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Swiss Battle Tanks
by R. M. Ogorkiewicz



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Pz.61, the first tank produced in quantity in Switzerland.

Swiss Battle Tanks

by R. M. Ogorkiewicz

FOR centuries the Swiss have been renowned as infantrymen. In recent years, however, it is Swiss armoured units which have risen into prominence. They did this during the fifties and the sixties when they were formed into a highly effective force in keeping with the very sound doctrine shared by the Swiss with the Ancient Romans that the best way of preserving peace is to be ready for war. Moreover, Swiss armoured units have been built into an effective force partly by being equipped with battle tanks designed and produced for them in Switzerland.

As in other cases, the interest of the Swiss Army in tanks goes back to their first use by the British and French armies during World War I after which, in 1922, it acquired from France two light tanks of the Renault F.T. type. This highly successful infantry support vehicle well represented the stage reached by the development of tanks at the end of World War I. What is more, for several years after the war it was by far the most widely used tank as it was in service not only with the French Army but also several others and was copied in the United States and Italy, as the Six-ton M1917 light tank and Fiat 3000, respectively.

However, the acquisition of the two Renault F.T. by the Swiss Army did not lead to anything beyond evaluation tests. At the time Swiss as well as other military opinion was not convinced about the general utility of tanks. At best, tanks were regarded solely as a specialised means of offence and although this proved to be a totally erroneous view it told particularly strongly against their acquisition by the Swiss Army because of Switzerland's traditionally defensive policies.

In consequence, nothing was done about tanks until 1934, when the Swiss Army purchased from Britain four Vickers Carden-Loyd light tanks. These tanks, which were designed by Sir John Carden and were made by Vickers-Armstrong Ltd., weighed only 3.8 tonnes and were armed with only one machine-gun but they represented, nevertheless, a very considerable advance on the Renault F.T. and other light tanks in mobility. As a result they were purchased from Britain or were copied in several countries and their mechanical performance gave a new impetus to the development of tanks.

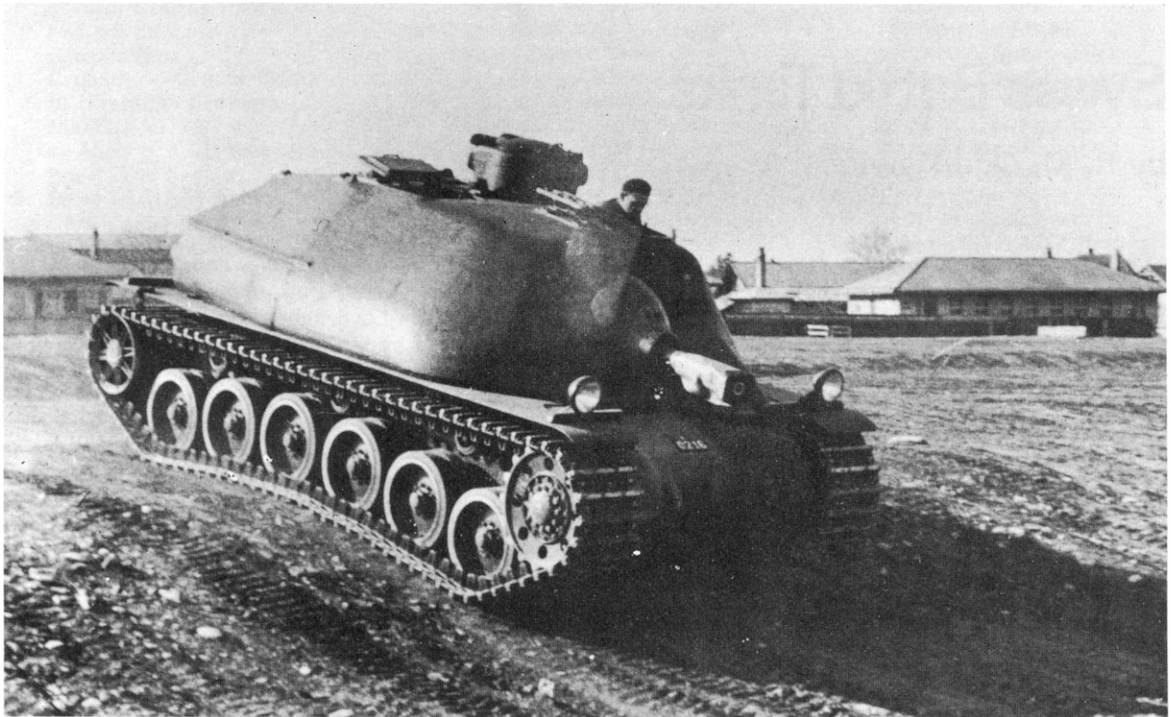
Pz.39, the Swiss version of the Czech LTH light tank.





NK 1 experimental 75mm self-propelled anti-tank gun of 1944.

NK II experimental assault gun.



PANZER 39

Four more years had to pass, however, before the Swiss Army took another step towards equipping itself with tanks. This followed a decision taken in 1936 to provide the reconnaissance units of Swiss infantry divisions with light tanks of the LTH type developed in Czechoslovakia by the Ceskomoravska Kolben Danek company.

