

French Infantry Tanks: Part I
(Chars 2C, D and B)

by Major James Bingham, Royal Tank Regiment



AFV/Weapons Profiles

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'Crews Mount! The main entrance to the Char D2 was in front of the wireless operator's position.

(E. C. Armées)

French Infantry Tanks (Part I)

by Major James Bingham, Royal Tank Regiment

AT the end of the War in 1918 the only tanks in French service which were fit for action, apart from a few British Mark Vs, were the small Chars Renault FT, and these were held in large numbers. Construction of the new, heavy Char 2C was well in hand, having been designed to provide the concentration of armour for an assault that was planned for 1919, but the end of hostilities soon stopped production of any further tanks. General J.-E. Estienne, commander and 'father' of the wartime tank units (*artillerie d'assaut*), continued to urge the development of tanks that could be used in mass as a decisive weapon on the battlefield, but his voice in peacetime was that of a lone wolf. Although he was placed in charge of technical development, that was not a position of power on policy.

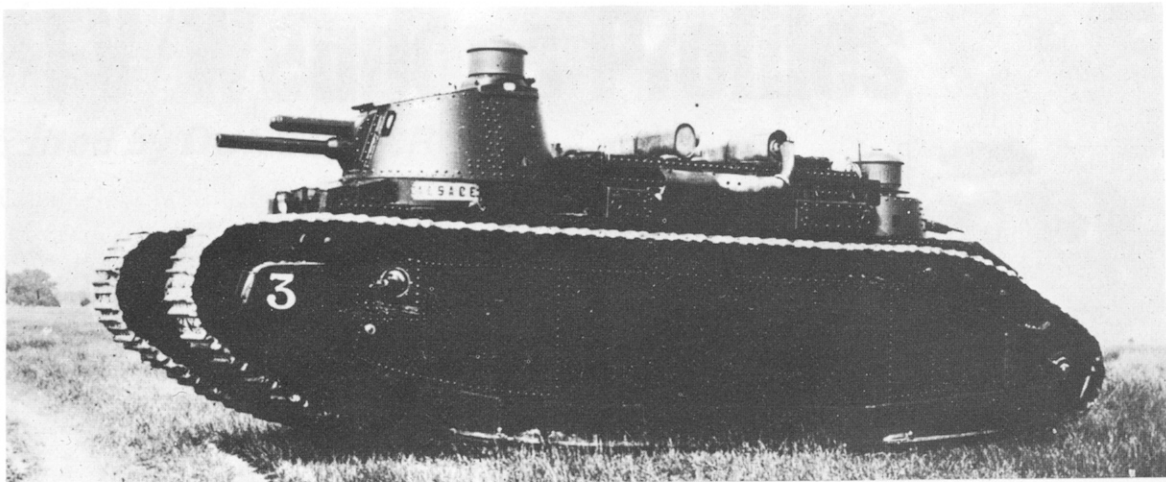
No doubt under the influence of General Estienne, an instruction was issued by Army Headquarters in July 1920 calling for the development of a wide variety of tanks. These ranged from light machine-gun armed tanks for the infantry, to heavier machines that could support with a howitzer of 4000 metres range, as well as 'breakthrough' tanks that could tackle enemy tanks; in addition there were to be various special tanks for wireless, obstacle crossing, supply or to mount searchlights. It was an imaginative programme that defined

the tank as the principal offensive weapon and, had it been followed in the spirit in which it was intended, it would have led to a reduction in the numbers of infantry and would have permitted more attention to air support for mechanised warfare.

However, these ideas ran counter to the basic tenets of French military philosophy of that time, and the programme was very quickly superseded by revised instructions prepared in January 1921 by a special commission under General Buat, Chief of Staff at Army Headquarters. Henceforth the tank was to be an infantry weapon, developed by and for the infantry, and the policy on its employment reverted to that of 1918. As a result, the need was foreseen for only two types; a heavy or 'breakthrough' tank (*char de rupture*), and a light, versatile 'battle' tank (*char de bataille*) which was to be designed and developed as a replacement for the Renault FT.

During the next two decades subsequent development led to further changes in classification, and, before dealing in detail with the various types of tanks produced, the progressive changes in designation must be explained.

Progress in development of tanks during the 1920s was very slow and not a single new type of tank was intro-



The first tank to mount a 75mm gun in a rotating turret, and the heaviest tank in service before World War II—the Char 2C was in service from 1921 to 1940.

duced into service. After the War there was little money for new weapons, while politicians and the High Command were apathetic, and this negative attitude found ready support amongst those who argued, logically, that if the Germans were prohibited by Treaty from developing offensive weapons (e.g. tanks), neither should the French develop them. The peacetime Army was to be a nucleus for the training of reservists under conscription, behind the shield of the Maginot Line upon which money, material and labour were lavished from 1928. New ideas on the employment of tanks were positively discouraged, and any work possible was directed to tests and improvements on existing vehicles and upon prototypes, in the expectation that production in quantity upon the latest designs could be undertaken at short notice in an emergency.

The Renault NC appeared as a possible replacement for the Renault FT and reached an advanced stage by 1926, but by then the idea of an 'all-purpose' light battle tank was found to be impractical. Some diversity in role and capability was seen to be necessary and the *Programme de 1926* defined the need for three classes of tank:

Light tank—of less than 13 tons, required in large numbers and to be simple in operation so that reservists could be quickly trained in its use. It would be used in close support of infantry to defeat automatic weapons, was to be armed with twin co-axial machine-guns or a 47mm gun, to be armoured against weapons carried by infantry, and to have a crew of 2 or 3.

Battle tank—of between 19 to 22 tons, to be used in conjunction with the light tanks, and to take on heavier resistance as well as enemy tanks and opposition outside the immediate area of the troops being supported. It was to be armed with a 75mm gun, or a high velocity gun, with 'several' machine-guns, to be armoured against infantry weapons below field gun, to have a crew of 3 or 4, and to be equipped with wireless.

Heavy tank—of up to 70 tons, for use where its greater armament (up to 155mm) was required to support the infantry and the lighter tanks. The only tank to come into this class was the Char 2C, already in service but few in number.

A new development to be known as the Char B,

weighing 25 tons, fell into the new class of battle tank, and three prototypes were authorised in 1926; the first of these appeared in 1929 for trials. In the light tank class, a new Renault D appeared in 1931, weighing 12 tons, and both these types formed part of a special detachment of armoured vehicles for the combined exercises in 1932 and 1933 to study the use of tanks in the infantry battle. As a result of the exercises a further definition of requirements was stated in 1933. Their main effect was to set new standards of armour protection and to give a new name to the 'battle' tank, but they did not change the basic roles of the three classes.

Light tank—to be proof against light anti-tank weapons. New specifications which appeared in 1933 were framed around a so-called '6-ton tank'.

Medium tank—to be proof against heavy anti-tank weapons. Both the Char B and the Renault D were later classified as Mediums, although the Char B was variously known as a Heavy or *Char de Bataille*.

Heavy tank—still the Char 2C.

Further development and production of infantry tanks up to 1940 followed these classifications, and these

Char 2C climbing the bank of a stream. Note the brackets in centre front hull for slinging on to special rail wagons. This tank, named 'Normandie', has the arms of the Province painted on the turret.



arbitrary groupings will be used to describe detailed development in the 1920s and 1930s.

Meanwhile the cavalry were showing an interest in tracked or half-tracked armoured fighting vehicles with a cross-country mobility to complement their road-bound armoured cars (*autos-mitrailleuses*). It was a logical development in the traditional cavalry role of reconnaissance and protection. The requirements of the cavalry and infantry gradually merged in producing similar armoured vehicles, but the basic concepts on employment were quite different. The *Direction de la Cavalerie*, with its own technical services, developed wheeled and tracked *autos-mitrailleuses*, while the *Direction de l'Infanterie* developed *chars*; the difference in terms helped to identify the role of the vehicle and the arm responsible for its use.

HEAVY TANKS

While the first French tanks, the *Chars d'assaut* Schneider and St Chamond, were being produced in 1916, and before they had been taken into active service, the specifications were issued for a new heavyweight, and in December 1917 the prototype Char 1A appeared from the Forges et Chantiers de la Méditerranée (F.C.M.). It weighed 41 tons, had a crew of seven and was to be armed with a 75mm gun in a rotating turret; a very similar prototype Char 1B was to carry a 105mm gun, and, developed from these, yet a third was produced as Char 1C. This weighed over 70 tons, carrying a crew of ten and armed with a 75mm gun and four machine-guns; an electrical transmission was selected for this, as in the St Chamond. Not content with these heavies, the French also carried out trials on a monster of 141 tons, that would carry a crew of 28 and no less than four 75mm guns; like the Germans, and their K-Wagen, the French were very concerned with the need for size and weight of firepower in battering through the defences in trench warfare.

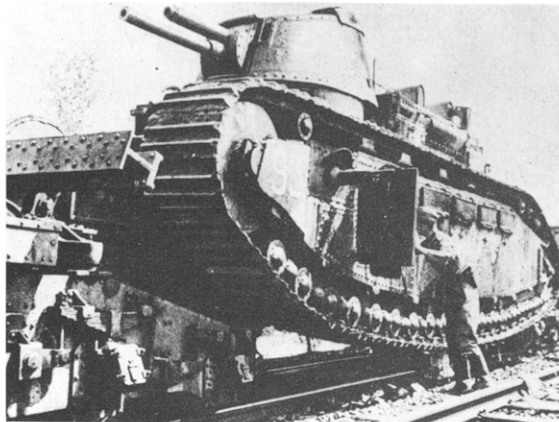
CHAR 2C

The Chars 1 are significant only as the prototypes for the Char 2C which, in 1918, was conceived as a *char de rupture* necessary for the Allied assault planned for 1919, with heavy concentrations of tanks. An order was placed

in February 1918 for 300, but the programme was delayed and after the War the order was reduced to 10, following trials with the first model. These were delivered from F.C.M. after installing engines used in German Zeppelins, first the Mercedes 200 h.p. and then the Maybach 250 h.p., for the electrical transmission.

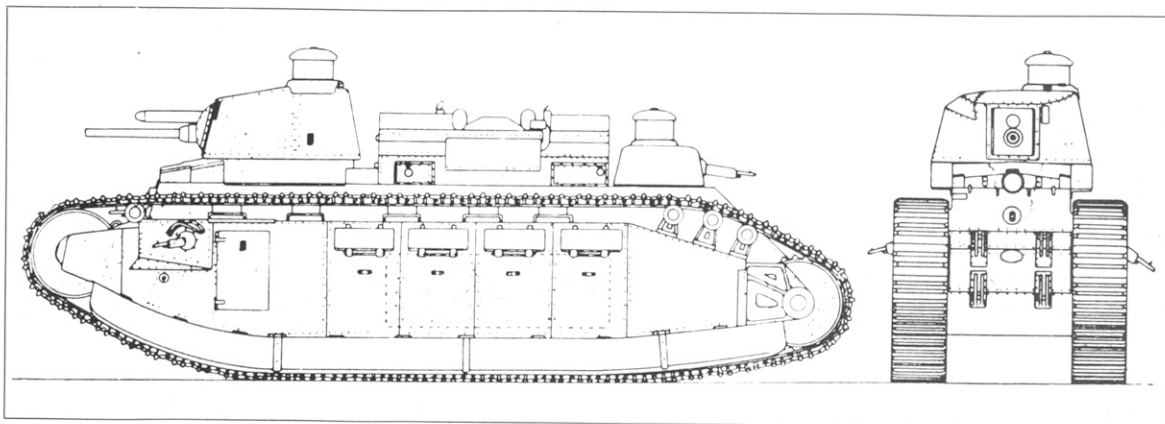
The Char 2C was a formidable weapon for its time. It was the first tank to come into service carrying a turret-mounted 75mm gun firing normal artillery ammunition (when the latest British/American Mark VIII 'International' had two sponson-mounted 6 pdrs—57mm), and it also carried four machine-guns, arranged with one in the front hull plate, one each side and one in a small rotating turret at the rear. The all-round track and the tank's length (10.27m) gave it an impressive trench-crossing capability of 4.25m and, furthermore, it carried 45mm armour, nearly twice as much as that of any other tank in service at the time. All this added up to a weight of 68 tons, which was a handicap to strategic mobility, but although the Char 2C had a speed of only 12 k.p.h. that was at least as good as, if not better than, that of most other heavies and mediums then being produced in other countries; it was an acceptable standard for the trench warfare for which the tank was designed.

