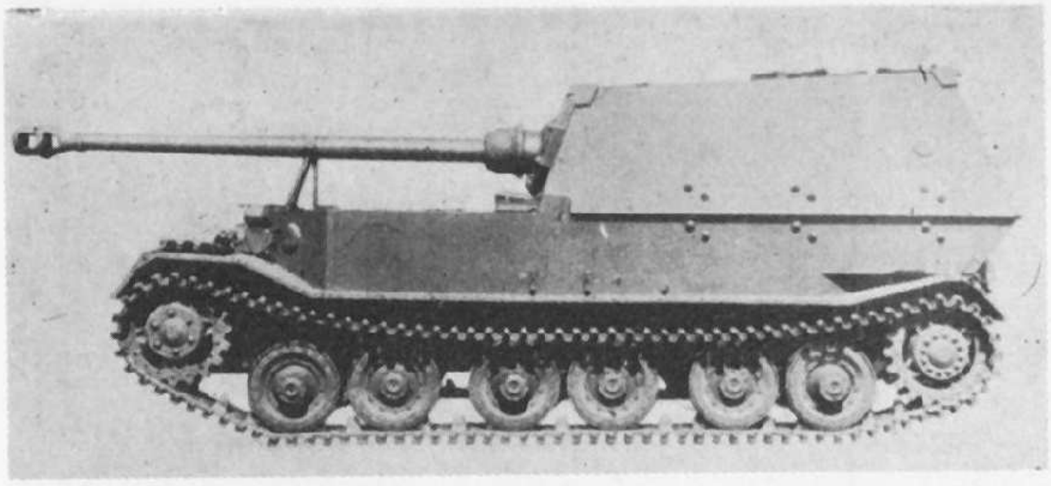
Nibelungenwerke, in setting up production schedules for the Porsche Tiger tank, envisaged also the necessity of creating armoured tank retrievers for such a heavy vehicle. From the first production batch, five chassis were set aside for this purpose. While the rest of the production, after the chassis had been assembled, was moved to Alkett for completion, these units remained in St. Valentin and were fitted with a small but fully-enclosed armoured superstructure. A Kugelblende 80 (ball-mounted machine gun 34) was installed in the front plate of the superstructure, providing necessary close-range protection. The basic armour of the tank with 100 mm. frontal plates was retained. No reinforcement was added. The recovery vehicles were issued to the two Elefant battalions and saw action both in Russia and in Italy.

A 21 cm. heavy mortar mounting on the chassis of the Porsche Tiger was also contemplated. But, since a similar attempt failed with the Henschel chassis, the project was dropped before it reached the prototype stage.

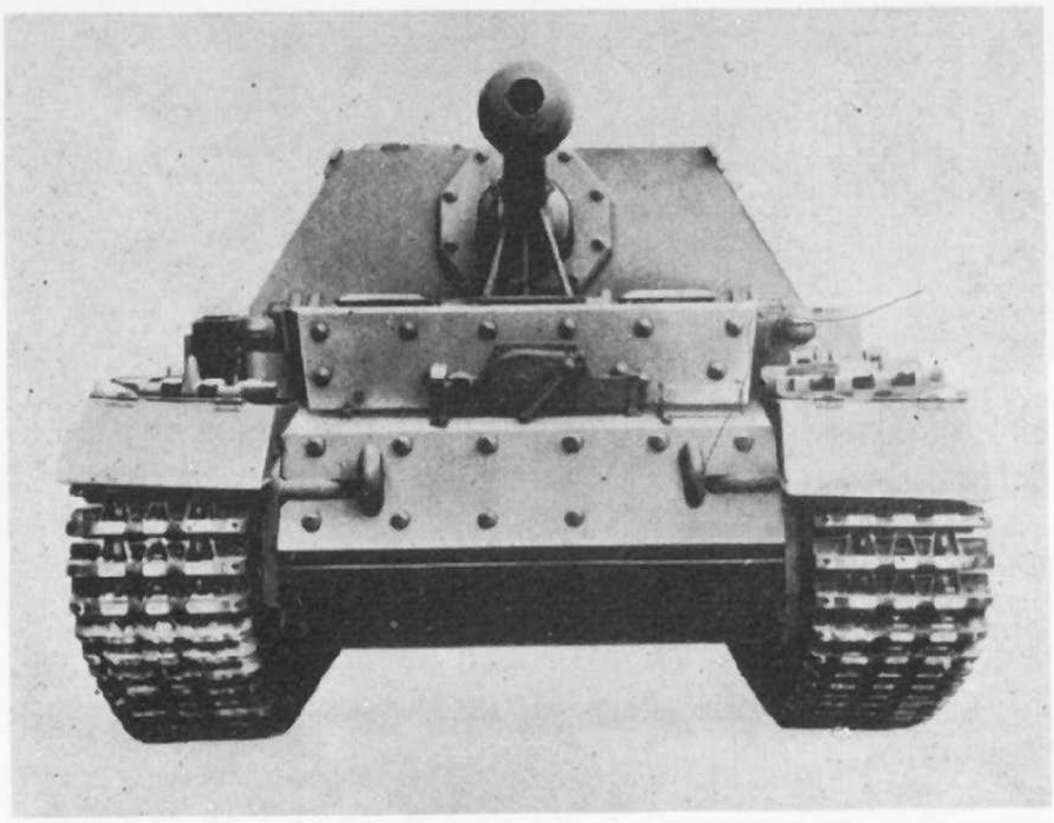
As a result of the experience gained during the savage street fighting in Stalingrad, Hitler ordered the production of so-called "Ramm" vehicles. They were supposed to wreck buildings which were heavily defended. In order to increase their radius of action, armoured fuel trailers were to be coupled to these units. Porsche investigated this requirement, preparing blueprints and models of a vehicle which was supposed to be called "Ramm-Tiger". Using the Type 101 chassis, they were fitted with a turtle-like superstructure sporting a pointed, shovel-like frontal section. Visibility for the driver was provided by means of a large opening in the glacis plate. Since grave doubts existed about the practicability of such an approach, the design never progressed beyond the blueprint stage.

*This picture shows the installation of the two power plants parallel to each other, occupying the engine compartment almost completely.*





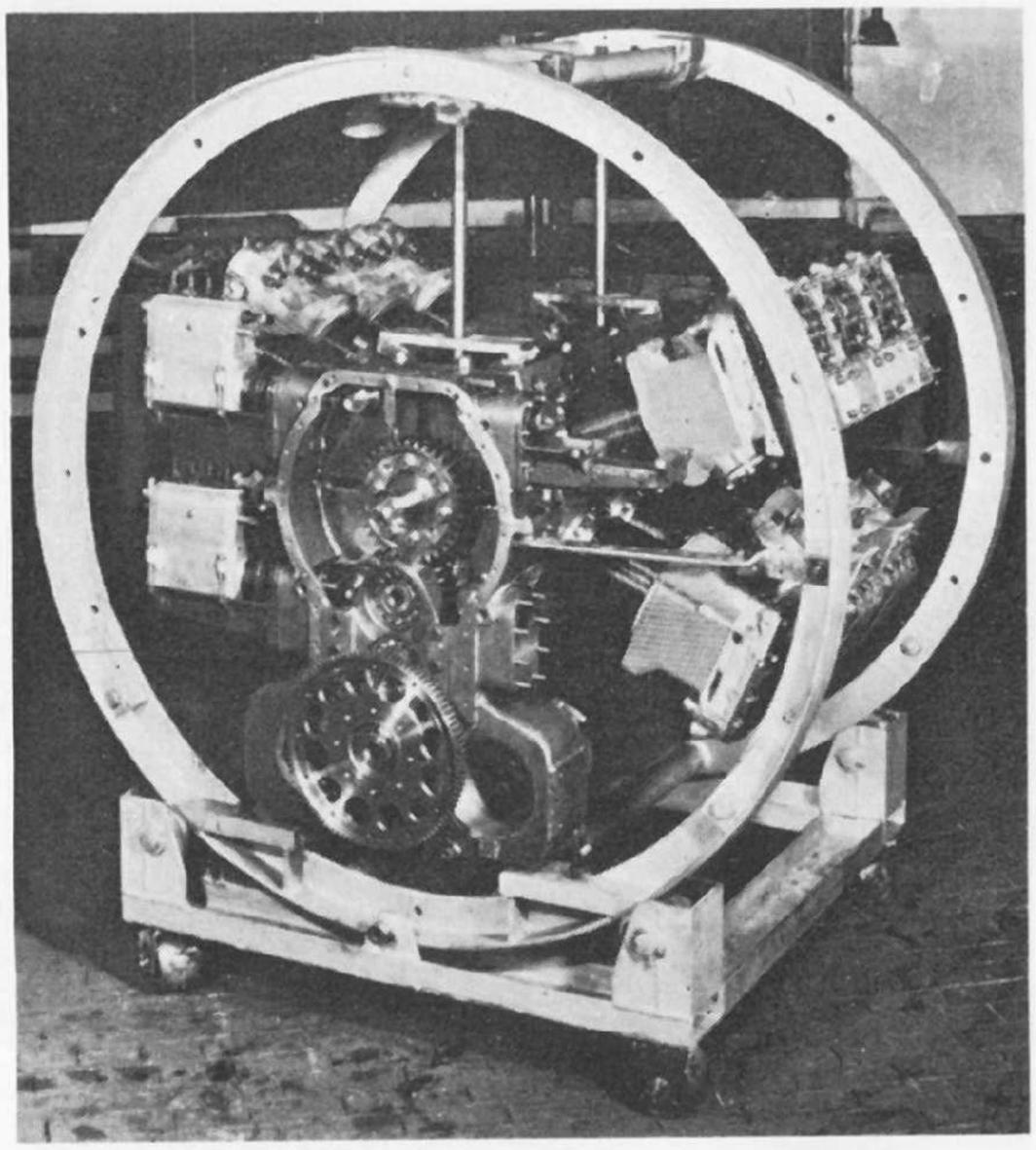
*A side view of the Elefant shows the armoured superstructure which replaced the rotating turret of the Porsche Tiger. The circular indentation on the side of the hull was originally an escape hatch for the driver. Later it was eliminated completely.*