The choice of the 7.5 tonnes LTH was very wise, as it was one of the best armoured fighting vehicles of its day. Similar TNH tanks had already been ordered by Iran,

and other tanks of this type were ordered by Peru and Lithuania, as well as by the Czech Army. The TNH was later also built under licence in Sweden as the Strv m/41 and other tanks of this type, including those originally ordered for the Czech and Swedish armies, were used very successfully by the German Army as the PzKpfw 38(t).

The tanks ordered by the Swiss Army were to be assembled in Switzerland from components made in Czechoslovakia, except for the engine which was a Swiss-built 125 b.h.p. Saurer diesel, and the armament

which consisted of a 24-mm Oerlikon gun and two machine-guns. The resulting vehicle was called Panzer 39, or Pz.39. But when only 24 had been completed the flow of components from Czechoslovakia stopped, as a result of that country coming under German control. In consequence, when World War II broke out in 1939, the Swiss Army only had the 24 Pz.39, which were divided between three newly formed tank companies.

While World War II lasted Switzerland's policy of strict neutrality prevented it from acquiring more tanks from other countries. At the same time it was not in a position to manufacture them itself. However, in spite of difficulties, some steps were taken in that direction.

NK I AND II

The first step in the development of armoured vehicles in Switzerland was the construction by the Federal Construction Works in 1944 of an experimental 75-mm self-propelled anti-tank gun which was called the NK I. This 10-tonne vehicle was based on a lengthened chassis of the Pz.39 and, like the contemporary semi-improvised German self-propelled guns, had a superstructure which was open at the top and rear. An alternative version armed with a 105-mm howitzer instead of the 75-mm gun was also contemplated but its development did not proceed beyond a single vehicle.

It was followed, however, a year later by the construction of a much more ambitious vehicle, a 75-mm turretless assault gun called NK II. This vehicle was armoured all round, the armour being up to 70 mm thick at the front as a result of which it weighed 24 tonnes, or more than twice as much as the NK I. The armour was cast and in particular the superstructure consisted of one large casting, which represented a considerable achievement on the part of the Swiss foundrymen. At the same time the castings eliminated the need for rolled armour plate for which there were no production facilities in Switzerland. Another interesting

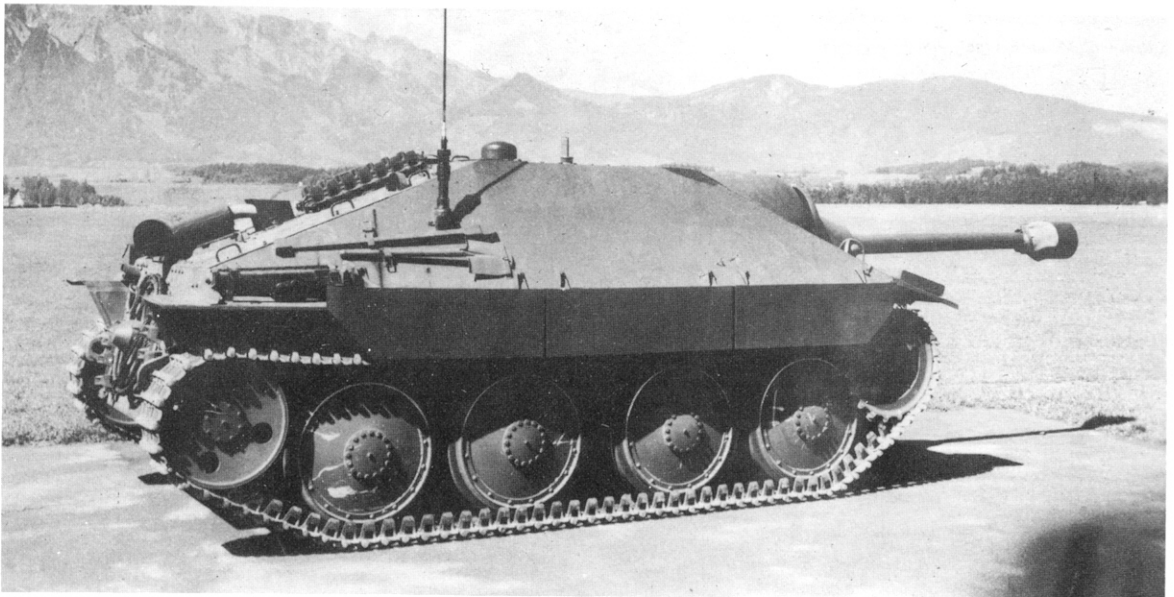
feature of the NK II was its 300 b.h.p. V-12 diesel which gave it a maximum speed of 50 km/h.

In principle the NK II was comparable to the contemporary German *Sturmgeschütze*, but by the time it was built in 1945 the need to build armoured vehicles in Switzerland became less urgent as World War II was coming to a close. Its development was not continued, therefore, beyond the construction of one prototype. The Swiss Army had, however, recognized the need to equip itself with armoured vehicles and in 1946 took advantage of an opportunity to purchase at a very favourable price a number of 75-mm assault guns from Czechoslovakia. These vehicles came from a surplus stock of the *Jagdpanzer 38(t)* produced in Czechoslovakia for the German Army during the latter part of World War II. At first 100 were ordered but subsequently the number was raised to 158, the first being delivered in 1947 and the last in 1952.