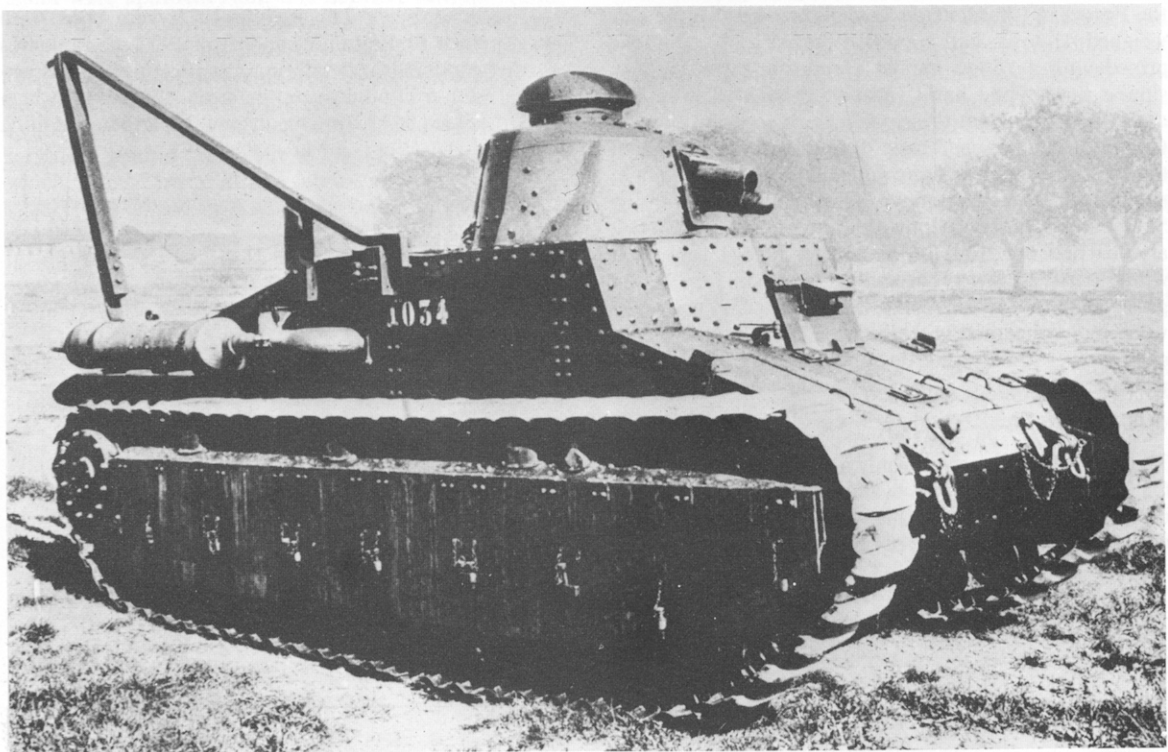
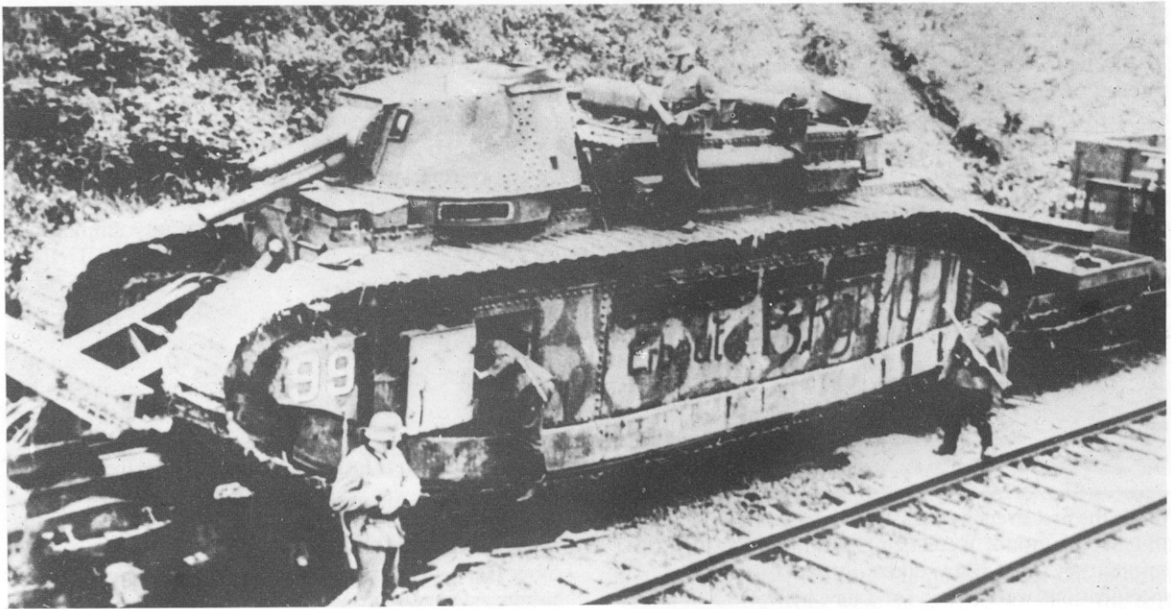
The ten models delivered in 1921 were taken into service with 51 Battalion, and until 1927 the tank was further modified in detail, mainly affecting the suspension, inter-communication between the crew (which had increased to 13 from its original 12) and in installing wireless sets.



The Char 2C travelled by rail slung between two special rail wagons. It was deemed very satisfactory to complete loading in less than four hours.

These drawings of the Char 2C show the proportions of great length to narrow width, which hampered steering and manoeuvrability.





Top Char 2C destroyed by German bombing in 1940. Note here the light shield over the bogie wheels, below the skirting plates. Bottom Early model of the Char D1, carrying the Renault FT turret with mounting for 37mm gun. The D1 was clearly developed from the Renault NC and was at first classed as a light tank.

Following decisions made in the *Programme de 1926*, one Char 2C was sent to F.C.M. for modification. There a short 155mm howitzer was mounted and extra armour added, apart from installing Sautter-Harlé engines in place of the two Maybach engines. This tank, the only one of its kind, was named Char 2C *bis*, and it gave rise to rumours abroad of a new generation of French super-tanks.

Meanwhile, studies on further improvements con-

tinued until 1932, when attention was diverted to other projects, including a Char B3 of 45 tons and a Char BB of 50 tons, neither of which was brought to fruition—and the Char 2C continued in service with 51 Battalion.

In May 1940 the battalion was ready for action, with six Chars 2C, but it was prevented from testing its tanks in modern warfare. Loaded on their special rail wagons for movement to the battle area, the tanks were destroyed in a German bombing attack.

MEDIUM TANKS

CHAR D1

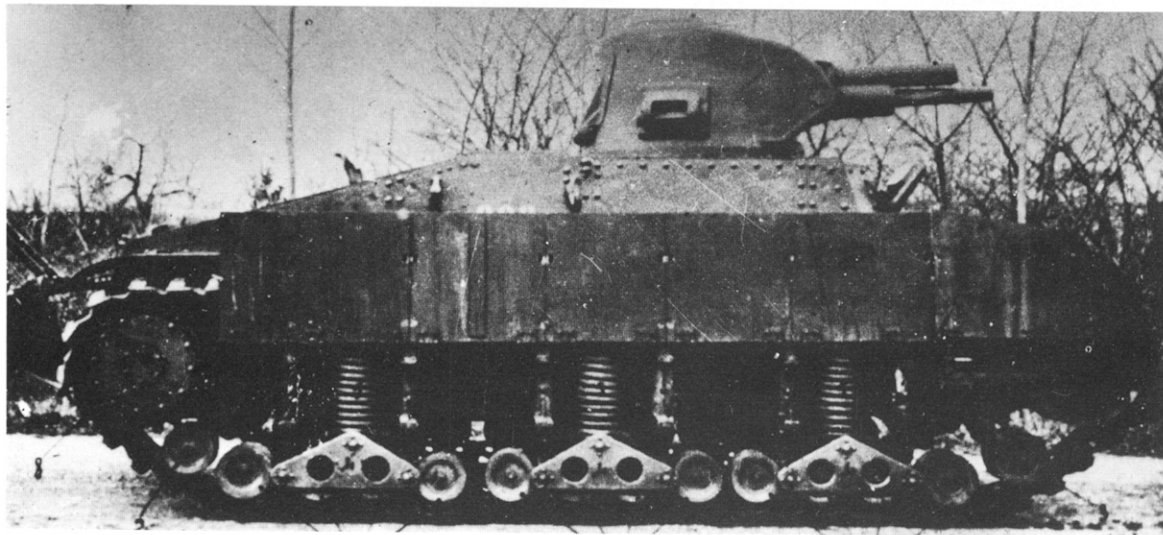
The Renault Chars D, together with a few Chars B, were the only new tanks to be issued to the French infantry between the end of World War I and 1935 when rearmament started.

They were classed at first as light tanks and appeared in 1931 for prototype trials in answer to the current need for a tank below 13 tons in the infantry support role. As such, they were direct descendants from the Renault NC tanks, retaining the same form of one-man turret carried on a high, vertical-sided superstructure and with the same type of suspension. The Char D1 was powered by a 65 h.p. engine, slightly more powerful than that of the NC, and the tank was appreciably larger to give more room for the three-man crew and for wireless equipment. Maximum armour was still only 30mm, but there was better all-round protection and skirting plates were added over the suspension. The weight was up to 12 tons.

Armament on the first tanks, sometimes referred to as Chars D1A, consisted of a 47mm gun in the turret, with a fixed machine-gun in the hull front which offered a crude form of extra firepower by the driver aiming and firing the gun while manoeuvring the tank.

The trials on ten Chars D1 prototypes at Bourges in 1931 were satisfactory, leading to a production order for 60 which was completed by the end of 1932. During that year and in 1933 the Chars D1 took part in the combined exercises with other arms and, although some weaknesses were noted, which is hardly surprising, they were considered suitable for their role 'in all phases of the infantry battle'. As a result, further orders followed to a total of 160 before construction was stopped in 1935. This included production of an improved version, mounting a 47mm gun and co-axial machine-gun in the S.T. 2 turret in addition to the hull gun, with armour up to 35mm and powered by an engine of 100 h.p. Most of

Char D1 with skirting plates raised to show the suspension, which was of the same type as on the Renault NC. An early form of cast turret mounts a 47mm gun.

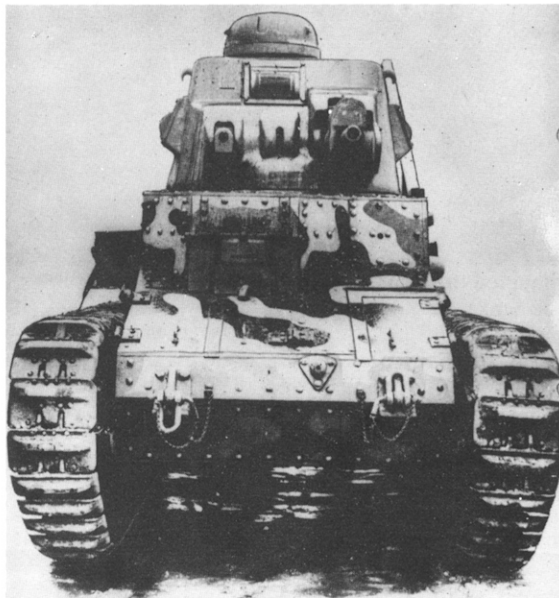


these were used in North Africa.