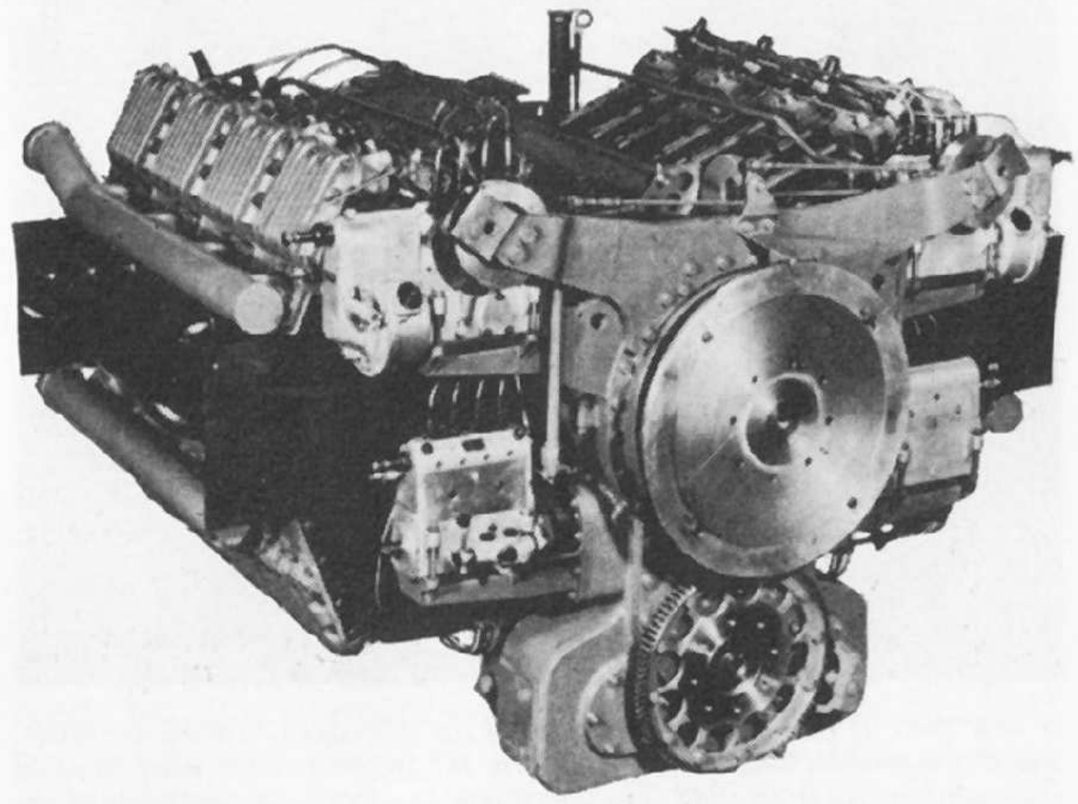
*The additional armour bolted to the Elefant's hull is clearly visible in this picture.*

Type 102 in the Porsche design programme was the already-mentioned Tiger with hydraulic instead of electric drive. One prototype of this series was equipped with a Voith "NITA" transmission and had, unlike previous models, two radial engine blowers to provide necessary cooling air for the transmission. This test vehicle had the designation Type 103. Tests were also conducted to investigate the feasibility of using half a Volkswagen engine with two cylinders only as a starting motor for the air-cooled tank engines.

The redesign of the Tiger tank, ordered by the Ordnance Department in the autumn of 1942, initiated at Porsche both Types 180 and 181. The Ordnance designation was VK 4502 (P). The designs now had inclined armour plates, following the trend of the time. Both models again appeared as drawings only. However, the turret, as in the case of the Tiger I development, was put in production. It was used for the first 50 units of the Henschel version of Tiger II, the so-called "King Tiger". Type 180 had a proposed petrol-electric drive, while its counterpart, Type 181, was intended to receive a hydraulic drive train. Two basic layout versions appeared on the drawing boards: one had the conventional arrangement with the fighting compartment in the front section of the vehicle, while the second placed the turret towards the rear. No changes were contemplated in the engines of these two types. Two parallel power plants were envisaged, however, and a diesel version was investigated. Fuel injection for the Otto engine was also examined.



*This unit was intended to become the main German tank engine starting in 1945. It never reached the stage of mass production however.*



*Continuous failures experienced with the 10-cylinder air-cooled tank engines prompted Porsche to create a 16-cylinder diesel engine designed to replace the Maybach water-cooled Tiger power plant. Only a few engines of this kind were built by Graz-Simmering-Pauker.*

The disadvantages of the dual engine arrangement were obvious and eventually led to the design of a brand new power plant which incorporated the combined experience of all previous attempts. Designed by both Porsche and Graz-Simmering-Pauker of Vienna, a 16-cylinder air-cooled diesel engine was conceived, which was supposed to deliver approximately 700 b.h.p. With a total displacement of 37 litres, it was intended to become the standard tank engine of the German armoured forces. Only a few trial engines were completed when the war came to an end. Under the designation "SLa 16" (Porsche Type 212), one was installed in a Jagdtiger, where it performed rather promisingly. Unfortunately, the new engine demanded a modification of the Tiger hull, thus delaying even further this much-

*Three new Elefants of the first production run during test trials at the Alkett factory in Berlin. The gun mantlet is without the additional protection applied later on.*

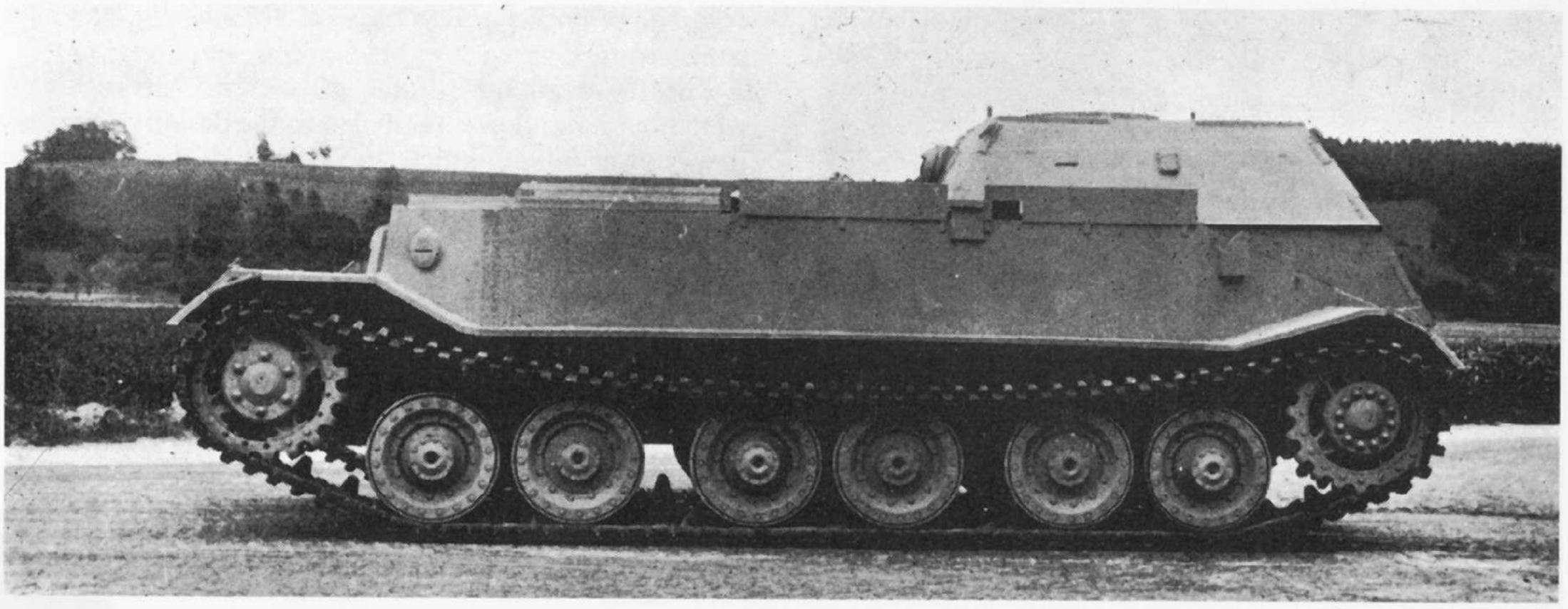
*A rear view of the Elefant preserved at the Aberdeen Proving Grounds, shows the interlocking armour plates of the superstructure used on most German vehicles from 1943. The concentric hatches in the rear plate of the superstructure served for the ejection of empty cartridges during combat, and also (the larger one) for the removal of the gun.*

needed innovation. As an 18-cylinder unit with an output of 780 b.h.p., the engine was also intended to be used for the Panzerkampfwagen "Maus" (Porsche Type 205). With that the story of the Porsche Tiger development ends.

## TACTICAL EMPLOYMENT

The appearance of superior Russian tank and anti-tank weapons shortly after the beginning of the German campaign in 1941 forced the German High Command into many a makeshift solution. Emergency orders to the German armament industry and the use of captured enemy equipment stabilised to a certain extent conditions on the front and again established a balance of power. Two categories of new anti-tank weapons emerged from this situation. One was the lightly armoured self-propelled gun mounted on an almost obsolete tank chassis. Most of these vehicles had their fighting compartment open on the top. The other solution provided for well-thought out, well-armoured and fully-enclosed full-tracked vehicles, eliminating the rotating turret, and

*The Elefant armoured recovery vehicle lacked the supplementary armour of the tank destroyer version.*