Due to its combination of an effective 75-mm gun, low silhouette and mobility, the *Jagdpanzer 38(t)* was one of the most successful armoured vehicles of World War II and it retained its effectiveness for some years after. It was, therefore, able to meet the most urgent need of the Swiss Army for mobile anti-tank weapons, and as the G.13 *Panzerjäger*, or tank destroyer, it became the first armoured vehicle to be used in quantity by the Swiss Army. It is also interesting to note that the G.13 was related to the Pz.39, as its chassis was based on the German Army's equivalent of the latter, the PzKpfw 38(t).

The purchase of the G.13, which were allocated to three specially created tank destroyer battalions, was followed by a period of uncertainty about the future of tanks. This prevailed throughout the Western World and especially in the United States as a result of the erroneous conclusions drawn at the time from the development of new anti-tank weapons. The uncertainty was, however, resolved by the Communist invasion of South Korea in

Czech-built G.13 tank destroyer.



1950, which showed the continued effectiveness of tanks and the need for other tanks to oppose them.

In consequence, the Swiss Army decided in 1951 to provide itself with some 550 tanks. As a first step towards this goal it ordered in December 1951, from France, 200 AMX 13. It was the first of many armies to acquire this highly original light tank, or tank destroyer, which it called *Leichter Panzer 51* and which substantially increased its number of mobile anti-tank weapons.

Next, a specially set up tank commission recommended to the Federal Government the purchase from Britain of Centurion tanks which had by then acquitted themselves well in Korea. As a result, an order was placed in 1955 for 100 Centurion Mark 3, which were delivered in 1956 and 1957. These were followed by 100 Centurion 7, which were ordered in 1956 and delivered between 1958 and 1960, becoming known in Switzerland as the Panzer 57, while the earlier Mark 3 were called Panzer 55. In 1960 100 more Centurions were ordered. This time they were Mark 5 purchased from South Africa which had offered them on very favourable terms as they had become surplus to its requirements. Thus, by the end of 1960 the Swiss Army had acquired 300 Centurion tanks whose effectiveness was subsequently increased by rearming half of them with the much more powerful 105-mm gun instead of the original 83.4-mm 20-pdr.



British-built Centurion tank with 105mm gun.

In the meantime, while it was equipping itself with French and British built tanks the Swiss Army also developed a tank of its own. The origins of this vehicle go back to 1951 when the Technical Section of the Swiss General Staff began to study the problem of the design and production of a tank in Switzerland. This offered the advantages of making the Swiss Army independent of the supply of tanks by foreign countries, saving foreign exchange, and providing a vehicle better suited to Swiss conditions.

By 1953 the studies had led to a requirement for a battle tank whose fulfilment was entrusted to the *Eidgenössische Konstruktionswerkstätte*—the Federal Construction Works—in Thun, the principal Swiss ordnance establishment which has produced and overhauled military equipment for more than a hundred years. In the early days the activities of the Federal Construction Works centred on artillery weapons and for a time also involved the building of military aircraft but it was only in the early fifties that they extended to tanks. Nevertheless, in spite of their lack of previous experience in this field, the Federal Construction Works successfully designed and built a battle tank which was not only the first ever to be made in Switzerland but which was also as advanced as any other.

The first tank to be completed, in 1958, was one of two prototypes which differed from each other in their main armament. Thus, the first was armed with a modified version of a Swiss 90-mm anti-tank gun, while the second prototype, which was completed in 1959, was armed with a British 83.4-mm 20-pdr which had been the main armament of the Centurions from the Mark 2 to the Mark 8. The 20-pdr was probably the best of the contemporary tank guns, its design being based on the last of the famous German 88-mm guns, the L/71, which was mounted in the Tiger II and made it the most effectively armed tank of World War II. Moreover, it fired armour-piercing discarding sabot ammunition which was originally developed in Britain for the 57-mm 6-pdr and the 76.2-mm 17-pdr but whose muzzle velocity was increased in the 20-pdr to as much as 1,460 m/s, with a corresponding increase in its ability to perforate armour.

First prototype of Pz.58, the forerunner of the Pz.61, armed with a 90mm gun.





First prototype of Pz.58 during early firing trials.



Second prototype of Pz.58 armed with a British made 83.4mm gun.



Pz.58, the first battle tank designed and built in Switzerland.

Another view of Pz.58 which shows its 20mm coaxial gun.





Assembly of Pz.58 tanks at the Federal Construction Works in Thun.

Pz.58 firing its main armament.





Pz.58 moving at speed.

However, in 1957, before either of the two prototypes was completed, it was decided to follow their construction with that of a pre-production series of ten tanks armed with the Swiss 90-mm gun. The ten pre-production tanks were completed in 1961 and were designated Pz.58. But by then the Royal Armament Research and

Development Establishment in Britain had developed the 20-pdr into the much more powerful 105-mm tank gun which was adopted not only for the Centurions but also for the U.S. M60 battle tank. In consequence, the Swiss General Staff decided in 1961 also to adopt the new British 105-mm gun and to produce not the Pz.58 but an upgunned version of it which was designated Pz.61.



Pz.58 fording a shallow river.

Pz.61

The production order for the Pz.61, which was placed in 1961, called for 150 tanks. The first of these were delivered by the Federal Construction Works in 1964 and the last in 1966.

As it appeared, the Pz.61 exhibited several noteworthy characteristics, one of the most important being its light weight. Its mass, in full battle order, is in fact only 38,000 kg, which makes it one of the lightest of its

Three-quarter rear view of a Pz.58.