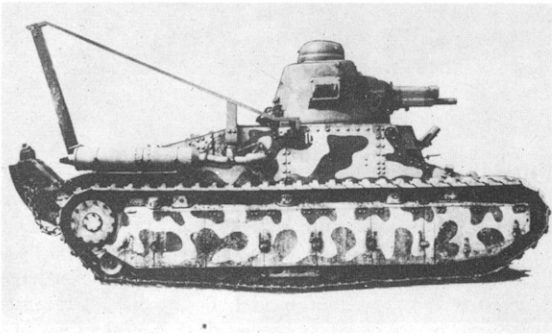
Following the tactical trials of the early '30s, and in view of their increasing weight and armament, the Chars D were re-classified as medium tanks in January 1935.

CHAR D2

From the start of the development programme of the Char D1, the need was recognised for increasing armour protection in the infantry support role, and in early 1930 a demand was stated for a more heavily armoured light infantry tank. In April, Army Headquarters ordered development of another model, based on the D1 and armoured to 40mm, with the result that prototypes of a new Char D2 started trials in 1932. The weight had now gone up to 16 tons, but with a 6-cylinder engine of 150 h.p. the speed was increased to a modest 25 k.p.h. (Two prototypes were fitted with Diesel engines, but these projects were abandoned.)



Char D1 with 47mm gun and co-axial machine-gun separated by the sights in the centre of the ST 2 turret. A boss in front of the fixed, hull machine-gun protrudes from the lower glacis plate.



The later production version of Char D1 with ST 2 turret, carrying triangular frame wireless aerial, and skid tail.

By the end of 1933 the Directorate of Infantry was ready for production in quantity, and in January 1934 an order was placed for 50—the complement for one battalion—but further trials were then demanded and in 1935 the money available for construction was diverted to the Char B1.

The order for the first 50 Chars D2 was not completed until 1938 and in June of that year a second contract was awarded; only 50 more were built before the German assault in May 1940.

In production the battleweight of the D2 went up to 20 tons, but it carried the same crew as the D1 and mounted the same armament. In appearance, however, the tanks were appreciably different; the D2 had the modern Puteaux cast APX 1 turret which was also mounted on the Char B1; track guards were fitted with stowage bins sloping up to the superstructure; and recesses were made in the upper part of the skirting plates to provide mud chutes beneath the four return rollers. An aerial base for wireless was mounted on the right side of the engine deck.



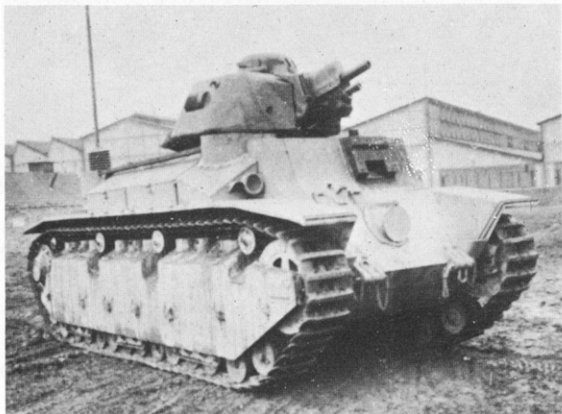
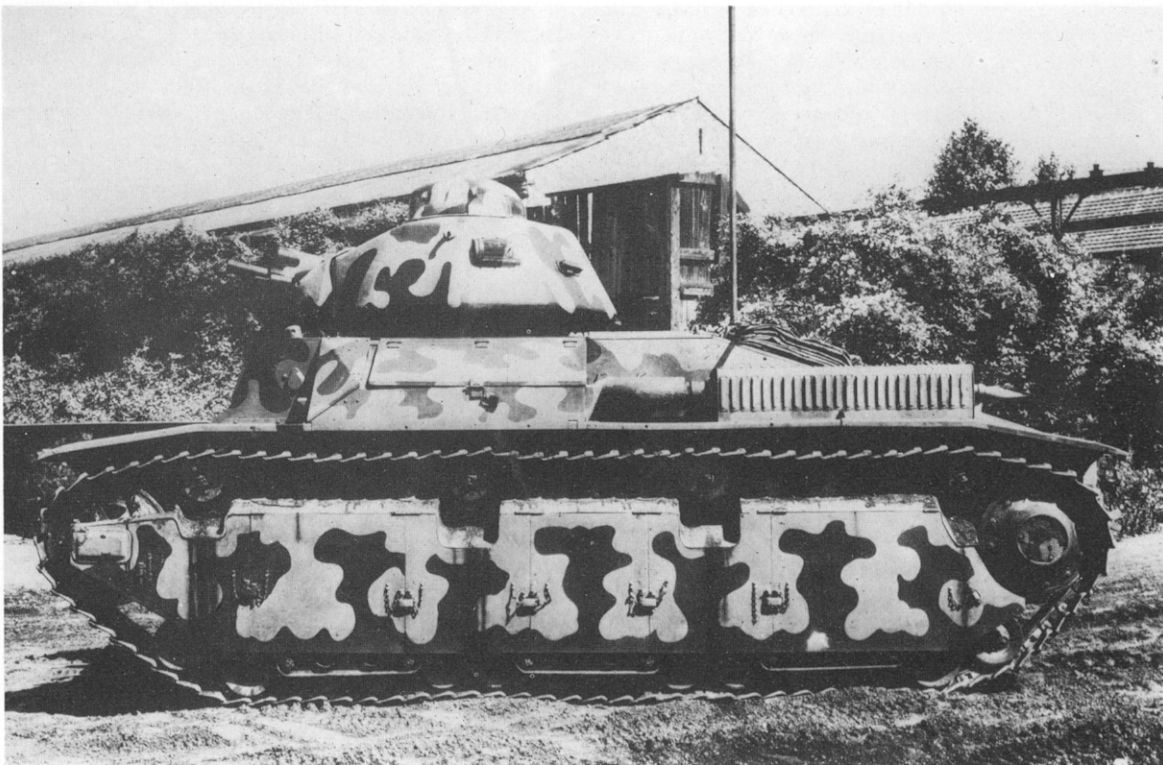
1 The Renault Char D2 was a 20-ton medium tank for the infantry which provided the basis for the design of the cavalry's S35, but in technical detail and construction the two tanks were very different. Although fairly well armoured (40 mm), the Char D2 offered an almost vertical front hull face. (E. C. Armées)

2 Rear of the Char D2. Note the conspicuous round structure for the aerial base.

3 The Char D2 was an improved version of the D1, with its appearance materially altered by the APX-1 turret, stowage bins on the track guards, and mud chutes below the top track rollers.

4 View of the Char D2 showing the separate mantlets for the 47mm gun and machine-gun, similar to those in the APX-4 turret. Note also the protruding boss of the fixed machine-gun on the right of the glacis plate (left of picture). (E. C. Armées)





CHAR B

The initial development of the Char B was essentially the work of General J.-E. Estienne, who was in charge of the *Section Technique des Chars de Combat* until the late 1920s. Under the *Programme de 1921* he initiated studies with five different firms on a 15 ton tank that was to have a 75mm or 47mm gun in a hull mounting and which was virtually a development of the ideas contained in the wartime *Chars d'assaut* Schneider and St Chamond. Mock-ups of four tanks, of about 19 tons, were presented at the arsenal Atelier de Construction de Rueil (A.R.L.) in May 1924—two from Schneider-Renault, one from Forges et Aciéries de la Marine et d'Homécourt (F.A.M.H.) and one from F.C.M. Following technical trials authority was given in January 1926 for three prototypes to be built, making use of the F.C.M. suspension, the Renault engine and the transmission from Schneider, whilst the *Section Technique* was encouraged by success with the Naeder steering system to develop this with the Société des Batignolles as the basis for aiming the gun. However, it was not until March 1927 that firm orders were placed with F.C.M., Renault and F.A.M.H., while A.R.L. remained in control of the project as design parent. Two years later, in January 1929, the first prototype was completed at Rueil, with the second coming also from A.R.L. and the third from Marseilles in mid-1931.

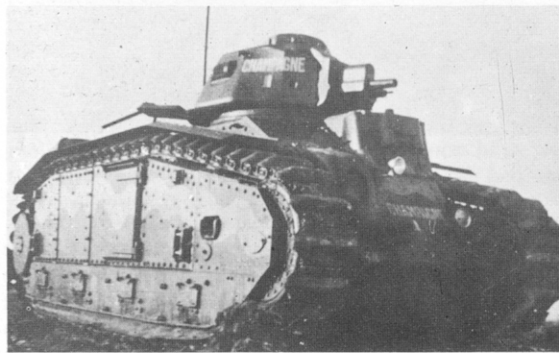
The prototype of the Char B weighed 25 tons, carrying a crew of four protected by a maximum of 25mm armour. In common with general practice of the period,

The APX-1 turret on the Char D2 was the same as on the Char B1, with short 47mm gun and co-axial machine-gun. Note the monocular periscope for the driver.
(E. C. Armées)



Char D2 rising over an obstacle. Many of the infantry tanks carried playing card insignia to identify sub-units.

(E. C. Armées)



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the armament carried a preponderance of machine-guns for 'man-killing', and included one 75mm gun in a hull mounting beside the driver, two fixed machine-guns in the front hull, and two co-axially in the one-man turret. A Renault 6-cylinder engine (180 h.p.) gave the tank a speed of 28 k.p.h., and, carrying 800 litres of petrol, it had a radius of action of 10 to 12 hours. After the initial technical trials and modifications the first prototype was presented to the trials establishment at Bourges in May

1 Char B1 with short 47mm gun in the APX-1 turret. (I.W.M.)

2 Char B1 with turret traversed to the rear, showing the door of the turret open. (E. C. Armées)

3 Char B1, showing one of the many variations of camouflage patterns. The Chars B usually carried the name of a French Province or district.

4 Char B1 bis during factory tests. Note the shield over the bogie wheels, below the skirting plates. (E. C. Armées)

1930 and, by September, was reported as 'representing a considerable progress on earlier weapons'. In October 1931 all three prototypes were brought together as a trials unit for tactical exercises at Mourmelon, for firing and mobility trials. The equipment performed 'perfectly'.

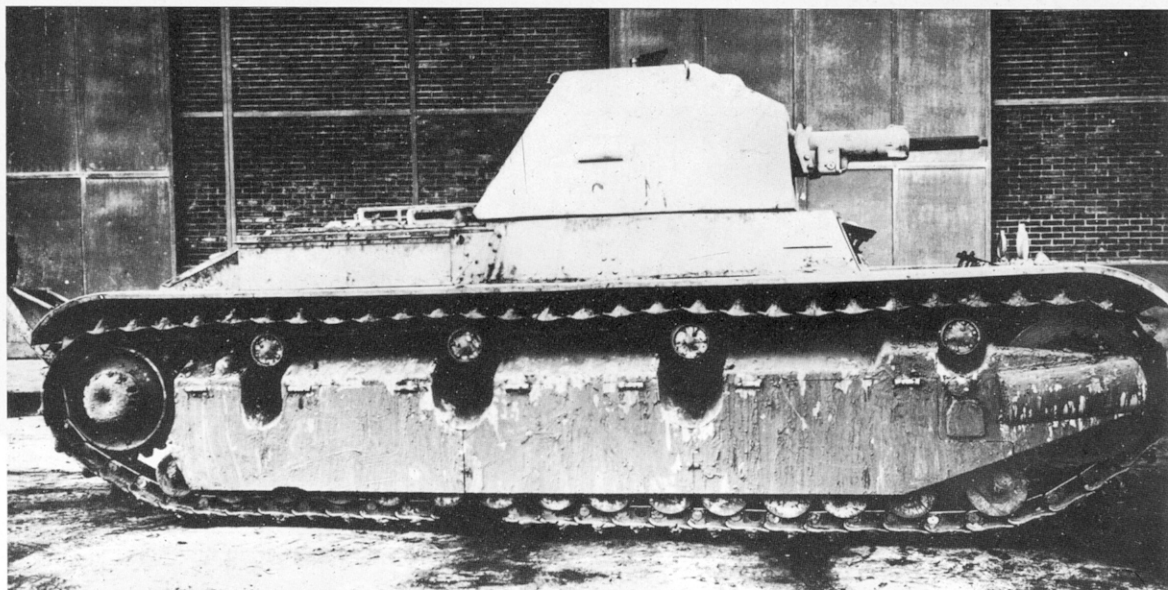
However, development was already lagging behind demands. In October 1930 the War Minister initiated studies on a new *char de bataille*, based on experience with the Char B1, and he presented a revised statement on the required characteristics, demanding high strategic mobility, speed and cross-country performance to move ahead of the infantry, heavy firepower and wireless. Although the battle tank was still tied to support of the infantry, it was at last officially accepted as an offensive weapon that was necessary 'in all phases of battle from

the advance to contact to the pursuit'. Specifications were drawn up and design studies started on a new tank which was tentatively named the Char B2. Its weight was limited to 35 tons, with a crew of 4 or 5 within 40mm armour, having a speed of 40 k.p.h., mounting a 75mm gun and two machine-guns with limited traverse, and the fighting compartment was to be protected against gas. These studies were not pursued to production.