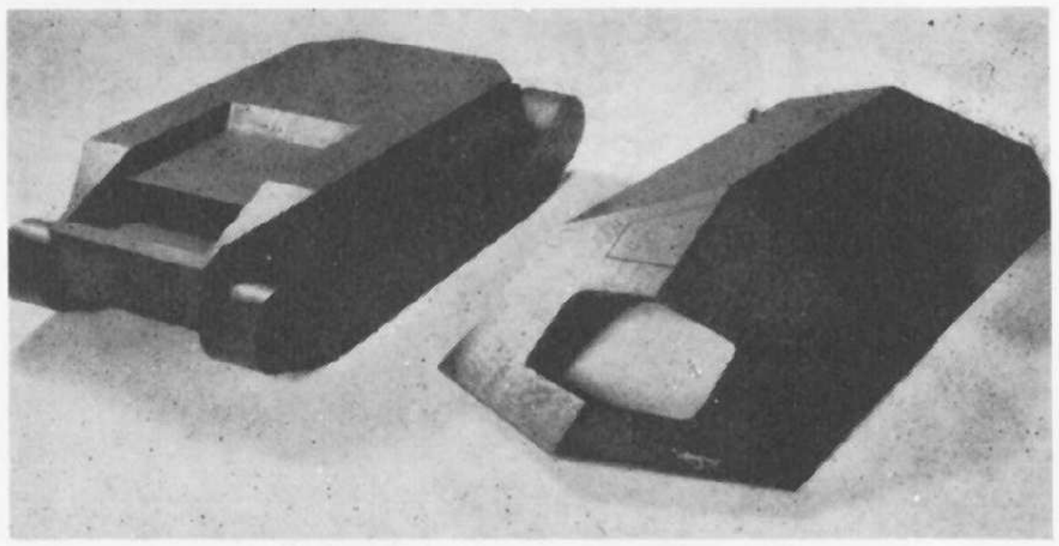



*Two Elefants knocked out during the summer offensive in Russia in July 1943. Assigned to Army Group Model, the northern arm of the pincer movement against the Kursk salient they were unable to provide enough momentum for the German attack. Determined Russian resistance stopped the offensive and forced the Germans on to the defensive.*

with their guns mounted in limited traverse. Both categories existed side by side for almost two years before the latter became predominant. Eventually these vehicles replaced to a large extent the conventional battle tank as German tactics responded to the defensive nature of warfare toward the end of the European conflict. The Ferdinand or, as it was later called, the Elefant, was something in between. The necessity of having to use all conceivable means to balance the situation forced the Germans to utilise all available equipment. Ninety chassis were around; they had to be used. They became equipment for two battalions of an armoured regiment (Panzer Abteilung 654). Each battalion had three companies plus a headquarters and supply section. Each company consisted of three platoons with four Elefants each. The headquarters company had two Elefants, one Panzer III and a number of soft-skinned vehicles. With reserve units allocated to these outfits, the total number of tank destroyer vehicles per battalion amounted to 44. They were intended to be used for break-through of defensive lines and for engagement against enemy tanks, anti-tank guns and artillery. Normally, two companies attacked in two front echelons, while the third company acted as a back-up unit.

## JULY OFFENSIVE, 1943

On 5th July 1943 the great German offensive, Operation Citadel, started in the area of Bjelgorod in Russia. A total of 17 armoured, three armoured infantry and 16 infantry divisions attacked in a pincer movement north and south of Kursk, against heavily fortified Russian positions in an attempt to change the course of the war. All the Elefants assigned to Army Group Model in the north participated. But they could not fulfill their obligation. Mechanically unreliable because of the complicated technical layout, short of ammunition because of limited storage, and unable to defend themselves against determined close-range attacks, they were never able to utilise the potential of their powerful gun. The attack bogged down after six miles and most of the vehicles which could not be retrieved fell into Russian hands during the ensuing counter-attacks. Removal of incapacitated equipment from the battlefield was a trying task, since the 18 t. half-track tractors normally



*Battle experience in Stalingrad prompted Hitler to demand a vehicle equipped with a superstructure capable of ramming and destroying buildings. An order to Porsche resulted in this wooden mock-up of the "Ramm-Tiger".*

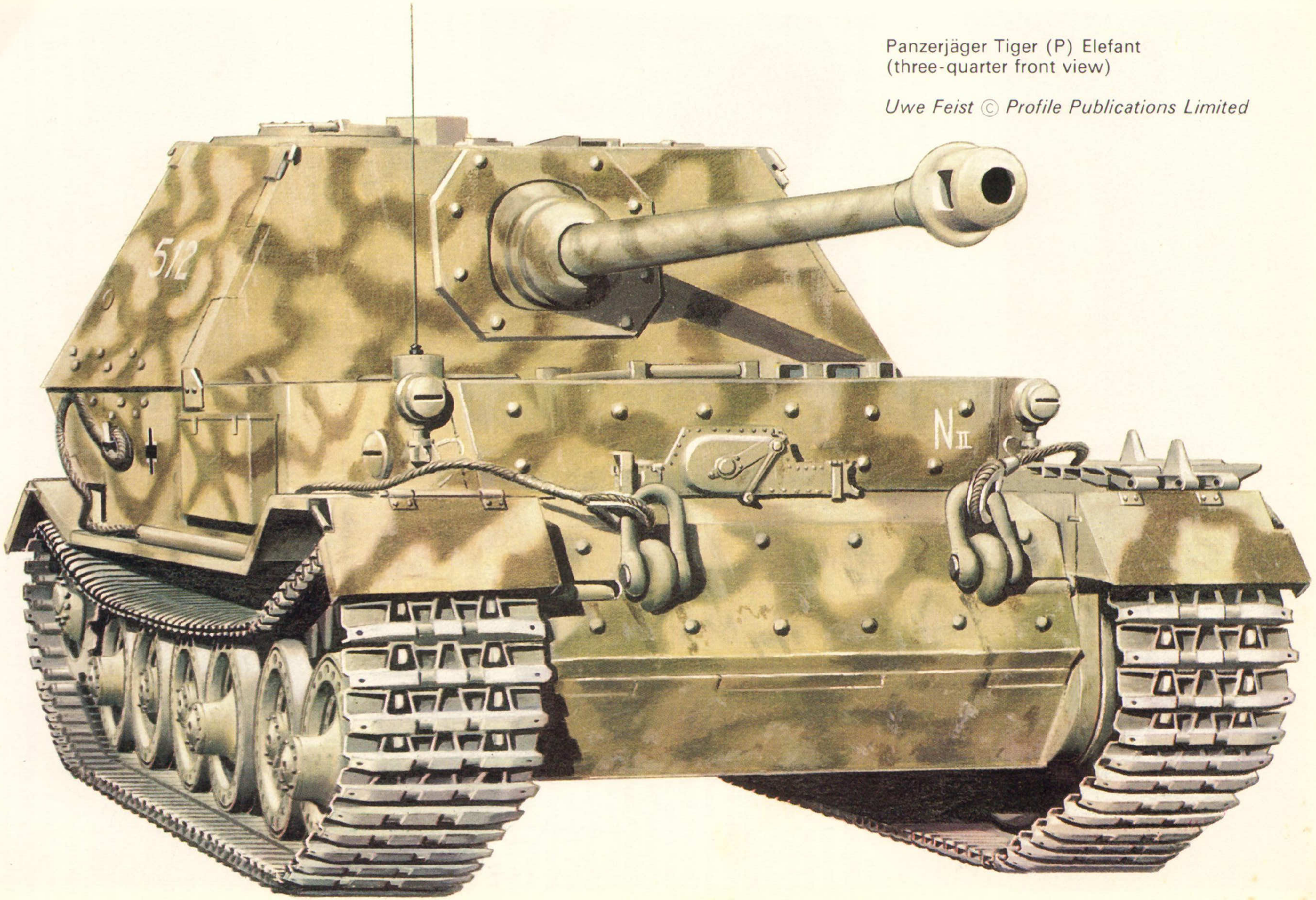
used for this purpose proved unable to move these heavy vehicles. However the bulk of them were somehow recovered, reconditioned and re-used on other parts of the front. They disappeared rather rapidly from the scene because of spare-part shortages, and the fact that copper for the electrical components was in too short supply. Removed from the Eastern Front, some of them saw action in Italy in 1944, where road conditions soon made it impossible for these vehicles to operate. They were either abandoned, captured or destroyed by their own crews.

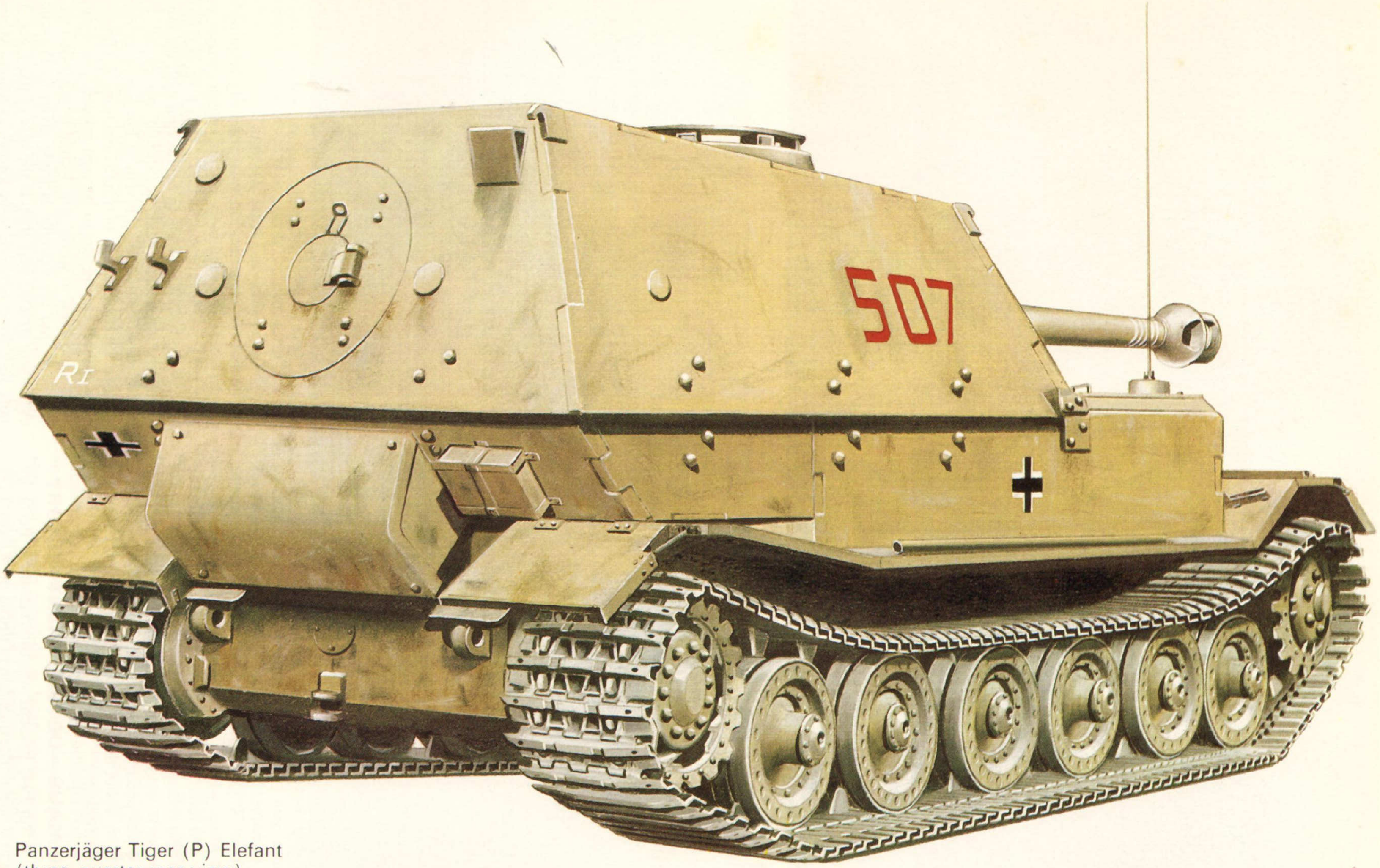
To sum up, it should be emphasised that the prototype Porsche vehicles served a definite technical purpose, namely to explore all possibilities of a petrol-electric drive train. This development found its climax in the adaptation of its features during the construction of the largest armoured fighting vehicle ever built, the 187 ton PzKpfw Maus. It was proven beyond any doubt, however, that a strictly technical solution, without consideration for military necessities, could only be a compromise at the best, and these findings were rather drastically demonstrated during the brief battlefield appearance of the Elefant.