Pz.58 with its turret traversed to the rear successfully negotiating muddy terrain.



Pz.58 climbing the bank of a river which it has just crossed.

generation of battle tanks and as light as any armed with the British developed 105-mm gun. Its mass is, in fact, virtually the same as that of the Anglo-Indian Vickers "Vijayanta" and of the much more recent Japanese STB-1. The relatively light weight of the Pz.61 gives it a significant advantage over heavier tanks, particularly because it can cross lighter bridges and because it is easier to transport by rail.

Another significant feature of the Pz.61 is its narrow overall width of 3.06 m, which is less than that of any other contemporary battle tank. Its closest rival in this respect, the French AMX 30, has an overall width of 3.10 m while several other tanks are 3.5 to 3.6 m wide. The principal advantage of the narrow width of the Pz.61 is that it corresponds to the maximum allowed for rail transport by the Berne International Load Gauge, so that it can be transported by rail without preliminary surveys or risk of interference with other traffic. Its modest width also helps the Pz.61 to move along narrow roads, through village streets and under similar circumstances.

The narrow width of the Pz.61 has been achieved through skilful design of the hull and without handicapping the crew by reducing the amount of room available for them within the tank. It has, however,

necessitated the adoption of such novel measures as the integration of the gun ammunition stowage with the fuel tanks. This was done by locating two fuel tanks at the front of the hull on each side of the driver and forming pockets in them for the 105-mm rounds. As a result, a considerable amount of space has been saved by comparison with the conventional arrangement of separate fuel tanks and ammunition stowage. Moreover, surrounding the pockets containing the 105-mm rounds with diesel fuel has increased their protection, particularly in the event of the armour being perforated by a shaped charge projectile or missile. It is interesting that a similar combination of fuel tanks with ammunition stowage was adopted at about the same time in the improved version of the Soviet T-54 tank, the T-55. However, the latter still carries fewer rounds than the Pz.61, which can carry a normal supply of 52 rounds.

ONE-PIECE CAST HULL

The hull of the Pz.61 is itself unusual, being cast in one piece. At the time it was designed there was only one other tank with a one piece cast hull, the U.S. M48, and experience with it brought out the difficulty of producing

such large castings. In particular, production of the M48 hulls showed the difficulty of controlling accurately the wall thickness of one-piece hull castings and therefore of ensuring that it did not fall below the required minimum without increasing the weight of the whole hull. However, casting hulls in one piece offered the advantage that they could be better shaped than the usual hulls welded from rolled armour plate and that fewer production man-hours were required than with hulls welded from smaller castings. Cast hulls also eliminated the need to import armour plate from other countries, which would have been necessary

had a more conventional design been adopted, because plate of the required thickness was not produced in Switzerland. Moreover, the problem of producing a one-piece cast hull for the Pz.61 was successfully solved by the Georg Fischer company, of Schaffhausen, who were entrusted with it.

The Georg Fischer company also produced all the turret castings for the Pz.61. In having a one-piece cast turret the Pz.61 resembled several other tanks but the shape of its turret was unusual in at least one respect: it dispensed with the rear bulge which has been a questionable feature of all battle tanks since World War II,

Turret being lowered onto the hull of a Pz.58 whose engine compartment awaits the installation of the engine-transmission assembly.