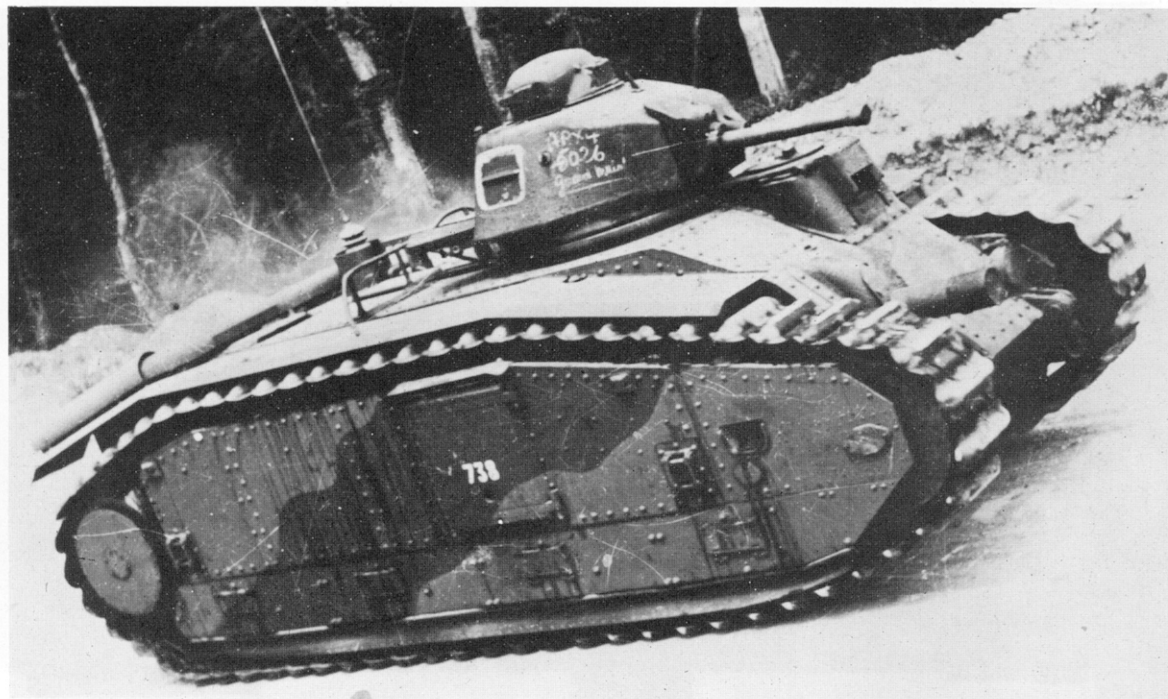
Meanwhile, prototype trials continued on the Char B1. By 1935 its armour had increased to 40mm and weight

5 *The A.M.X.38 was a heavily armoured medium tank with co-axial 47mm gun and machine-gun, but only a two-man crew. Few were built.*

6 *Char B1 bis under tests, 1940. Note the gun deflector rail on the engine deck, and the aerial base placed well to the rear.* (E. C. Armées)

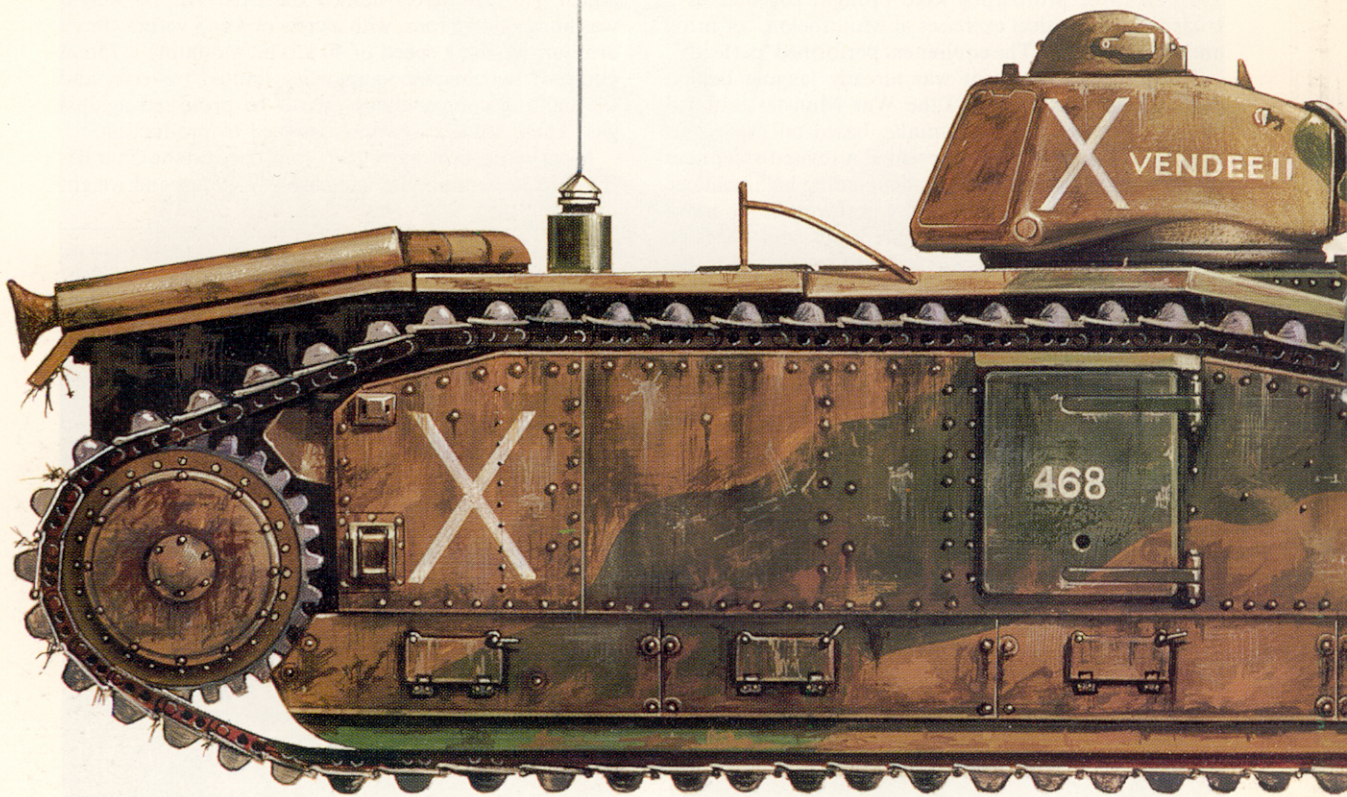


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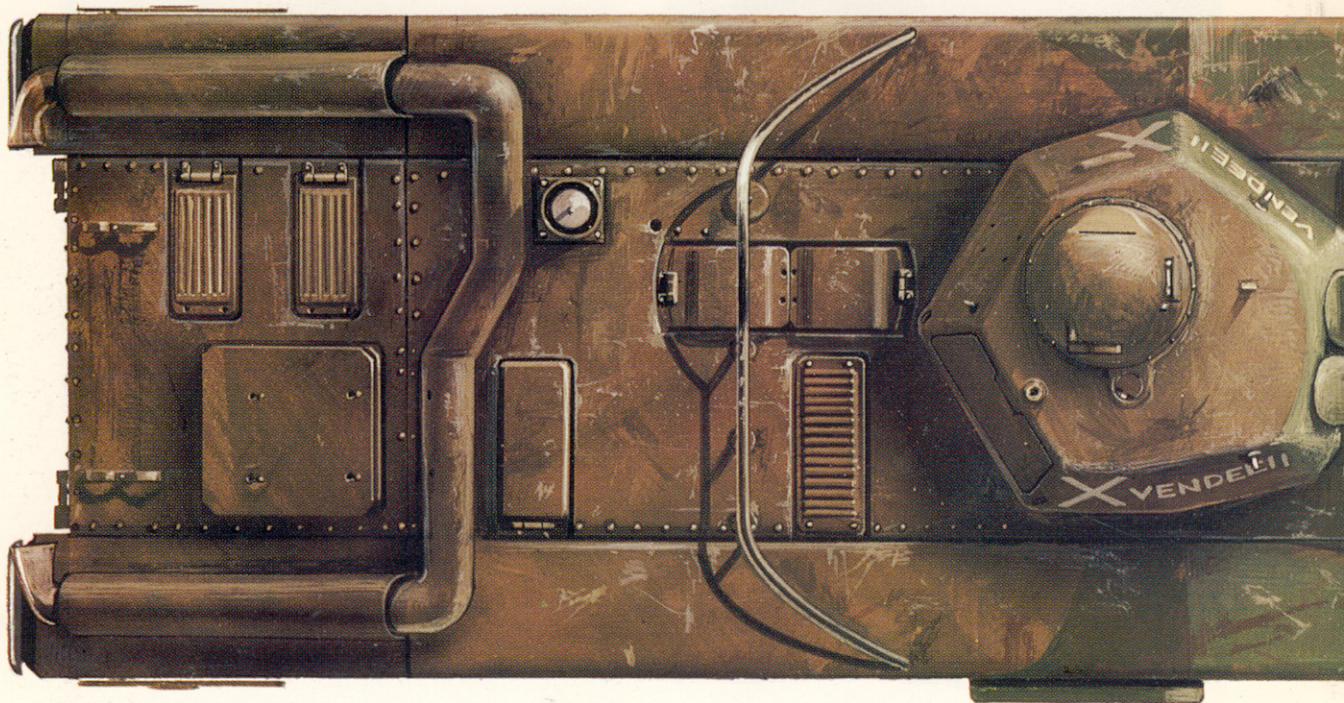