Thus, we can conclude that we have been introduced to an interesting armoured fighting vehicle, reflecting in its own way the genius of its designer, Professor Dr. F. Porsche, who had proved yet again that he could master any conceivable area of mechanical design.

Panzerjäger Tiger (P) Elefant
(three-quarter front view)








Panzerjäger Tiger (P) Elefant
(three-quarter rear view)

*Maus I with its turret fitted complete with armament.*

# German Super-Heavy Tanks Maus and E-100

by John F. Milsom

DURING the course of the war the Germans directed a large amount of resources to the development of super-heavy armoured fighting vehicles, ranging in weight from 100 to 1500 tons. Apart from a super-heavy gun carriage called Grille and a heavy self-propelled mortar Karl (which was actually used in operations), only two vehicles, both tanks, were actually built. These were the Maus (Mouse) and the E-100.

It is uncertain just how much the men in the German tank industry generally believed in the future of heavy tanks. At the end of the war, all the engineers interrogated claimed that they were always opposed to such vehicles as impractical in combat and uneconomical of production resources. It is quite possible that their stories were coloured by later experience. At any rate, in 1942, many men must have felt differently because two Mouse vehicles were started at that time, together with one E-100. Both types were to use a turret mounting a 128 mm. gun (one layout showed a 150 mm. gun) as main armament with a coaxial 75 mm. gun. The armour was about 30% heavier than on the Tiger II. The weight of the Maus was about 200 tons and that of the E-100 about 150 tons. For the Maus, Porsche was developing all his own components, and the E-100 was to use Tiger II components until larger power plants were developed. Both developments were progressing quite slowly and there is no doubt that at the end of the war interest had ceased completely.

## THE MAUS—DEVELOPMENT HISTORY

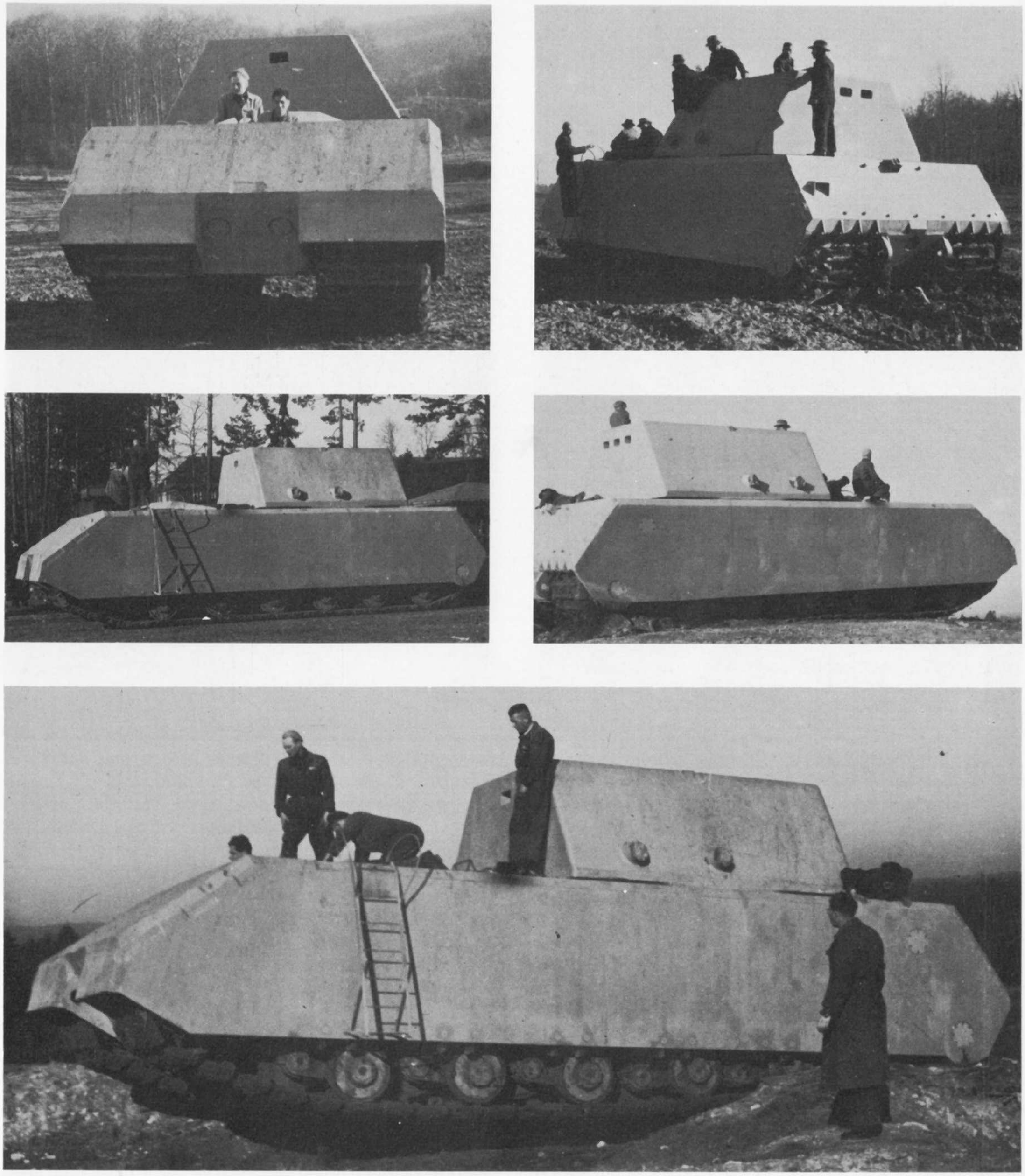
On June 8th 1942 Porsche was interviewed in Berlin by Hitler and Speer. The question of fitting the 8,8 cm. L/71 gun in the Tiger (P) was discussed, and then Porsche was asked to start work on a chassis to mount a 12,8 cm. or 15 cm. gun in a revolving turret, or, as an alternative, an 18 cm. gun as a piece of SP equipment. A coaxial 7,5 cm. gun was also to be incorporated.

At this time, Porsche was still President of the Panzer Kommission, and very influential due to his close relationship with Hitler. He pushed the design of super-heavy tanks. Heydekampf, Kniepkampf and Guderian were, on the other hand, of the opinion that tanks of this size did not have much future. When the project was first suggested, the vehicle was referred to as Mammut (Mammoth). They were intended to operate in pairs with the support of smaller AFVs. Basic armour requirements were to be:

Front: 200 mm.
Sides: 180 mm.
Track guards: 100 mm.
Turret front: 220 mm.
Turret sides and rear: 200 mm.

The Porsche organisation was primarily responsible for designing the machinery of this vehicle, which was given the Porsche type number 205. They also, of course, had certain responsibilities in connection with the hull.

Porsche suggested that he should design an air-cooled diesel engine for the vehicle but was over-ruled by Speer on the grounds of insufficient time. A Daimler-Benz aircraft engine was to be used instead. No stipulations were made as to the size, weight or performance of the tank, and the extreme latitude given to Porsche is even more striking here than in the case of the Tiger. The tank was, from here on, to be known as Maus (Mouse).



*Five views of the Maus during its trials, with a 55-ton weight set on the superstructure towards the rear of the vehicle to simulate the turret which was not yet completed. It was over 30 ft. long.*

The Maus was an effort to give a relatively large armament protection and 360 degrees traverse, together with the most adequate mobility. It was Porsche's opinion that the vehicle should not be classed as a tank in the strict sense of the word, but as a heavily-armoured mobile pill-box.

As with his Tiger design, Porsche decided to use electric transmission again but this was, of course, before the use of copper was given as one of the official reasons for the rejection of Tiger (P). He states, however, that he would have used it in any case as he considered it by far the most practical method of obtaining light steering of an ultra-heavy vehicle. It was decided, however, to redesign the system.

Towards the end of 1942 the Heereswaffenamt appointed a Col. Haenel to act in the capacity as chaser to all firms who were involved in the construction of the Mouse. His directive was to pay continual visits to all such firms, threatening them with serious penalties if they fell behind schedule in their work. Haenel's first visit to Stuttgart was on December 18th 1942 when he issued orders that the Mouse was to be completed and

*Assembly of the E-100 prototype was not complete when the war ended in May 1945. The partially finished vehicle was captured by the Allies. It was 869 cm long (without barrel overhang)*

ready for trials on May 5th 1943. This was naturally considered as being more humorous than anything else and no notice was taken.

Slightly before this, at the end of November, a hitch occurred as Daimler-Benz intimated that they could not supply the diesel engine which Porsche had proposed to use. The only other possible engine was the MB 509, an I.C. engine, which therefore had to be used in spite of Porsche's desire for a C.I. engine. It was found that this engine could only be installed in an inverted position necessitating the provision of a vertical gear train to bring the drive down to the level of the generator shaft.

The next event of any interest was on January 4th 1943 when Porsche was ordered to Berlin for the purpose of showing Hitler a model of the Mouse. Hitler showed considerable interest but no concrete comments or suggestions were made.

On January 12th members of the Heereswaffenamt came to Stuttgart and the allotment of the construction was put on an official basis as follows:

Design and production of vehicle as a whole—Porsche KG
Hull and turret responsibility—Krupp
Engine development—Daimler-Benz
Electrical apparatus—Siemens-Schuckert
Suspension, tracks and gearing—Skoda, (Prague)
Assembly—Altmaerkische Kettenfabrik (Alkett)
Design and specification of tracks—Alkett.

There followed a very large conference at Berlin on January 21st at which all outstanding major points were discussed, and it was decided to push on with the project as fast as possible. The only discordant voice appears to have been that of Kniepkampf (representing Wa. Prüf.6) who was positive that the vehicle would prove to be quite unsteerable.

Porsche was again summoned to Berlin on February 2nd 1943 and was informed by Haenel that he must incorporate a flame-thrower carrying 1,000 litres of fuel. He said that it could not be done but was over-ruled and was told that the flame-thrower was considered to be essential.