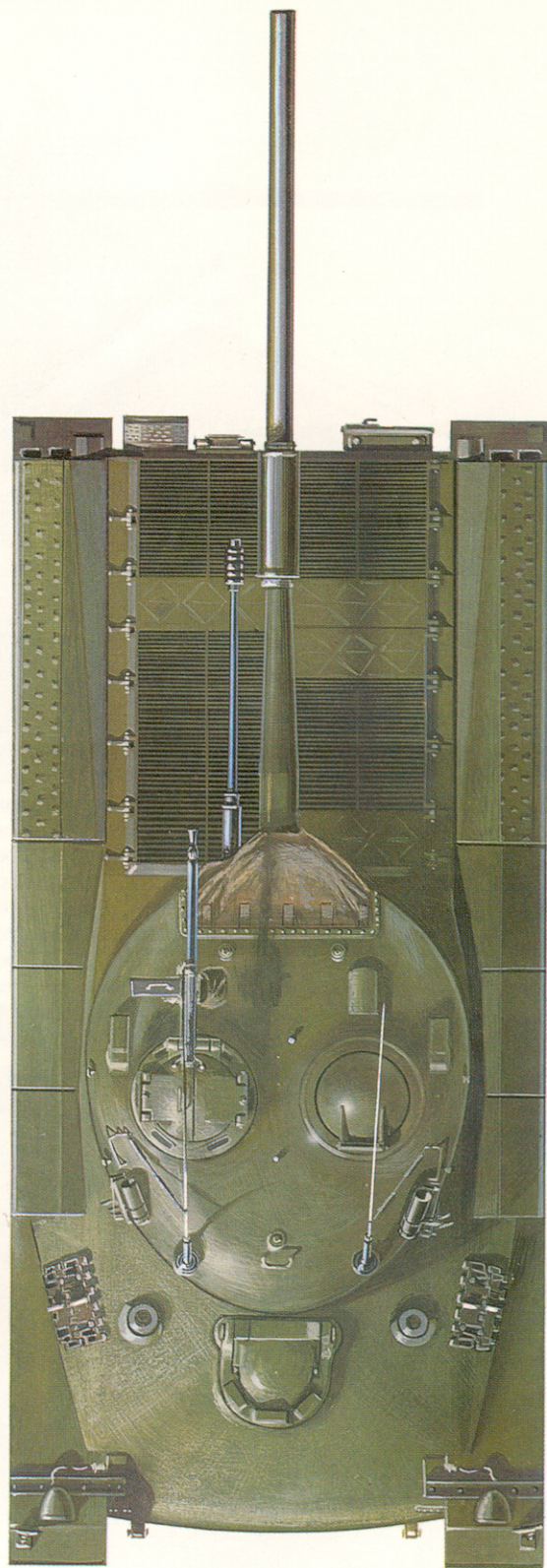
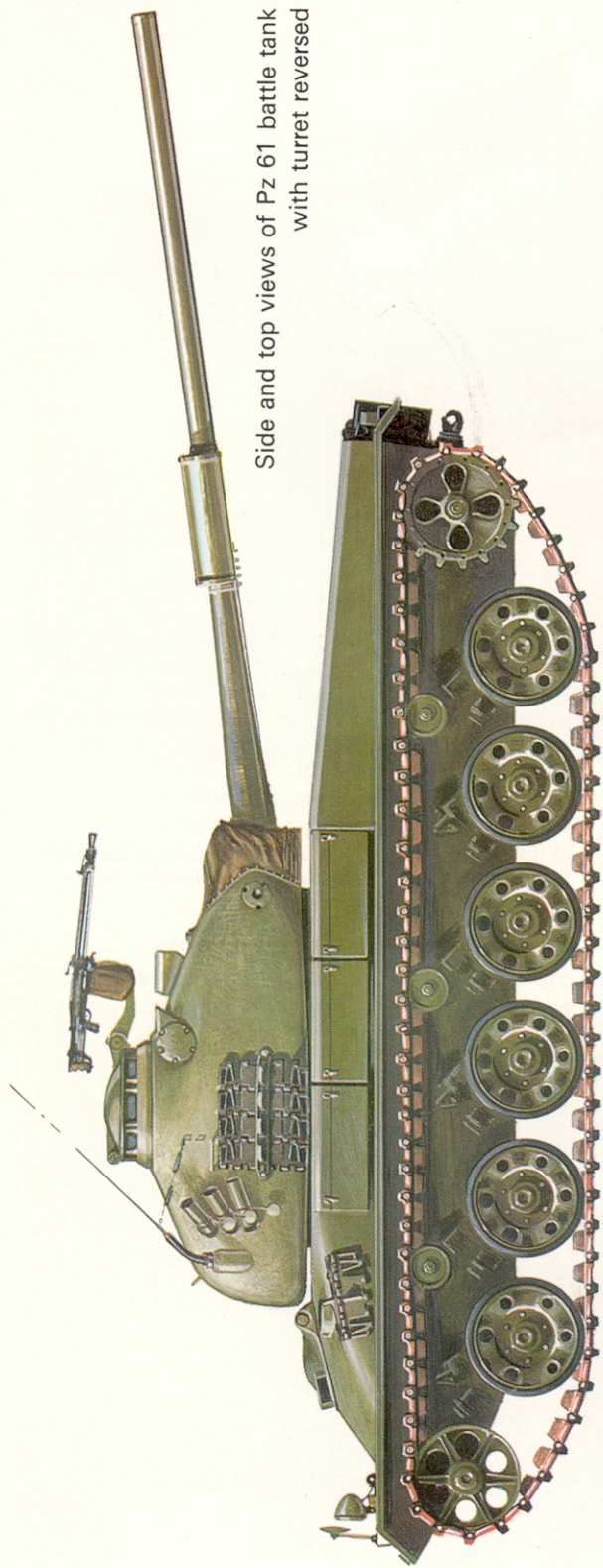
Above: Production version of the Pz 61 battle tank

Below: Prototype of the Pz 68 battle tank

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Side and top views of Pz 61 battle tank
with turret reversed





The original production version of the Pz.61.

except for the Soviet T-54 and T-62. However, in contrast to the turrets of the Soviet tanks which do not allow their guns to be depressed more than 4 degrees below the horizontal, the turret of the Pz.61 allows its gun to be depressed no less than that of any other battle tank, namely 10 degrees. This is important as it helps the Pz.61 to take up advantageous hull-down firing positions on reverse slopes in hilly terrain. To make such a depression possible the turret of the Pz.61 has had to be higher than the exceptionally low turrets of Soviet tanks. But, in spite of this, the height of the Pz.61, measured to the roof of the turret, compares favourably with that of other tanks, being 2.47 m, which is less than those of the Centurion and Chieftain and considerably less than the 2.99 m of the U.S. M60A1 battle tank.

The turret is surmounted by two cupolas which increase the overall height to 2.72 m but this is still no more than the overall height of most other tanks and well short of the 3.31 m of the U.S. M60A1E1. One of the two cupolas, which is fitted with eight episcopes, is for the commander; the other, with six vision blocks, is for the loader who is therefore provided with better means of all-round observation than in most other tanks, although at the expense of partially obstructing the commander's field of vision and increasing slightly the silhouette of the tank.