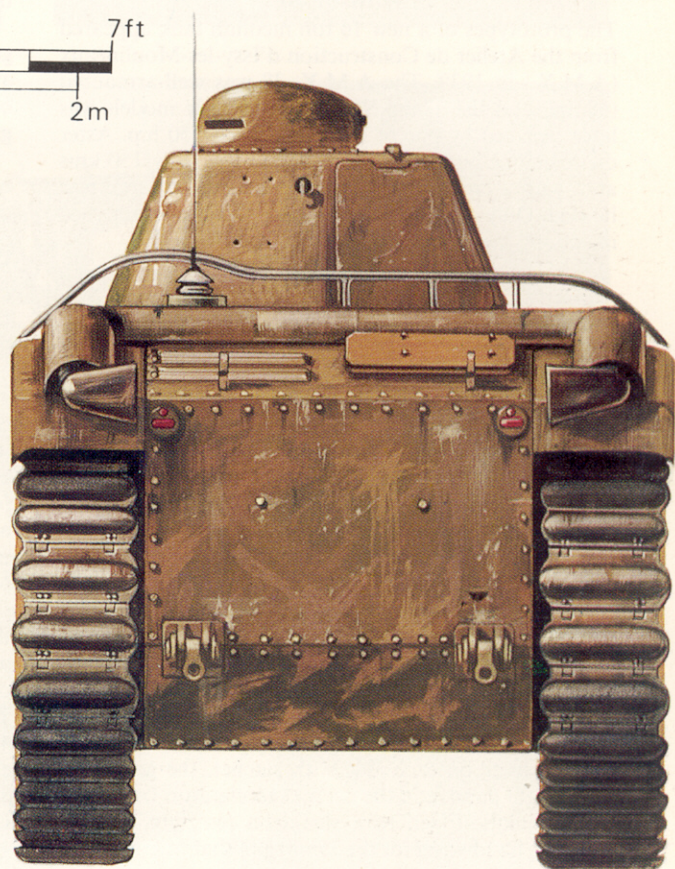
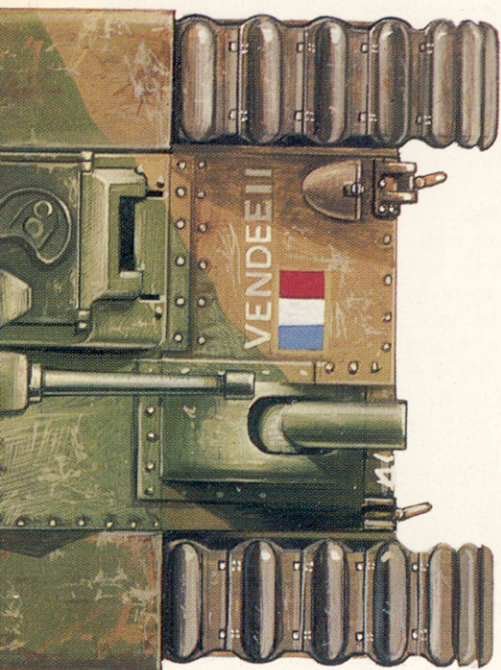
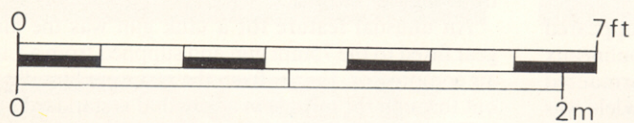
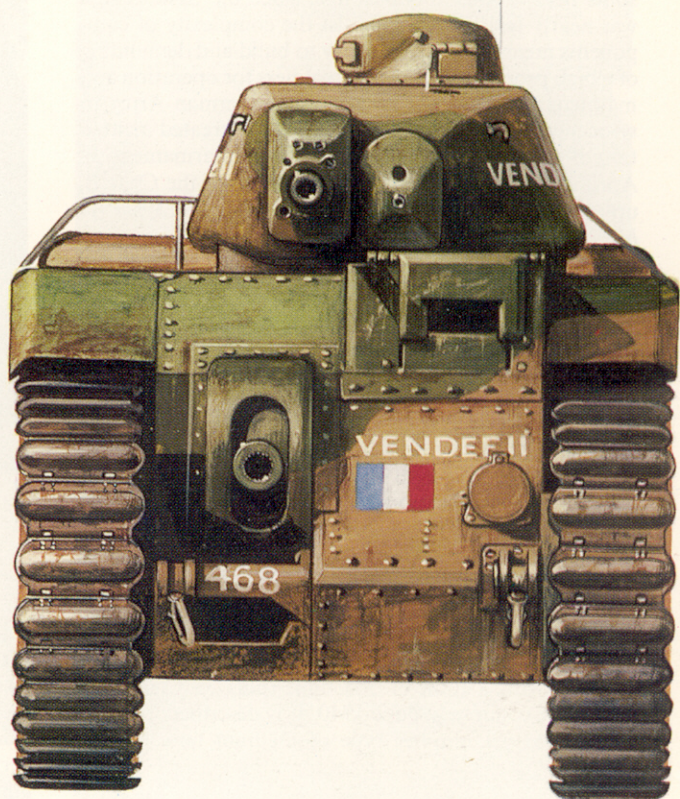
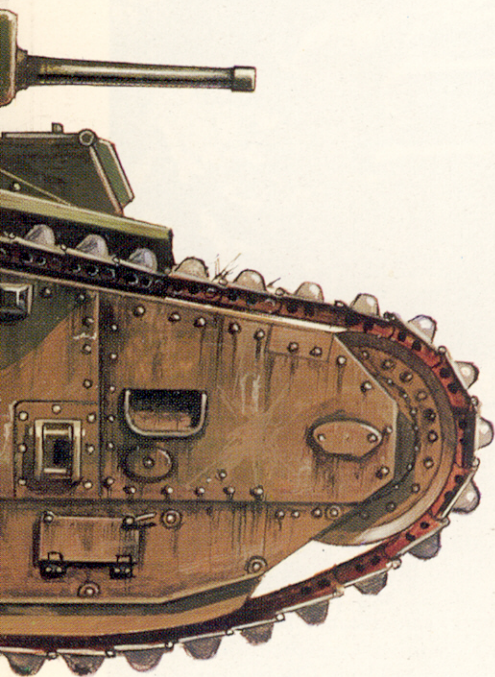
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Char B1 *bis*



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to 28 tons, and its advanced technical merits had confirmed its position as a powerful weapon. There were some reservations about its age, since the basic design was nearly ten years old, whilst the complexity of components meant that it was costly to build and demanding of a high proportion of regular soldiers for operation and maintenance. Then the moves by the German Army to re-occupy the Rhineland in March 1935 created a situation of crisis that demanded immediate re-armament. In April the decision was made to build 40 of the Char B, up-armoured to 60mm, and to be known as the Char B1 *bis*.

This meant further design work and trials to accept the extra armour, but production started meanwhile, based on the prototype designs with armour to 40mm and with the cast APX 1 turret carrying a 47mm gun and machine-gun. Only 35 to this design were delivered before the improvements were introduced, and these early tanks are usually referred to as Char B1—although the prototypes are also sometimes so-called, which can be confusing. The new Char B1 *bis* now weighed 32 tons and mounted an engine boosted to 300 h.p. to carry the extra five tons, but at the expense of a reduced radius of action; the turret was changed to the similar but thicker APX 4 turret mounting a better, high velocity 47mm gun.

Production continued slowly in peacetime, but the Char B1 *bis* became the principal French medium tank in 1940, with a total of 365 built (plus 35 Chars B1) before the collapse in June 1940. It is described in detail below; but yet another type of medium tank was to appear.

A.M.X. 38

The prototypes of a new 16 ton medium tank appeared from the Atelier de Construction d'Issy-les-Moulineaux (A.M.X.) in 1939. The A.M.X. 38 was well-armoured (60mm) and the 37mm SA 38 gun in early models was later replaced by one of 47mm; it had a 150 h.p. Aster diesel engine but its radius of action was only 150 kms and, with a crew of two, its employment in battle was limited. Only a few were produced, and it was not used in action.

DESCRIPTION OF CHAR B1 BIS

The hull of the Char B1 was formed by a few cast armour components bolted together with armoured plates resting on two cross members and on girders along each side. The suspension assemblies, which incorporated vertically mounted coil springs, were fixed to these girders (*à poutre*) so that the springs projected upwards into the hull; skirting plates protected the suspension system below. The hull was divided by a fireproof bulkhead into two parts, with the fighting compartment at the front holding the crew of four, and the engine and transmission at the rear.

The driver, who was a key member of this crew in that he also fired the main weapon, sat on the left front; and he was the only one apart from the commander who had the means to see what was happening outside. Driving controls included a steering wheel (connected by chain and rods to the Naeder hydrostatic system), a brake lever on each side with ratchet, the gear lever to the right hand, and the normal accelerator, brake and clutch pedals. Fixed to a shield on his right was the elevating handwheel for the 75mm gun that was mounted



The heavily armoured Char B1 bis, with its 75mm gun in the hull and a turret-mounted anti-tank gun, was regarded at the outbreak of World War II as one of the most formidable tanks in service anywhere.

(E. C. Armées)

behind a mantlet bolted to the hull front on the right. Movement of the gun in elevation operated the linkage which turned prismatic binocular sights mounted on the driver's hood on an axis parallel with the gun trunnions; the sights were rotated behind a pair of vertical slits beneath the driver's episcopes. However, the gun was fixed in azimuth, and laying for line was effected by swinging the tank.

An unusual feature for a tank gun was the air-blast gear fitted to the 75mm gun and supplied from a Luchard air compressor. Fumes from the gun were literally blown out through the muzzle in a way that is standard in naval gun turrets.

The driver was also, often, responsible for firing (by cable) the fixed machine-gun that was mounted low in the hull to the right of the 75mm gun, although, by repositioning the firing handle to the tank roof, this could be done by the tank commander. There was limited movement of the machine-gun in elevation by a turn-buckle on the mounting but, like the 75mm gun, it was fixed for line.

The loader's duties were to serve the two hull guns; in action he was a busy man as his tasks included the fitting of fuses to the 75mm shells, stowed separately, and he was also needed to provide ammunition for the tank commander (in the turret) when rounds were used up from the racks immediately to hand. Ammunition for all weapons was stowed in bins or racks on the walls or under the floor of the fighting compartment, while some were also stowed in the engine compartment.

The wireless operator was seated, like the loader, at the base of the tank commander's seat. The commander was the sole occupant of the turret, which was carried centrally towards the rear of the fighting compartment. The cast APX 4 turret on the Char B1 *bis*, mounting the 47mm SA 35 gun and machine-gun and equipped with electric power traverse, was identical with that on the Somua S 35, while the APX 1 turret on the Char B1, with less armour and mounting a short-barrelled 47mm gun, was the same as that on the Char D2. This part of

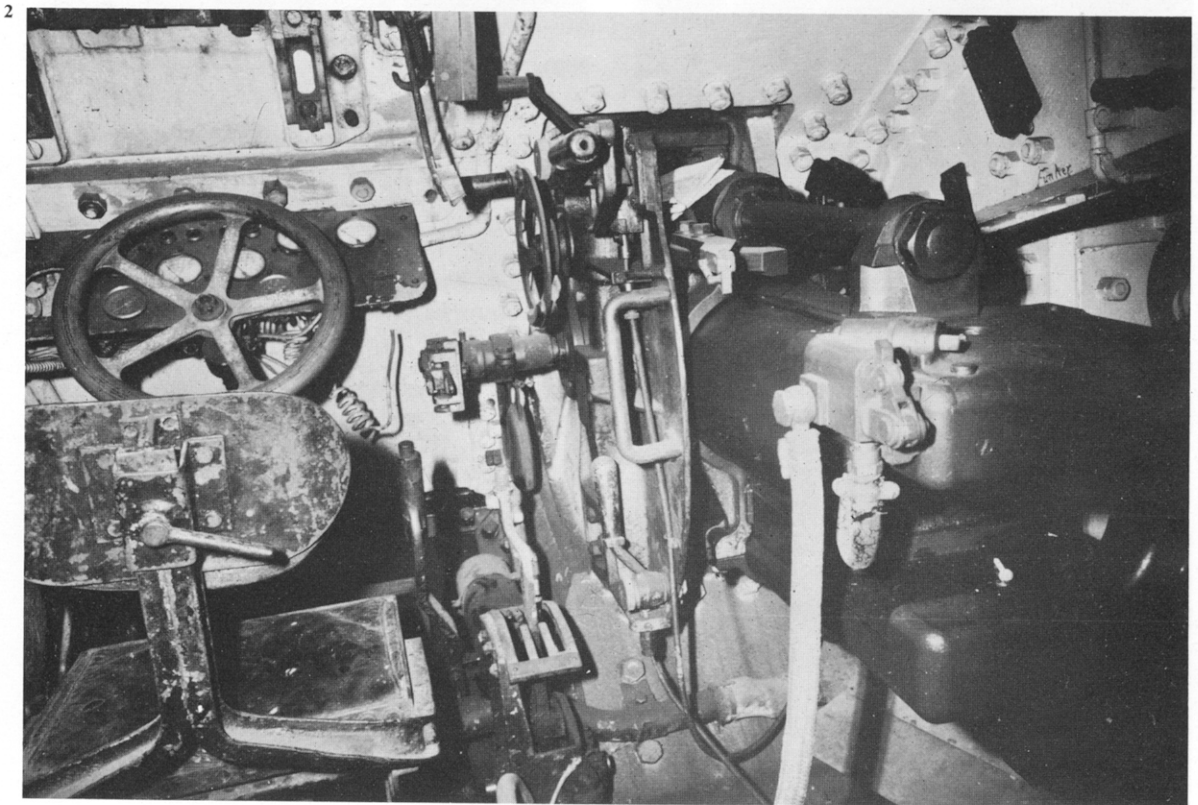
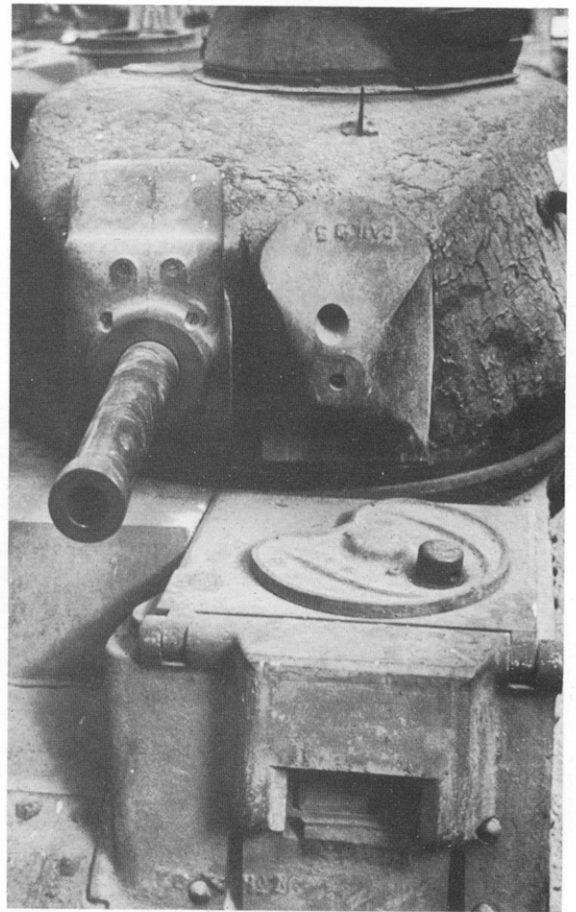
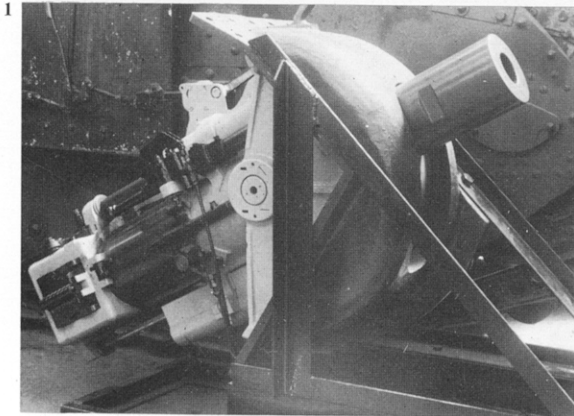
the fighting compartment, known as the 'command post', included the wireless set, the inter-communication control box, a binnacle-mounted compass and a gyroscopic direction indicator. The latter was driven by compressed air supplied from the same Luchard air compressor through a reserve air bottle mounted beside the driver.