At this time it appears that the earliest possible completion of the Mouse was considered a matter of great urgency and there was a further "pressure" meeting between the Heereswaffenamt and representatives of the contracting firms at Stuttgart on February 10th. All the manufacturers protested against the inclusion of the flame-thrower on grounds that it would cause considerable delay in delivery dates, but it was again insisted upon. At the end of the meeting it was agreed that all firms would do their utmost but no actual dates were set.

The necessity for fitting the flame-thrower was the direct cause of a major change in design, i.e. a change from torsion-bar to volute-spring suspension. This was necessitated by the fact that a new suspension system had not been designed, the intention being to use Tiger (P) suspension units. The first detailed weight estimate

*The partially completed prototype of the E-100 has been hoisted on to a low recovery trailer for removal by its captors.*

had come out at 179·3 metric tons but this had increased slightly and with the addition of the flame-thrower (4900Kg) the total increase amounted to slightly more than 5½%. This could only be catered for by the inclusion of two additional suspension units (one on each side) but as there was not enough room to accommodate them this solution was not practicable. In collaboration with Skoda it was therefore decided to adopt a simple volute spring suspension as time was all-important and Porsche did not wish to design a new torsion-bar layout in a hurry and without time for proper mechanical testing. This appears to be the complete explanation for Porsche's departure from his favourite form of suspension.

At the end of February 1943 extensive tests of the somewhat complex engine cooling arrangements were carried out at the Technical Institute of Stuttgart under the supervision of Professor Kamm. These were found to be quite satisfactory.

Speer paid an unexpected visit to the Stuttgart offices on April 6th 1943 and remained for half-an-hour inspecting a full-size wooden model of the Mouse.

On April 10th orders were received to take the model to Berchtesgaden, doubtless as a result of Speer's inspection. It was accordingly dismantled and packed up but on April 16th the order was cancelled so it was re-assembled again. On May 6th the order came through for the second time and the model was finally inspected by Hitler at the Führerhauptquartier at Rastenburg on May 14th 1943. Complaints were made that the size of the tank made the 12,8 cm. gun like a child's toy and accordingly Krupp was ordered to prepare a new turret mounting a 15 cm. gun, the coaxial 7,5 cm. to be retained. It seems hardly probable that Hitler would have ordered a larger gun on purely aesthetic grounds but in point of fact it does appear that this is what actually occurred.

The Heereswaffenamt now began to complain about the amount of copper being used, so Rabe (Porsche's chief engineer) was sent to Zahnradfabrik of Friedreichshafen to discuss plans for using the well-known ZF electro-magnetic gearbox, developed by this firm before the war and by now further developed to provide seven ratios. Wiedman, a director of ZF, refused to do anything without an OKH contract and as this was not forthcoming the matter was dropped and the manufacture of the electric drive was continued without alteration.

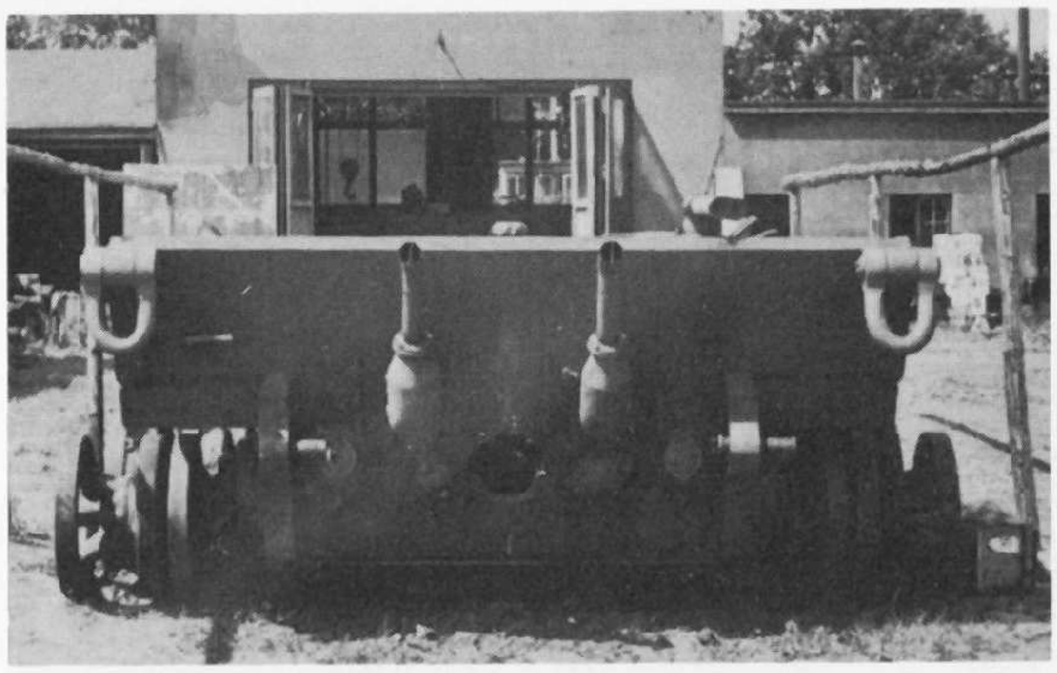
On July 16th, the MB 509 engine arrived at Stuttgart and was sent to the Technical Institute for further trials both of itself and of the cooling system, under Professor Kamm. The only modifications necessary to convert the engine from aircraft to tank use had been minor detail to permit operation in an inverted position and a lowering of compression-ratio and boost pressure in order to allow for lower grade fuel. No troubles were experienced on these tests.

At the beginning of August it was decided to construct a second prototype tank as Daimler-Benz could now supply a diesel engine modified from the MB 517 motor boat engine.

Alkett had begun assembly of the first tank on August 1st when Krupp intimated that they could not keep their delivery dates on account of interruption by air-raids.

A very significant date is October 27th 1943 when Porsche and Rabe met Speer in Berlin and were told that no arrangements were going to be made for the eventual production of the Mouse. However, the construction of Mouse I (with MB 509 petrol engine) and Mouse II (with MB 517 diesel engine) was to be continued. (Speer and Saur stated that this project helped to clarify their ideas on the optimum size of heavy tanks. In Saur's opinion 80 tons was the economic limit in weight).

Krupp supplied the hull in the middle of September



*Rear view of the partially assembled E-100 prototype. The tank was 448 cm wide.*

and Mouse made its first trial run at Alkett on December 23rd 1943 with a 55-ton weight in place of the turret. This trial was satisfactory as far as it went and on January 10th 1944 the tank was sent to Böblingen near Stuttgart for extensive trials on the tank-testing ground there. Herr Zadnik was the driver on these trials.

The trials were very trouble-free except for several cases of spring failure and it is stated that these would have been stiffened slightly had the tank gone into production. There was also a bearing failure in the auxiliary. gearbox which could not be accounted for, as no trouble had been experienced with this assembly on the test-rig. The tracks gave no trouble nor did the two-stage epicyclic reduction—about both of which Porsche had expressed concern earlier.

Herr Zadnik reported that the steering was excellent, it being possible to turn the tank on its own axis, with, of course, contra-rotation of the tracks. Manoeuvrability and cross-country performance were tested on snow, ice, grass, mud and hard surfaces, and independent observers, who had witnessed earlier tests of different vehicles, are reputed to have told Zadnik that the Mouse did everything that the Panther did. This indicates very exceptional resistance to bellying and is explained by the phenomenally high ratio of track width to belly width. The maximum speed on a hard surface with full motor speed was 13 k.p.h., and on weakening the field to a minimum a speed of 22 k.p.h. was recorded.

At about this time instructions were given to Porsche by Hitler that the complete tank, with turret and guns, was to be ready by June.

Mouse II, to be fitted with the MB 517 engine, arrived at Böblingen on March 20th 1944, and was put on one side until such time as the engine was delivered.

On May 3rd the first turret arrived from Krupp in a bare condition. A few days later the guns arrived (12,8 cm. L/55 and 7,5 cm. L/36·5) together with the powered traverse and all other turret fittings. By June 9th the turret had been assembled and fitted to the tank (by Krupp engineers) and further trials were started. These were very satisfactory and performance was slightly up, doubtless due to the fact that the turret weighed rather less than 55 tons (the weight previously fitted). At the beginning of October orders were received to send the tank to Kummersdorf.

Immediately after this, the MB 517 engine arrived at Böblingen. During tests in September 1944, this engine had shown itself to be superior to the MB 509, and, in addition, special manifold cooling arrangements had been made in order to overcome the trouble experienced with the petrol engine.

The engine was installed and Mouse II was sent straight to Kummersdorf without trials. This was at the beginning of November and was on instructions from the OKH, the reason for these instructions not being known. On arrival at Kummersdorf the engine was started and immediately broke its crankshaft, this being traced to faulty alignment of engine and generator.

In the middle of March 1945 another engine was delivered to Kummersdorf and Porsche sent a team of fitters to install it. These returned to Stuttgart on April 3rd having completed their job and successfully run the engine, but they state that the tank had not been driven up to the moment of their departure.

Thus the Mouse situation at the end of the war in May 1945 was:

a) Mouse I, with MB 509 petrol engine and 12,8 cm. L/55 and 7,5 cm. L/36·5 guns, completed and fully tested;
b) Mouse II, with MB 517 diesel engine but no turret, untested.

A further nine prototypes were in various stages of construction, and production plans had been made for 150. The vehicles at Kummersdorf were blown up by the Germans.