ARMAMENT SYSTEM

The turret-mounted 105-mm gun, which forms the main armament of the Pz.61, is a modified version of the

Column of Pz.61 tanks with 105mm guns.





Rear view of a Pz.61 tank.

Pz.61 in a winter setting.





Pz.61 fording a river.

British L7A1 gun manufactured under licence in Switzerland. Thus, it fires the same highly effective APDS projectiles with a muzzle velocity of 1470 m/s as the Centurion and also the U.S. M60 and the German Leopard battle tanks. Like the other tanks, the Pz.61 is also provided with HESH ammunition but, in contrast to the M60 and the Leopard, not with HEAT ammunition. On the other hand it is provided with Swiss-made HE rounds which are not available for the other tanks.

The principal difference between the Swiss version and the original British gun lies in the Swiss-made breech block which is of the horizontal type. The gun mounting also provides for a recoil of 0.55 to 0.6 m, which is almost twice that of the other 105-mm guns and makes for much smaller recoil forces. The gun mounting also incorporates a unique method of controlling its elevation which makes use of a quadrant guide behind the breech instead of the usual gears at the trunnions.

The effectiveness of the 105-mm is enhanced by the installation in the Pz.61 of an optical rangefinder, which is operated by the tank commander. The rangefinder is the split-image coincidence type and has a base of 1.55 m. It was designed and made in Switzerland by Wild AG.

The gun can be elevated and the turret traversed manually, using a gear system, but normally these functions are expected to be performed by an electro-hydraulic system. This is one of only two systems or components incorporated in the Pz.61 which are not made in Switzerland. It was, in fact, designed for the Pz.61 in 1960 in France by the Société d'Applications des Machines Motrices (SAMM) which shortly afterwards

developed a very similar system for the French AMX 30 battle tank. The essential components of the system are two electric motor driven multi-plunger hydraulic pumps one of which elevates the gun at up to 31 degrees/sec and the other traverses the 10-tonne turret at up to 24 degrees/sec.

Instead of the usual rifle-calibre "co-axial" machine-gun, the Pz.61 has a 20-mm automatic gun mounted alongside its main armament. This provides it with a means of engaging targets for which a machine-gun is inadequate but which do not really justify the expenditure of main armament ammunition. The gun is made in Switzerland by the Oerlikon Buhle & Company, which has had a long record of successfully producing small-calibre automatic guns, particularly for anti-aircraft defence.

The Pz.61 also carries a machine-gun, a 7.5-mm MG 51, but mounted externally, on the loader's cupola. In this respect it differs from most other contemporary tanks where machine-guns are mounted on top of commanders' cupolas. The alternative arrangement adopted by the Pz.61 is based on the very sound argument that tank commanders should concentrate on their proper function, which is to command their tanks, instead of being reduced for much of the time to the rôle of machine-gunners. This argument has not, obviously, been accepted by all armies but it is worth noting that the Soviet Army also mounted machine-guns so that they were operated by loaders and not tank commanders, although more recently it has given up mounting them on tops of tank turrets.



Pz.61 with its turret-mounted 7.5mm machine-gun manned by the loader.

NOVEL STEERING AND SUSPENSION

Apart from the elevation and traverse controls, the only major component of the Pz.61 which is not Swiss made is its engine. The engine has been manufactured in Germany by Daimler-Benz AG, of Stuttgart, and is very similar to the engine of the German Leopard. However, whereas the latter is a V-10 the engine of the Pz.61 is a V-8 and it was adopted earlier so that the engine of the Leopard benefitted from the experience acquired with the prototypes of the Pz.61.

In either case, the engine is a fairly conventional, robust, water-cooled, 4-stroke diesel with precombustion chambers. The cylinders have a bore of 165 mm and the

piston a stroke of 175 mm which gives the MB 837 engine of the Pz.61 a total swept volume of 29.9 litres. Out of this, at 2,200 revs/min, it develops 630 b.h.p. which gives the tank a maximum road speed of 55 km/h. In addition to the main engine there is also a small, 4-cylinder 31 b.h.p. auxiliary engine which drives a 9 kW generator.

From the engine the drive is taken through a transmission system made by the Schweizerische Lokomotiv und Maschinenfabrik (SLM), of Winterthur. The transmission consists of a multi-clutch semi-automatic gearbox with 6 forward and 2 reverse speeds and a double differential steering system with a hydrostatic steering

Two Pz.68 battle tanks.





Prototype of the Pz.68 built by modifying a Pz.61.

drive developed by the Gesellschaft der von Rollschen Eisenwerke, of Klus. The Pz.61 was only the second tank ever to be built with such a sophisticated steering system—the first being the French *Char B* of the thirties—which gives it infinitely variable control over the turning radius and in the writer's experience makes it one of the most pleasant tanks to steer. The wisdom of adopting such a sophisticated steering system in the Pz.61 has been demonstrated by the development of similar double differential steering systems with a hydrostatic steering drive for some of the latest armoured vehicles, such as the U.S.-German MBT-70.

Another interesting design feature of the Pz.61 is its suspension. This includes six road wheels on each side

which are all independently located and sprung by means of stacks of Belleville washers, or conical springs. The use of this form of springing was first proposed in Germany towards the end of World War II for tanks of the E-series which were then being designed, because of the large amount of energy it could absorb in relation to its size and weight. However, the Pz.61 was the first tank to be built with such springing.