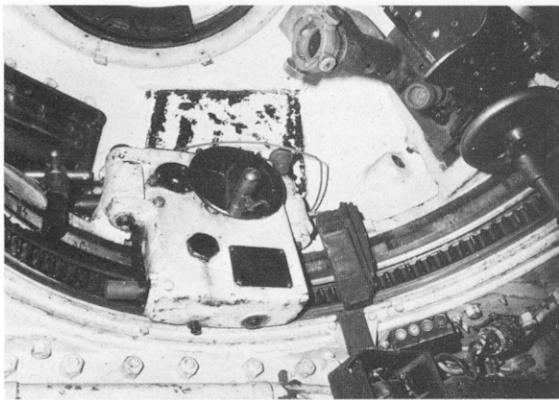
The main entrance to the hull was by a door in the right side, while the driver had a hatch over his head and there was a door in the rear of the turret for the com-

1 Char B1 bis detail 1: The 75mm hull gun and mounting in a recoil position. (RAC Tank Museum)

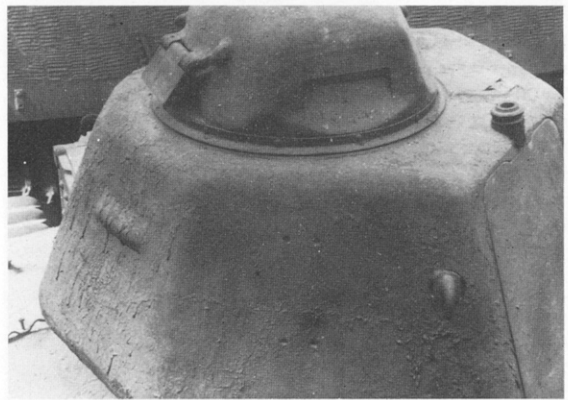
2 Char B1 bis detail 2: The driver's position, with gun elevating hand-wheel and firing gear on his right. Note the compressed air pipe to the air blast gear on the gun, for expelling fumes. (RAC Tank Museum)

3 Char B1 bis detail 3: The driver's hood included binocular sights (for the 75mm gun) mounted below an episcopes in a heavily armoured front face, with monocular periscope in the roof. (RAC Tank Museum)

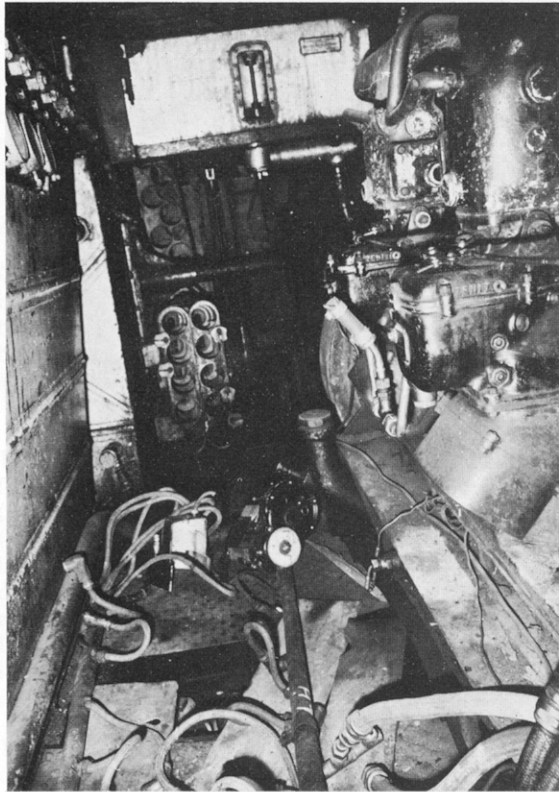




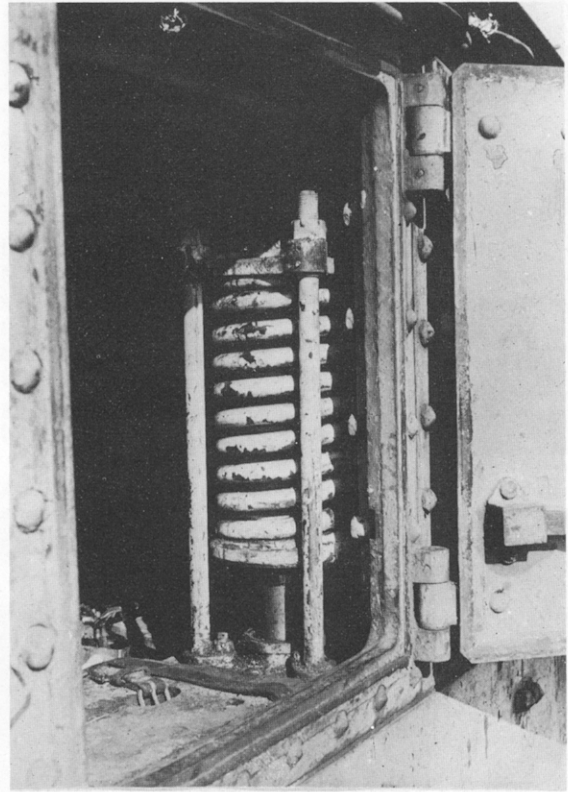
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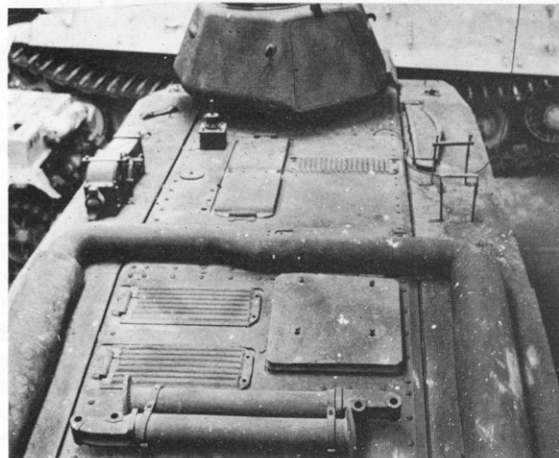
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1 Char B1 bis detail 4: Inside the APX-4 turret, common also to the Somua S35. Right, the elevating handwheel; centre, the electric power traverse gear (driven by electric motor out of sight, left).

(RAC Tank Museum)

2 Char B1 bis detail 5: APX-4 turret, with dome-shaped cupola showing alternative vision devices through episcopes behind either a slit or visor.

(RAC Tank Museum)

3 Char B1 bis detail 6: The gangway beside the engine also contained some ammunition stowed at the end and under the floor.

(RAC Tank Museum)

4 Char B1 bis detail 7: Vertical coil springs of the centre suspension assembly, beside the main entrance door.

(RAC Tank Museum)

5 Char B1 bis detail 8: The rear escape hatch is between the exhaust pipes, reached through the gangway below. German changes in captured vehicles included the aerial base mounted further forward, and the jacks carried on the track guards.

(RAC Tank Museum)

mander. An escape hatch was provided in the hull floor, where there were other doors for the disposal of empty ammunition cases, whilst there was another escape hatch in the roof of the engine deck, reached through the gangway alongside the engine.

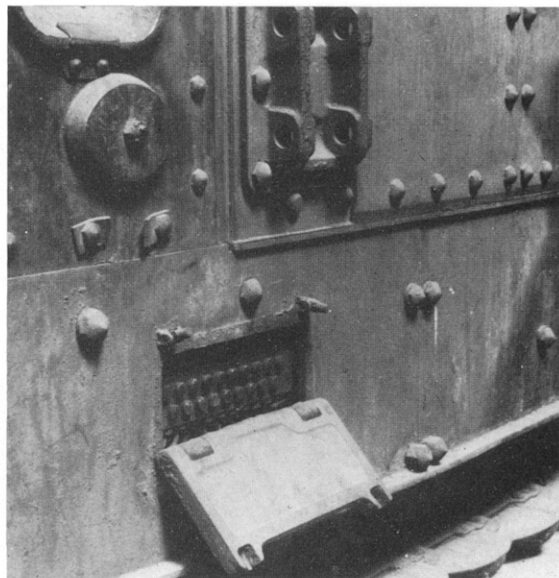
The engine compartment was itself divided into three parts—Right, Left and Centre—and the engine, with associated power train to the gearbox and rear sprockets, filled the Centre. On the Right a narrow gangway, entered through a door in the bulkhead, gave access to some components, fuel gauges and ammunition. Two self-sealing fuel tanks were on the Right side with another on the Left where two radiators and fans were mounted along the axis of the tank, so that cooling air was drawn in from above the gangway, across the engine and out through grill louvres on the left side of the tank.

The engine, a Renault 6-cylinder aircraft engine with magneto ignition, incorporated an unusual compressed air starting system in addition to the normal electric starter motor. This Viet system provided independent ignition and a source of mixed fuel and air under pressure to the cylinders, which was sufficient to turn the engine slowly until the normal firing system started.

The gearbox and transmission unit incorporated a differential connected directly to the final drive and sprockets, together with an auxiliary differential controlled by the Naeder hydrostatic system for steering. In conjunction with this double differential unit, the Naeder system controlled power distribution to each track and permitted the infinitely fine variations in steering which were vital in aiming the gun. Brake drums were mounted externally at each end of the auxiliary differential, operated with servo-assistance by the driver's hand brakes and pedal. If necessary, these brakes could be used for steering.