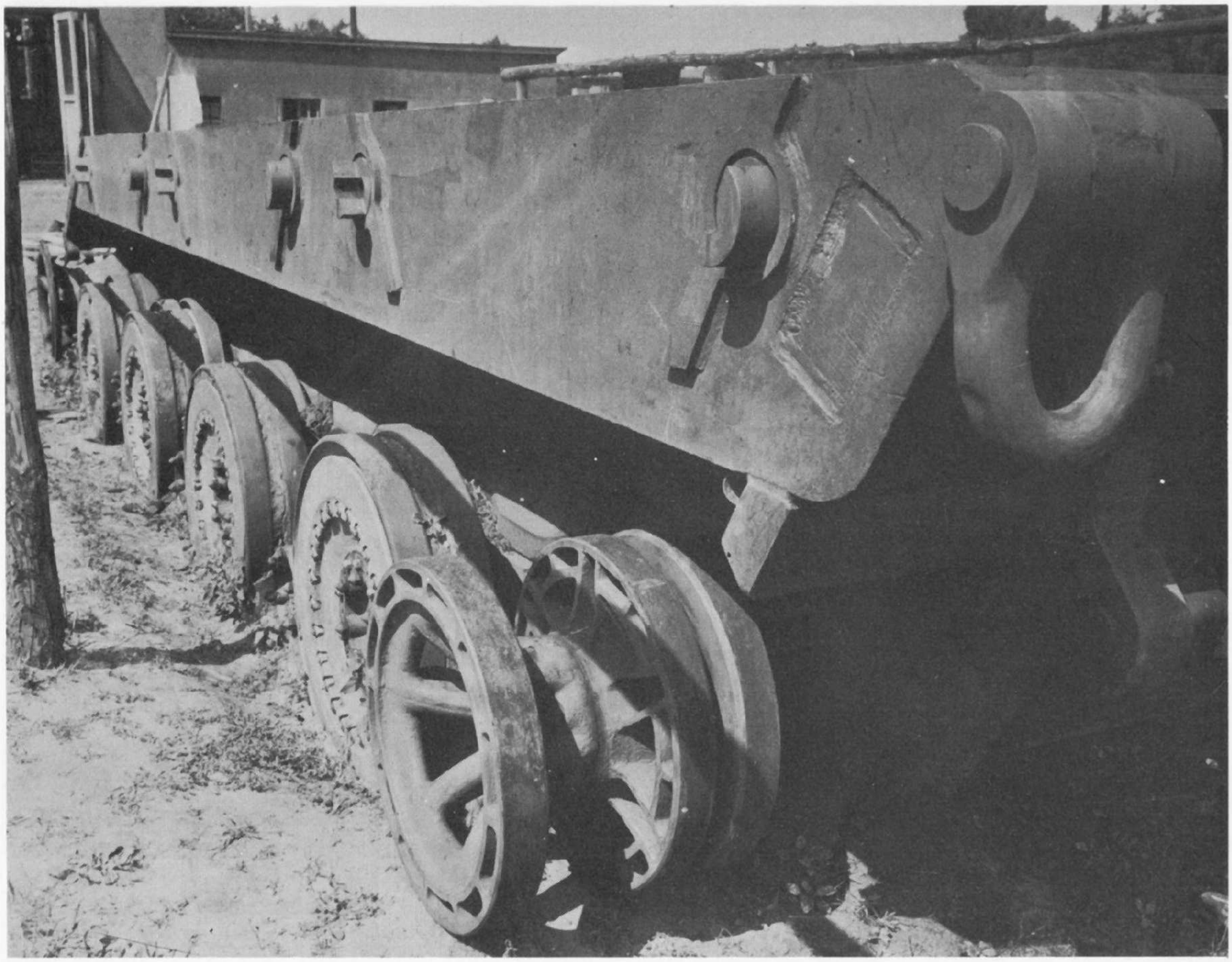
## THE E-100—DEVELOPMENT HISTORY

Since the development of the E-100 tank was less spectacular than that of the Maus, and since it was never completed to the running stage, not a great deal is available on this vehicle. For this reason, a full technical description of the Maus is given, but only a partial one of the E-100.

The Heereswaffenamt knew that, should Hitler ever decide to build very many super-heavy tanks, they would have to supervise the construction, and as a result they wanted a design which could be most easily built. Such a vehicle was needed to offset Dr. Porsche's Mouse. Originally, Henschel was given an order to build a super-heavy version of the Royal Tiger, called the VK 7001 Tiger-Maus. This was, however, cancelled in favour of the E-100. As the result, the engineering staff of Adler, under the direction of Dr. Jenschke, were loaned to the Heereswaffenamt to design the new tank, the design of which was commenced at Friedberg on June 30th 1943. The E-100 was one of a whole range of new armoured fighting vehicles designated the "E" (Entwicklung=Development) series.* By the end of the war its parts were under assembly near Paderborn.

The Germans were seeking to gain more room in the fighting compartments of their tanks, necessitated by the stowage requirements of larger-calibre ammunition, without increasing the exterior dimensions appreciably. This unwillingness to increase the exterior dimensions was prompted by (1): realisation of the fact that armour is the larger percentage of total vehicle weight; therefore the size of the exposed space should be a minimum, and (2): the fact that there were limitations in size for

*The others were: E-5 (5 tons); E-10 (10–15 tons); E-25 (25–30 tons); E-50 (50 tons—Panther replacement); E-75 (75 tons—Tiger I and II replacement).



*Close up of left side of E-100 hull showing the lugs used for securing massive armoured side skirts.*

strategic mobility. To achieve maximum use of space in the fighting compartment and to increase the fighting ability of the tank, it was decided to do away with torsion-bar suspension and to eliminate the power-train from the crew compartment. The result was a new exterior-fitted suspension and a combined transmission, steering and final drive system packed into as small a space as possible for mounting in the rear of the engine. The positioning of the power-train in the engine compartment was expected to improve accessibility to a considerable degree, in addition to saving weight and space. In the design of this new vehicle the maintenance factor was to play a much more important part than had been the case in previous models. Another reason given for the elimination of the torsion-bar suspension was the desire to install a floor escape hatch in tanks, heretofore impossible with the interleaved wheel and torsion-bar suspension. Belleville washer springing was used instead and fitted externally, in an interleaved arrangement. The suspension system was developed by Dr. Lehr of M.A.N. at Augsburg. As regards the design of the new suspension units, a low spring rate was desirable to aid in reducing the pitch rate of the vehicle as low as possible.

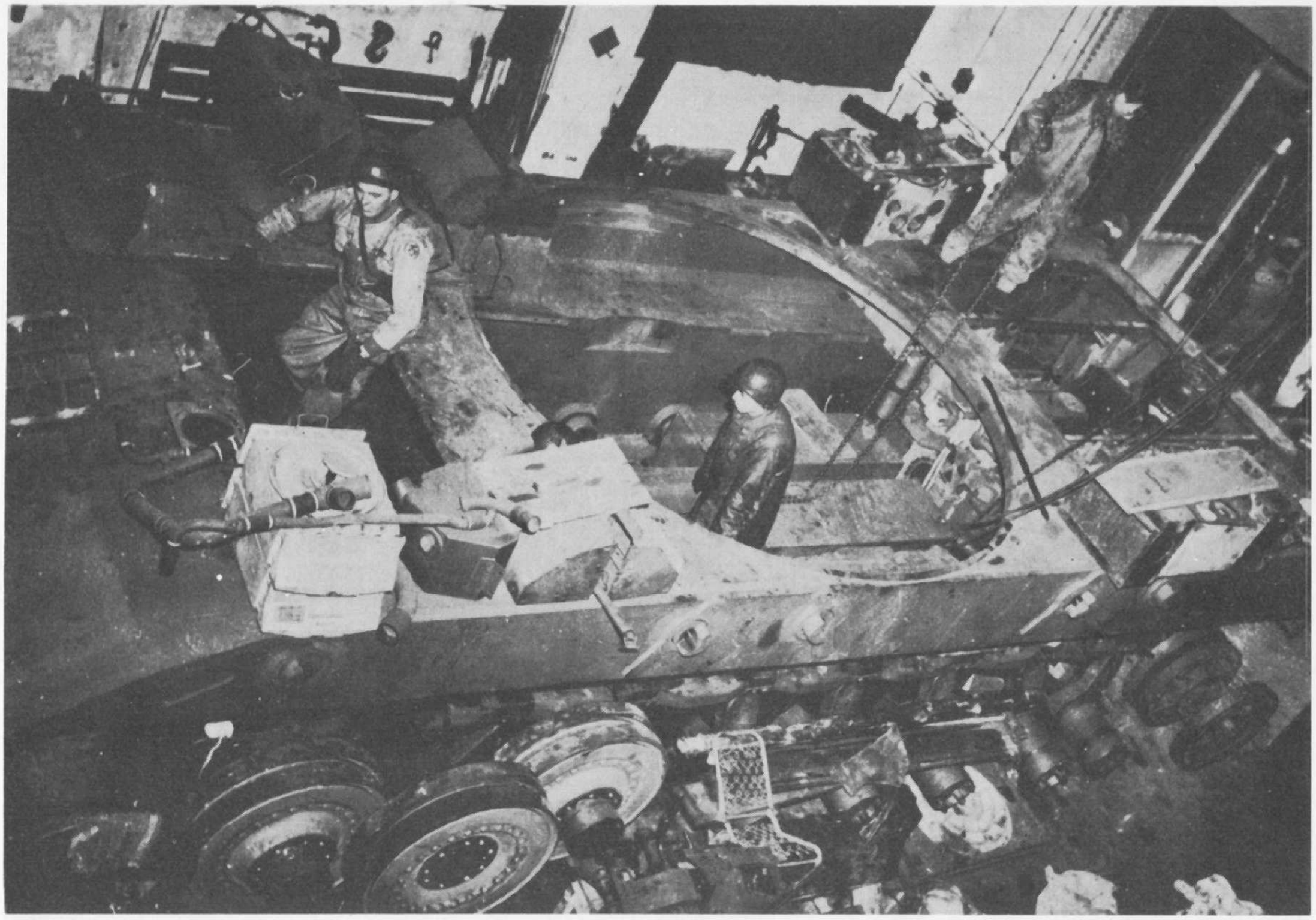
Dr. Jenschke stated that the vehicle as a tank was obsolete as soon as the drawings were finished, due to inability to load the weapons in a turret mount.

E-100 used the same engine as the E 50/75 models, based on the Maybach HL-230 P30. This 12-cylinder V engine developed 700 h.p. at 3000 r.p.m., which would have resulted in the low power/weight ratio of about 5 h.p./ton. A modified HL 234 engine with Bosch fuel injection developing 900 h.p. was completed. With super-charging this engine was to have developed between 1000 and 1200 h.p., which would have raised the power/weight ratio to 8·5 h.p./ton.

The gearbox was a Maybach 8-speed OG 40 1216B. The steering system (the same as used on the Tiger) was built by Henschel Werke at Kassel. The tracks were built by Adler. The M.A.N. suspension consisted of two-wheeled single springs in overlapping arrangement with two guide lugs, suspended by double spiral springs outside the hull. There were shock-absorbers on the inside. In combat a 1-metre steel track was to be used, which would have given a ground-pressure of 19·9 p.s.i. For rail transport a special new track was to be mounted.