Moreover, because Belleville washer springs are relatively light and compact, they lend themselves to being installed outside the hull and this was exploited in the design of the Pz.61. As a result, a valuable amount of space has been saved within its armour envelope.

Entp. Pz.65, the armoured recovery vehicle based on the Pz.61, with its jib raised into the working position.



Pz.68

After the last of the Pz.61 was completed the Swiss Army decided to procure more tanks of its type but in an improved form. The new version was designated Pz.68 and 170 of it were ordered in 1968, the first being delivered in 1971 by the Federal Construction Works.

Outwardly the Pz.68 is very similar to the Pz.61 and the majority of its components are the same as those of its predecessor. The most important differences are in the weapons system. Thus, the Pz.68 has had added to it a hydro-electric stabilization system to maintain its gun in a given position in space whilst the tank is in motion by gyro-stabilizing the gun in elevation and the turret in azimuth. Like other tank gun stabilization systems, that of the Pz.68 allows it to fire on the move with a greater probability of scoring a hit and offers a number of other advantages, such as the ability to begin laying the gun on target before the tank stops, so that it can engage the target much more quickly from rest which—all stabilization systems notwithstanding—still offers the greatest chance of hitting the target.

The secondary armament has also been changed at the request of the Swiss Armoured Corps which came to the conclusion that the 20-mm gun did not have the required sustained fire capability. In consequence, the 20-mm Oerlikon was replaced by another 7.5-mm MG 51 which could be provided with much more ammunition. The replacement of the 20-mm gun by a machine-gun also created more room within the turret and eliminated the problem of powder fumes released into the crew compartment by the larger weapon. At the same time the turret of the Pz.68 has been modified by the introduction of a port in its left side for the ejection

of spent cases and by the addition of a stowage rack at the rear.

In addition to changes in the armament system, the mobility of the Pz.68 has been increased by uprating its engine to produce 660 b.h.p., which has increased its maximum road speed to 60 km/h. The original all-steel dry-pin track has also been replaced by a slightly wider track with rubber bushed pins and rubber road pads. The single pin rubber bushed type of track adopted for the Pz.68 is similar to those used commonly in light armoured vehicles but had not been used previously in a battle tank. The rubber bushed and padded track is inevitably heavier than the earlier all-steel track and its weight has contributed to the Pz.68 being one tonne heavier than the Pz.61.

ENTP. Pz.65

As well as being developed into the Pz.68, the Pz.61 has also served as the basis of other armoured vehicles. The first of these has been the *Entpannungspanzer*, or Entp. Pz.65, an armoured recovery vehicle which began to be produced by the Federal Construction Works in 1970. The automotive characteristics of this vehicle are similar to those of the Pz.61 but it has no gun turret. Instead, its hull has been modified to accept a box-like superstructure which accommodates a crew of five and various items of recovery equipment. The most important of these is a winch capable of exerting a pull of up to 25 tonnes and provided with a 120-m cable. There is also an auxiliary winch, with a 240-m cable, for bringing out the heavy main cable. The more powerful of the two winches is driven directly by the main engine which

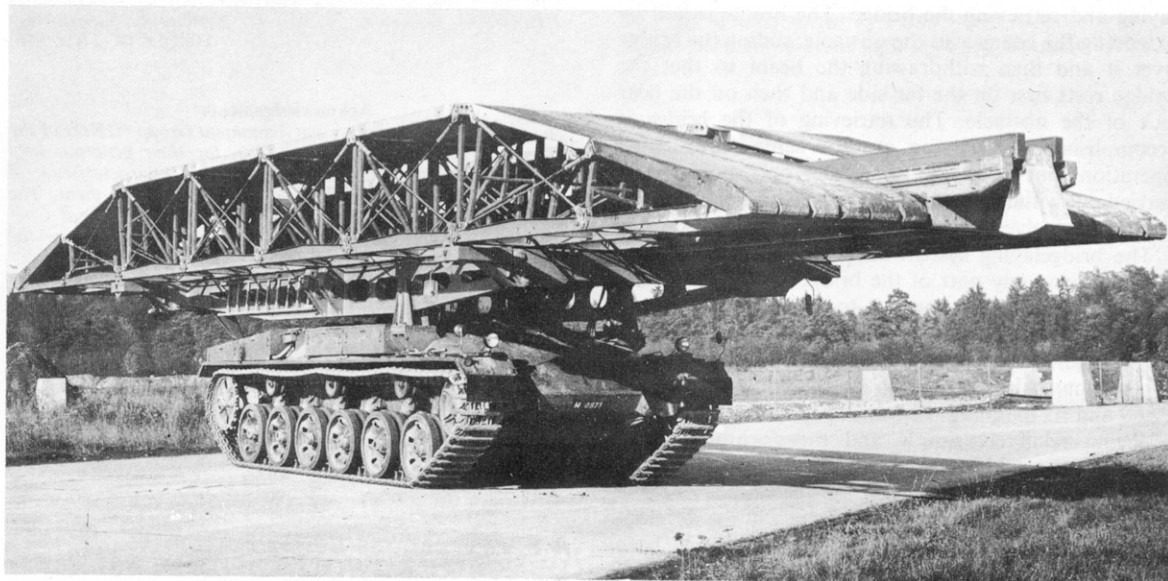
Entp. Pz.65 with its bulldozer blade used as a ground anchor pulling an overturned battle tank.