The suspension was a development of the Holt tractor type, comprising three main assemblies each side, each of four bogies mounted in pairs on plates pivoted at the centre; each of these plates was mounted at the end of a similar one balanced at the base of vertically mounted coil springs, whilst semi-elliptic leaf springs also came into play as dampers under extreme compression. In addition, but not bearing the weight of the tank, there were four independently mounted bogies (three forward, one rear) controlled by leaf springs. Unusually, the front idler wheel (tensioner) was also spring-mounted, and adjustments for track tension were made from inside the fighting compartment. All this involved considerable lubrication of bearings and guides, but the task was made easier with an arrangement of grease nipples in four groups each side behind small doors in the armoured skirting plates. However, the track pins needed greasing individually.

All in all, the Char B was a sophisticated tank with some technically advanced features, but its very complexity was a disadvantage in manufacture and maintenance, whilst its layout and demands on the crew hindered an efficient use of its weapons in battle. It was, in effect, a heavily armoured self-propelled howitzer which also carried an anti-tank gun in a separate turret. Some features of the Char B are said to have influenced the design of the British Churchill with its all-round track; and the Churchill I had a 3-inch howitzer beside the driver. The Char B1 *bis* stood up well to attack by all German anti-tank guns except the 88mm gun in 1940, and it was regarded as a very powerful weapon in its day.

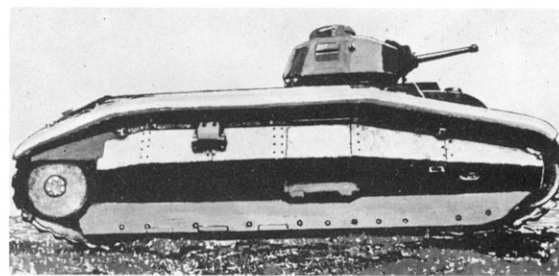


Char B1 bis detail 9: Grease nipples for suspension assemblies were grouped together behind doors in the skirting plates. Above, the bracket for a supporting leg which was used when the tank was jacked up for repairs to the suspension.
(RAC Tank Museum)

CHAR B1 *ter*

At the same time that funds were made available in 1935 for production of the Char B1 *bis*, instructions were given for development of the Char B armoured to 75mm. The opportunity was then taken to change the construction of the hull and to make space for a fifth crew member, described as a mechanic. The armament remained the same, but practical experience had shown that there were disadvantages in laying the gun for line solely by turning the tank, and the new design gave the 75mm gun a mounting with limited traverse of 5° each way.

A prototype of the new tank, known as Char B1 *ter* was presented before M. Daladier at Satory in 1937. However, only five models were made while production concentrated upon the Char B1 *bis*.



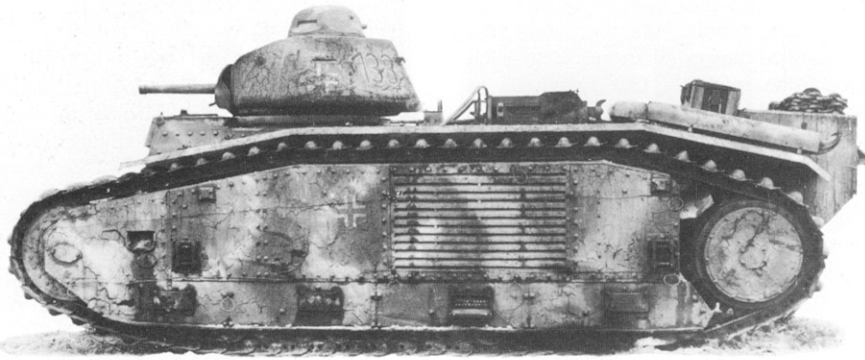
Char B1 ter was an improved version of B1 bis, giving the 75mm hull gun a limited traverse and carrying an extra crewman. Only five were built.

CHAR B IN GERMAN SERVICE

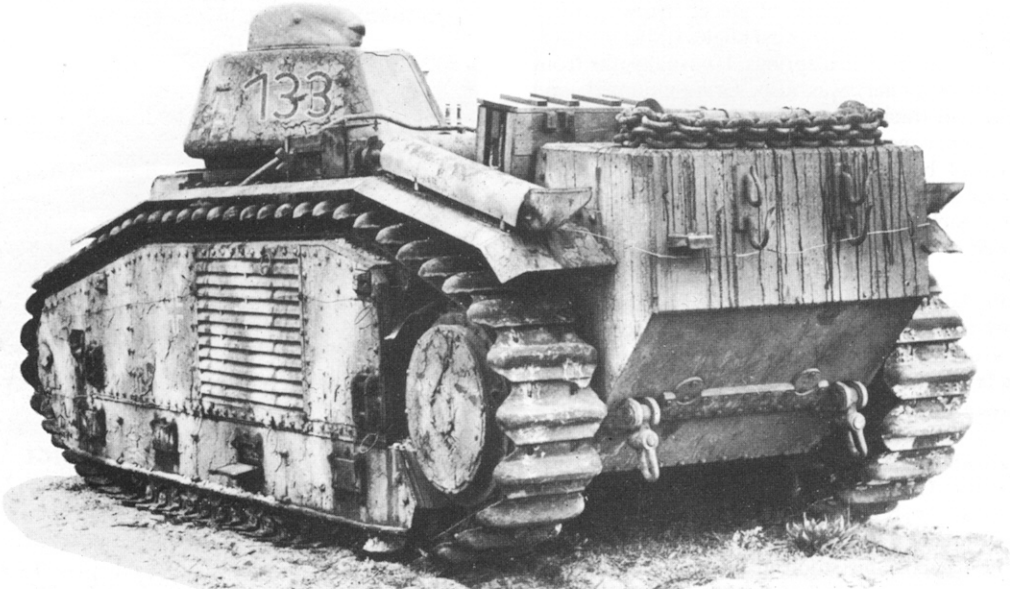
Like many other French tanks, the Char B1 *bis* was taken into use by the German Army after 1940, although the one-man turret for the commander was a severe handicap to its use within the Panzer divisions, and the layout did not lend itself to development. The Char B could, however, be adapted for other purposes and, as



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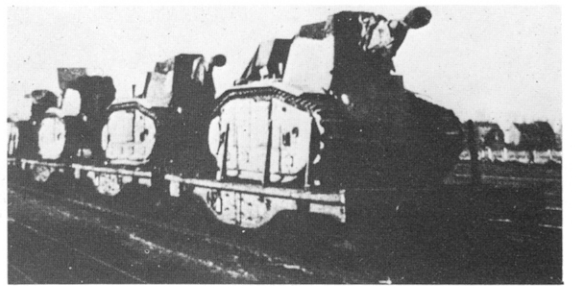
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1 Char B1 bis converted to a flamethrower in German service with flame projector in place of the hull gun. Note the new armoured visor beside the driver's hood to give vision to the flame operator.

2 The PzKpfw B1 bis (f) Flamm in German service, retaining the turret guns for use as a normal gun tank. Note the tank for flame fuel protruding at the rear.

3 The fuel for the flame projector was carried in an armoured tank built on to the rear hull.

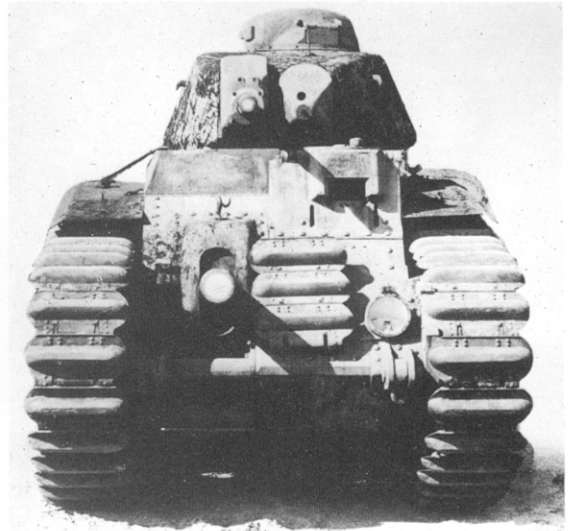
4 A group of Char B1 bis converted by the Germans in 1942 to self-propelled artillery, mounting the standard German 105mm field howitzer and designated 10,5cm le FH 18 auf Gw B2 (f).



the Germans suffered increasing losses on the Russian front, there were demands for the French tanks to fill the gaps in roles where they could be used.

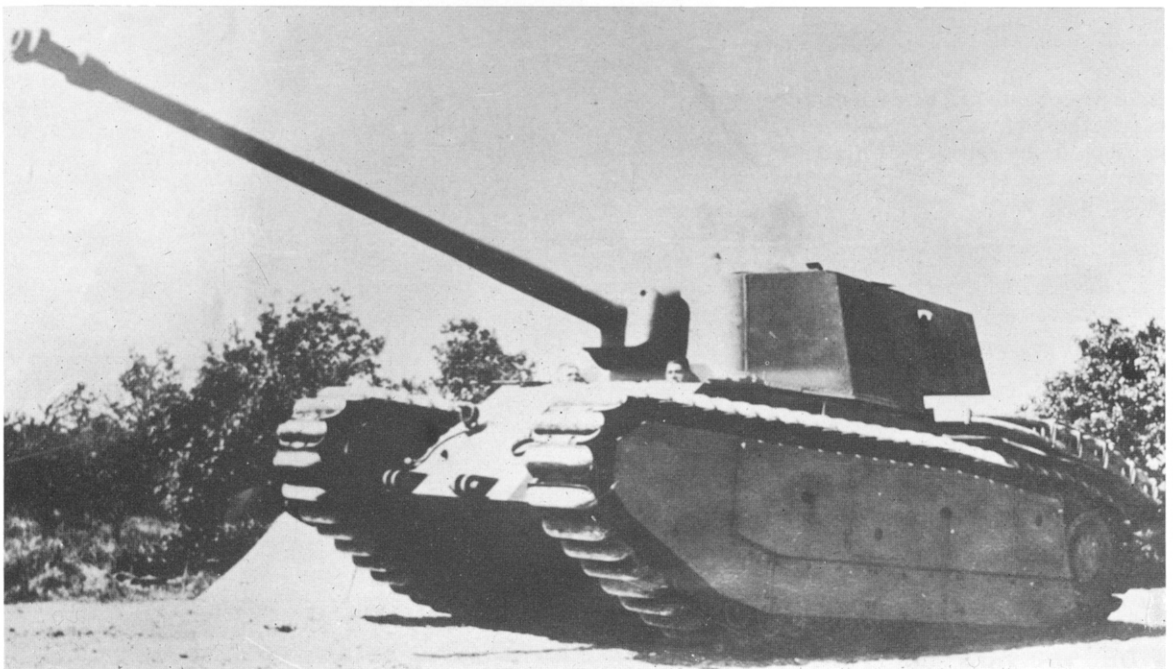
The Char B1 was called into use for driver training, when it was stripped of non-essentials and was known as Pz Kpfw B1 (f) Fahrschulewagen; the turret was removed and the 75mm hull gun and mounting was often replaced by a German machine-gun. In 1942 a conversion to self-propelled artillery was undertaken by Rheinmetall-Borsig, in which the tank turret was removed and a 105mm field howitzer was mounted with limited traverse in a fixed, open-topped turret above the fighting compartment; the 75mm hull gun was also removed. This weapon carried a crew of five, and was deployed among the occupation troops in France under the name of 10,5 cm le FH 18 auf Gw B2 (f). Very few were made.