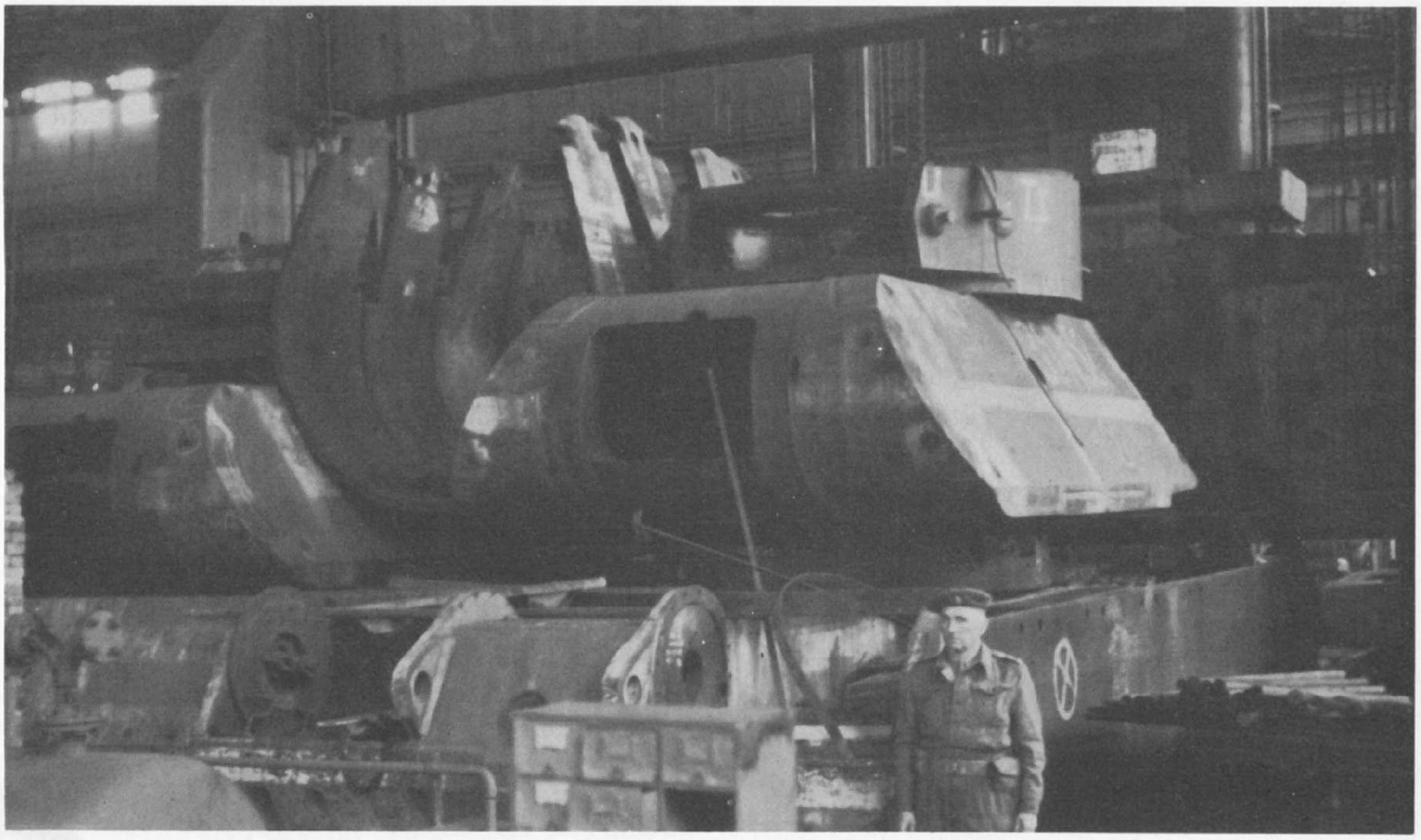
Frontal armour was 200 mm. at 30° and side armour 120 mm. All armour was interlocked. A crane was fitted for lifting protection skirts and ammunition.

The turret was made by Fried. Krupp, Essen, and was very similar to that of the Mouse. As its completion was delayed, an equally heavy trial turret was to have been mounted for driving tests. The final turret was to have had a gun of calibre 17,4 or 15 cm. When the hull was completed, however, it was determined that the vehicle did not have sufficient space to carry a 50 ton turret as



*Top view of partially assembled E-100 being examined by American troops. The tank was to be 332 cm high.*

*Maus hulls and turrets. Production plans had been made for 150 of these 185 ton tanks. The Maus was 1008 cm long, of which 105 cm was barrel overhang. It was 367 cm wide and 366 cm high.*



originally planned. After some time, therefore, it was decided to alter the vehicle to an SP mounting.

Although the vehicle was produced at Adler Werke, assembly of the one prototype was half-complete at Henschel proving grounds (Haustenbeck near Paderborn) when the war ended. The project had been officially discontinued in June 1944.

## MAUS DESCRIPTION

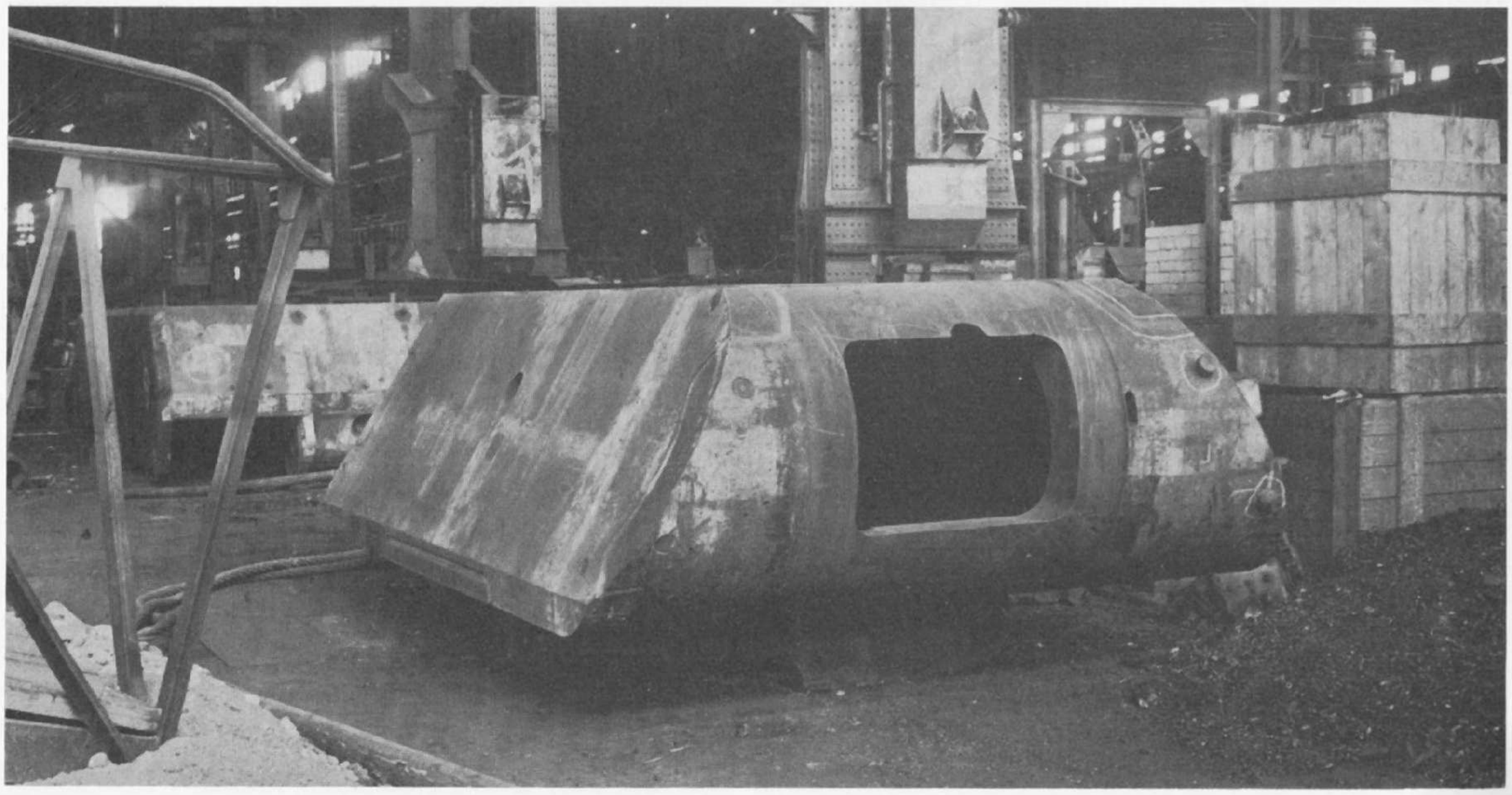
The general impression given by the interior of the Maus, in spite of its size, is that it is filled almost completely with a mass of complicated machinery. The production difficulties facing the designer were mainly as follows:

a) Overall size and weight—185 tons
b) A 12,8 cm. gun with 38 in. recoil and 60 in. ammunition. This necessitated an overall turret-ring diameter of 9 ft. 7 in.
c) Armour plate thickness up to 350 mm. (horizontal across the driver's front) and strong frontal floor armour against mines
d) Performance—top speed of 12½ m.p.h.
e) Power unit—to provide 1200 h.p.
f) Transmission
g) Suspension—incorporating small vertical movements
h) Transportation.

The hull of the vehicle was designed as an armoured box, spanning the entire width of the chassis. The track and suspension arrangements caused two sponsons which ran the length of the vehicle and were large since the tracks were more than 43 inches wide. There was thus a central well also running the length of the tank filled with the complicated power and drive train. The front portion of the tank had the fuel tanks in each sponson, and in the compartment which contained the driver and the wireless operator in the central well between them. Behind this was the compartment containing the engine, cooling fans, radiators etc. Again, behind this, the main generator was placed centrally, and in this transverse section all the nearside sponson was occupied by ammunition stowage, and the offside partly so, and partly by batteries and the auxiliary power plant. The rear part housed the propulsive motors in the sponsons, the output from these being inwards into the well through transfer cases to the final drives and sprockets which were, of course, in the suspension tunnels. The crew in the fighting compartment were situated above the main generator and thus, being cut off from the forward compartment by the engine and its cooling apparatus, had no access to it. The air intake was situated centrally above the engine and just behind the driver and wireless operator. The wireless and inter-communication equipment was situated on the operator's right-hand side in the forward compartment. The centre of gravity of the vehicle was further to the rear than usual. This was due to the location of the turret. The armour was all rolled with the exception of the turret front and mantlet. A 100 mm. thick front belly plate was incorporated as an anti-mine precaution. One access door was provided for the driver and operator and two for the crew in the turret. Some of the periscopes were of conventional design, but others were specially prepared for submersion. The driver's seat had two positions; one for driving in action (closed down) and the other for driving with the escape hatch open and the driver's head exposed. His controls were fixed relative to the seat position, so that he was given the maximum of comfort in both positions.