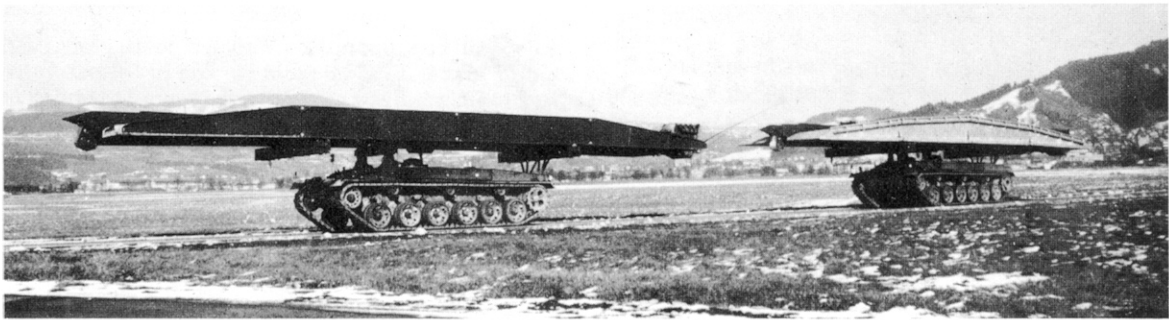




Entp. Pz.65 lowering an engine-transmission assembly into a Pz.61 battle tank.

The original working model of the bridgelayer based on the Pz.61 chassis with a short span bridge.





Left, first prototype of the Bru. Pz.68 with a steel bridge and, right, the second prototype with an aluminium bridge.

means that the Entp. Pz.65 cannot winch and drive at the same time. However, this is generally not required and the use of the main engine to drive the winch saves the tank from having to carry another fairly large engine for the purpose.

The Entp. Pz.65 is also provided with a jib whose lower, pivot ends incorporate an ingenious arrangement of hydraulic jacks so that it can be tilted slightly. This makes possible fine adjustments to the position of any load, such as a tank power pack, which is being lifted or lowered with the aid of the jib. When not in use, the cable supported jib is lowered to lie on top of the superstructure roof. Unlike a number of other recovery vehicles, the Entp. Pz.65 is not provided with a separate ground anchor spade but it is fitted with a heavy bulldozer blade which can also be used as an anchor.

BRU. Pz.68

Another vehicle based on the Pz.61 is the *Brückenpanzer*, or Brü. Pz.68. This is an armoured bridgelayer which consists, in essence, of a turretless Pz.61 with a frame structure carrying a light-weight one-piece bridge and a hydro-mechanically actuated telescopic beam for laying and retrieving the bridge. The bridge is laid by extending the beam over the obstacle, sliding the bridge over it and then withdrawing the beam so that the bridge rests first on the far side and then on the near side of the obstacle. The retrieving of the bridge is accomplished by carrying out the same sequence of operations but in reverse and either operation can be carried out without the crew of the bridgelayer having to expose themselves.

The bridgelaying system adopted in the Brü. Pz.68 avoids raising any part of the bridge above its normal transport position, in contrast to the folding, scissors-type assault bridges or the "flip-over" method of laying single span bridges, both of which are much more conspicuous in action. Moreover, the bridge of the Brü. Pz.68 and its handling mechanism have the great merit of being relatively simple and therefore serviceable under adverse field conditions.

In addition to the Brü. Pz.68 and the Entp. Pz.65, the Pz.61 has also been adopted as the basis of the development of a 155-mm self-propelled gun and it has also been considered as the basis of an anti-aircraft tank.

SUMMARY OF THE LEADING CHARACTERISTICS OF THE Pz. 61

Gun, calibre	105 mm
length	51 calibres
ammunition	52 rounds
Coaxial gun	20 mm Oerlikon
Machine-gun, external	7.5 mm MG 51
Weight, net	37,000 kg
combat loaded	38,000 kg
Length, overall, with gun forward	9.36 m
overall, without gun	6.685 m
Width, overall	3.06 m
Height, to turret roof	2.47 m
to top of loader's cupola	2.72 m
Ground clearance	0.42 m
Width of tracks	0.50 m
Track length to centre distance ratio	1.66:1
Ground pressure	0.85 kg/cm ²
Engine, type	V-8 diesel
make	Daimler Benz
model	MB 837
gross horse power	630
Maximum road speed	55 km/hr
Range, roads	300 km
Crew	4

Acknowledgements

The author wishes to thank the Armament Group (GRD) of the Federal Military Department, Bern, for their generous help with information about the history and characteristics of Swiss armoured vehicles and for photographs of them. The author also wishes to thank the GRD and the Federal Construction Works, Thun, for the opportunity to examine the Pz.61 and the armoured vehicles derived from it at first hand.

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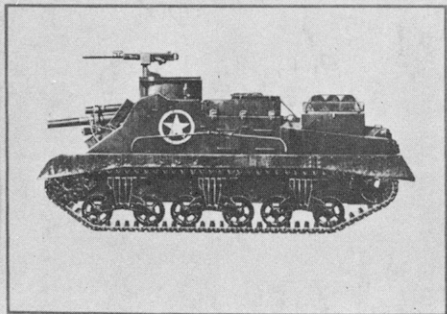
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