Two types of engine were considered—compression-ignition (MB 517) or air-cooled petrol (DB 603). Porsche was in favour of the compression-ignition type. The two engines used in the Maus I and II were developments of the Daimler-Benz 603 inverted 12-cylinder V petrol aircraft engine. That in the Maus I was called the Mercedes-Benz 509 and retained the petrol-injection characteristics, while that in the Maus II was called the Mercedes-Benz 517 being installed in the upright position and converted to C.I. There was a 2-cylinder 8 h.p. auxiliary petrol engine which was used to give pressurization to the crew compartment for air-con-

*Maus turret. It weighed 50 tons and was almost identical to the turret intended for the E-100.*



ditioning purposes and snorkelling. It was also used for heating, poison-gas filtration and battery charging.

The electric transmission provided the tank with an infinitely variable range of ratios. It also provided a means of self-starting and was used for propulsion during submersion, the power being provided through cables by a second tank. The electric motors developed a speed of 20 k.p.h. at 3100 r.p.m. They drove simple reduction gears that could be shifted for either road or cross-country operation. The final drives and sprockets were in the suspension tunnels.

A schematic design utilising bogey type torsion-bar suspension (the type used on the experimental Porsche Jagdtiger) was considered, but abandoned due to space considerations. Later a new unconventional volute-spring type was used. This consisted of 24 identical double rollers assembled in 12 bogies, 6 on each side. The bogies were attached to a cross-beam which in turn was secured to the hull and apron. Each pair of bogies was attached to a double crank-arm, and was sprung by double coil springs. The road wheels were similar to those on the Tiger II and had steel rims with rubber inner liners. The tracks were produced by Altmaerkische Kettenfabrik and were 44 inches wide.

The turret was practically identical to that intended for the E-100. The front was rounded and consisted of a single plate. Three bare hulls and turrets were found on the Krupp proving ground at Meppen. Two turrets were without armament but a mounting for a 12,8 cm. KwK 82 L/55 (originally referred to as 12,8 cm. KwK 44 (Maus)) and a coaxial 7,5 cm. KwK 44 L/36·5 was under construction. The cradle in which the guns were mounted was referred to as Mauswiege (Mouse cradle). The gun was sent to Meppen in November 1943 for firing trials. It was intended eventually to mount a 15 cm. weapon of lower velocity 38 calibres long. An AAMG was also to be installed in the turret roof, as well as a light mortar. The turret was fitted with a shock-absorption device to distort and absorb the horizontal energy components of violent blows given to it. It was of welded construction, massive interlocks being used. Total weight of the turret with armament and ready-to-use ammunition was 50 tons. It was rotationally out of balance. Assisted manual loading was used for the main armament. Both guns were fired electrically. The guns originally used fixed ammunition, although provisions were made later to use separate ammunition for the main armament.

The Maus was submersible to 26 feet. Tanks were to work in pairs, power being supplied to one, whilst submerged, by the other, stationed on the river bank. Lowering of the turret into the sealing ring was achieved by means of eccentrically located bearings of the six turret ring rollers. Two trunks were to be used initially, the forward one as an air-intake, and the rear as an exit. In this scheme each tank was to propel itself by its own petrol-electric machinery. This was, however, abandoned on account of the fact that full power from the engines could not be developed, that difficulties existed with cooling air and exhaust gas disposal, and that it appeared unlikely that these tanks would operate singly. The successor scheme incorporated one trunk only. The electric transmission of the tank was used but power was supplied to it by cable from another vehicle stationed on the river bank. By operating in pairs the tanks could thus push and pull each other across. This latter operation (including sealing) would have taken about three-quarters of an hour. On reaching the far bank the crew would dismount to remove the trunk etc.

A special war flat was designed to carry this vehicle and at least one was made and used.

**AFV/Weapons Series Editor:**
**DUNCAN CROW**

### SPECIFICATION PANZERJÄGER TIGER (P) ELEFANT

**General**
Designation: 8,8 cm. Panzerjager 43/2 (L/71) Tiger P (SdKfz 184)
Crew: Six—commander, gunner, two loaders, radio operator, driver
Battle weight: 65 metric tons.
Power/weight ratio 8,16 b.h.p./ton.
Ground pressure: 3·44 lb./sq. in.

**Dimensions**
Length overall: 26 ft. 8 in.
Height: 9 ft. 10 in.
Width: 11 ft. 1 in.
Track centres: 8 ft. 9 in.
Track width: 25 in.

**Armament**
Main armament: One 8,8 cm. StuK 43/2 L/71 in limited traverse, centre fighting compartment.
Auxiliary armament: One machine gun 34 (loosely stowed inside vehicle), two sub-machine guns 38. (Later vehicles with ball-mounted machine gun 34 in the bow.)

**Fire Control**
Maximum elevation +14° to −8°.
Maximum traverse to 14°.
Traverse and elevation by hand wheels through gunner.
Firing system: Electric primer operated by trigger.

**Ammunition**
50 rounds for 88 mm. gun.
600 rounds for 7,9 mm. machine gun.
384 rounds for 9 mm. sub-machine gun.

**Sighting and Vision**
Main armament: One SF1. Zf 1a binocular telescope.
Commander: Telescope.
Driver: Telescope.

**Communication**
W/T set (transmitter/receiver/intercom): Fu 5 and Fu 2.

**Armour**
Machinable chromium—molybdenum armour.
Plate: All-welded construction, superstructure partially interlocked. Austentic welding.
Hull: Nose 100 + 100 mm. 31°, front plate 100 + 100 mm. 11°, lower sides 80 mm. vertical, upper sides 80 mm. vertical, rear 80 mm., 45°, top 30 mm. horizontal, bottom 20 + 30 mm. horizontal.
Superstructure: Front 200 mm. 22°, sides 80 mm. 31°, rear 80 mm. 19°, roof 30 mm. 87°.
Engines: Two Maybach "HL 120 TRM", gasoline 60° V-12 cylinder, water-cooled 11,867 cm., together 530 b.h.p. at 3,000 r.p.m.
Fuel: 240 gallons in two tanks on each side of the engine compartment.
Transmission: Porsche/Siemens-Schuckert petrol-electric drive with one generator and two electrical drive motors. Final drive ratio 16,75:1, three speeds. Electrical steering, hydro-pneumatic assisted.
Suspension: Three bogies each with two bogie wheels each per side, mounted on primary and secondary arms, incorporating longitudinal torsion bars.
Steel-rimmed road wheels. 31 in. diameter.
Track: Type Kgs 62/640/130; cast manganese steel, 109 links per track, 24 in. wide, track pitch 5 in.

**Electrical System**
12 V. dynamo. Two 12 V. batteries—120 Ah. Bosch BNG 4/24, 4 h.p. starter motors.

**Performance**
Maximum road speed: 12·5 m.p.h.
Cross-country speed: 6 m.p.h.
Maximum gradient: 22°.
Trench crossing: 10 ft. 6 in.
Wading depth: 4 ft.
Road range street: 95 miles. Cross-country: 55 miles.

# AFV/Weapons Profiles

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FUTURE TITLES WILL INCLUDE:

### Commando and Twister and High Mobility Vehicles

*by Christopher F. Foss*

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*by John F. Milsom*

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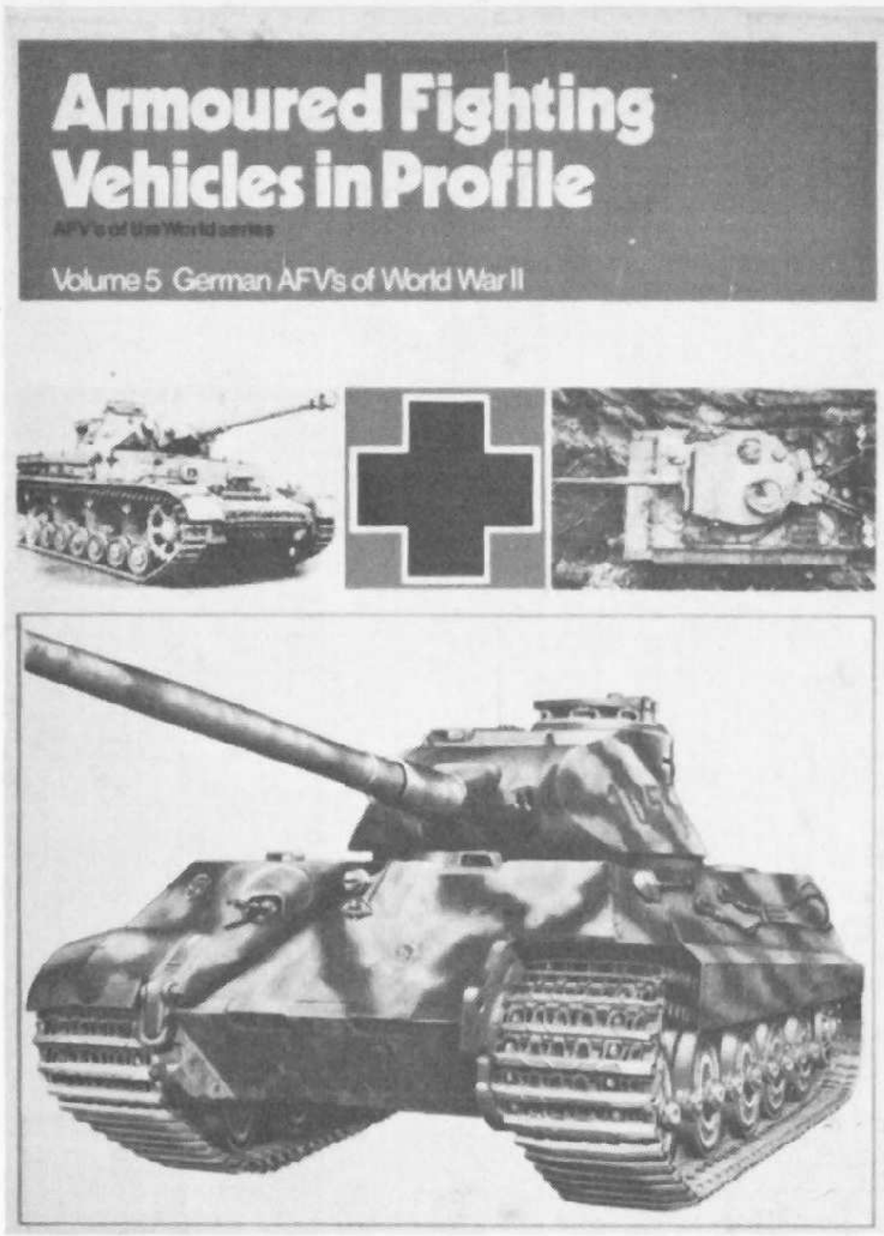


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