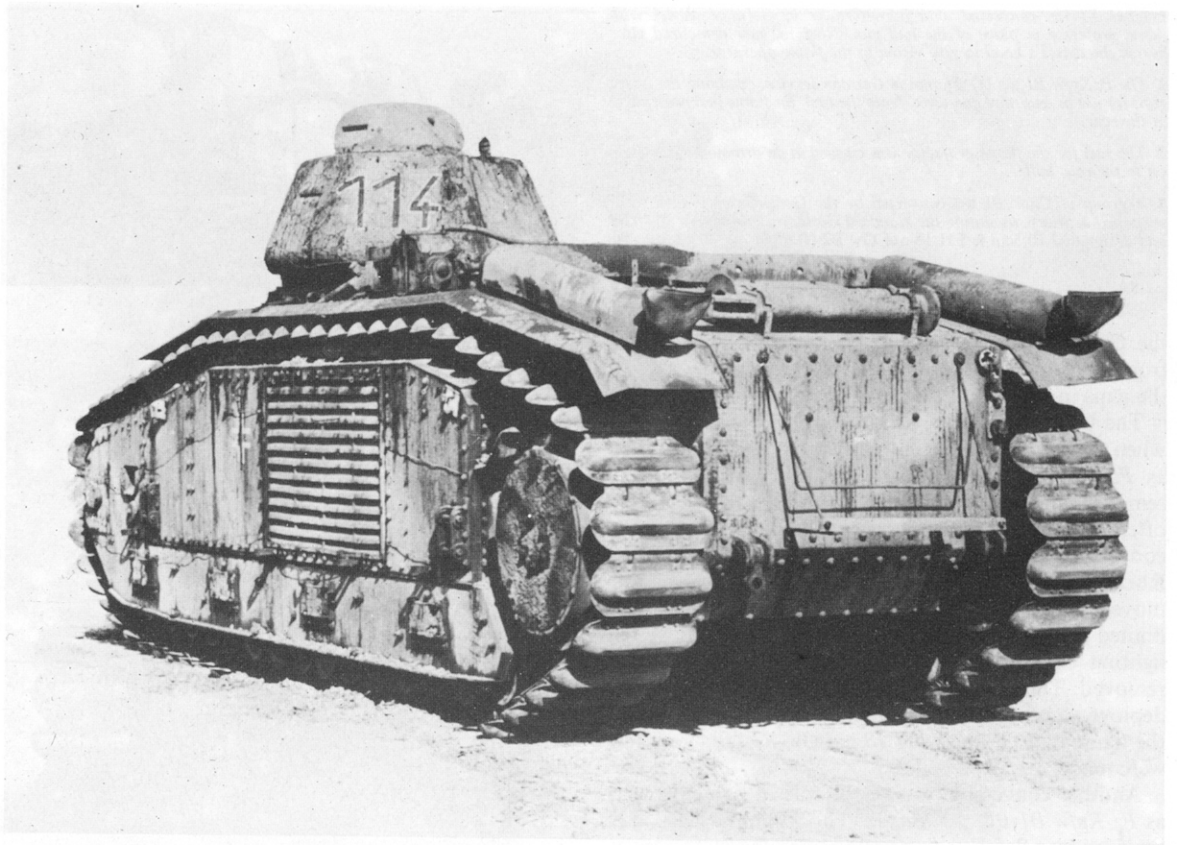
Another conversion was to the role of flamethrower, as Pz Kpfw B1 Bis (f) Flamm. The 75mm hull gun was replaced by a flame projector unit and the hull front was altered to give forward vision to the flame operator for aiming the weapon; the flame fuel was carried in an armoured container built on to the rear hull. The 47mm gun and turret was retained, so that the machine remained a gun tank. Only 24 of these conversions were made, and it is said that at least two were with the German garrison on Guernsey. Another was captured at the end of the war at Deventer, Holland.



The purpose of the German modification in adding to the superstructure above the 75mm hull gun is not clear. The headlamp normally carried an armoured front when not in use. (RAC Tank Museum)

The A.R.L.44 was built as a 'transitional tank' immediately after World War II, based on designs prepared secretly during the war. It had the track and suspension system of the Char B. (E. C. Armées)

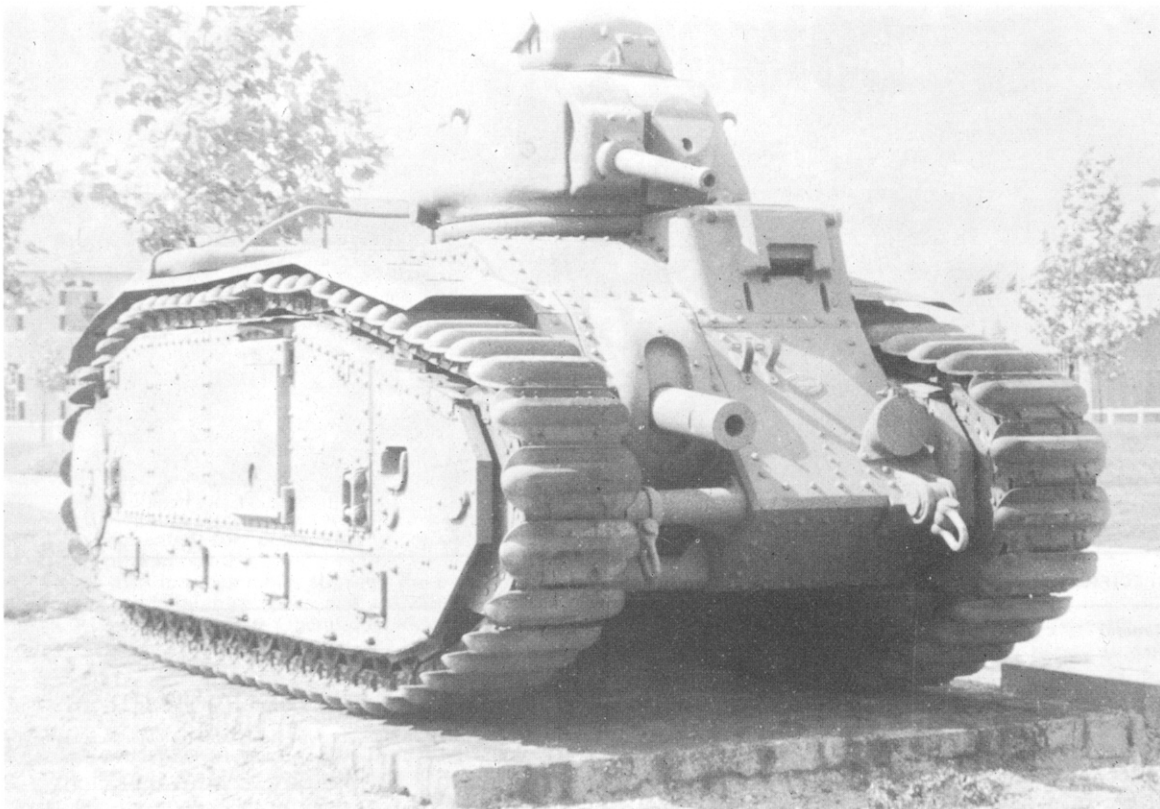




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1 Rear of the Char B1 bis, carrying a German identification number on the turret. Note stowage between the exhaust pipes of the two supporting legs which were used when the tank was jacked up. (RAC Tank Museum)



4

2 This Char B1 bis, captured from the Germans and now in the RAC Tank Museum, Bovington, Dorset, bears the letter abbreviation for 'School of Tank Technology'. Note the slits for periscopic binoculars in the cupola, revealed by the raised visor. (RAC Tank Museum)

3/4 Two views of the Char B1 bis preserved at L'Établissement du Matériel de Gien. These photographs were kindly sent to the Editor by M. Jean Pitaud of Anfa, Casablanca. (Collection Pitaud)

Except when otherwise credited photographs are via RAC Tank Museum.

quite different, carrying a 90mm gun in a conventional turret on a hull that was sloped in front like the German Panther. An order was placed for 60, and production continued until 1950, but the A.R.L. 44 was never very successful and did not remain in service long before being replaced by the new A.M.X. series.

A.R.L. 44

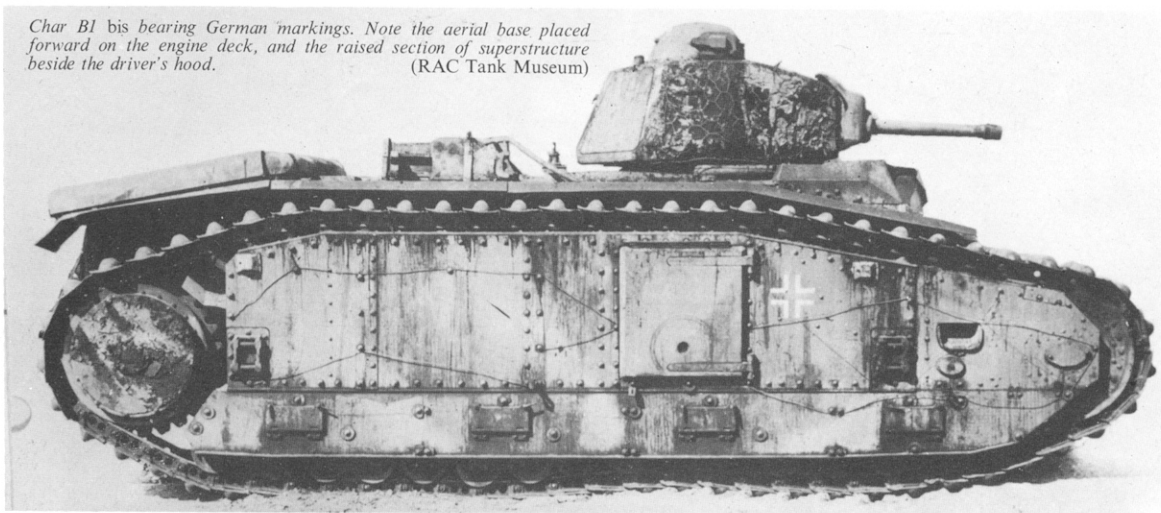
From about 1938 A.R.L. had studied conversion of the Char B to carry a turret-mounted 75mm gun, and this produced a preliminary design as A.R.L. 40. The German occupation then restricted further development, but design studies continued at Rueil in secret. After the liberation of Paris in 1944 the French Army Headquarters initiated production of a new 'transitional tank' based on these wartime designs, and the first one appeared in March 1946, built mainly by F.A.M.H. It was a triumph, and a tribute to faith and determination throughout the Occupation, that it appeared so soon. The A.R.L. 44, as the tank was known, had tracks and suspension based on those of the Char B1, but in other respects it was

FINALE

After the debacle in 1940 the Char B1 bis enjoyed some moments of glory in the liberation of France. In 1944 a section of Chars B1 was recovered and, under the command of an officer who had worked at Rueil and had served in the Chars B in 1940, took part in the capture of the naval base at Royan, at the mouth of the Gironde.

This was the final act. Now there remain only three surviving models of the Char B1 bis, one at the French Cavalry School at Saumur, one at the Royal Armoured Corps Tank Museum in Dorset, and the third at the Etablissement du Matériel at Gien.

Char B1 bis bearing German markings. Note the aerial base placed forward on the engine deck, and the raised section of superstructure beside the driver's hood.
(RAC Tank Museum)



SPECIFICATION – CHAR B 1 bis

General

| | |
|---------------------|--|
| Crew: | 4—commander, driver/gunner, loader, wireless operator. |
| Battleweight: | 32 tonnes. |
| Power/weight ratio: | 9.5 to 1 b.h.p./tonne. |
| Ground pressure: | 13.9 kg/sq cm on hard ground. |

Dimensions

| | |
|----------------------------|-------|
| Length: | 6.52m |
| Height: | 2.79m |
| Width overall: | 2.50m |
| Width over tracks: | 2.43m |
| Track centres: | 1.93m |
| Track width: | 50cm |
| Length of track on ground: | 3.66m |
| Ground clearance: | 48cm |

Armament

| | |
|---------|---|
| Hull: | 75mm SA 35 How (Length 17.1 calibres, muzzle velocity 725 ft/sec). 7.5mm Châtelleraut machine-gun. |
| Turret: | 47mm SA 35 (Length 34 calibres, muzzle velocity 2200 ft/sec). 7.5mm Reibel machine-gun. |

Fire Control

| | |
|---------|---|
| Hull: | 75mm How controlled in elevation by hand-wheel (+25° to -15°), with linkage to sights mounted in front of driver. Control in direction by swinging the tank. Fired by trigger on handwheel. 7.5mm machine-gun in fixed mounting, aimed by moving the tank. Fired by Bowden cable. |
| Turret: | Same APX 4 turret and weapons as for Somua S 35 (or APX 1 turret on Char B 1 and D 2). 47mm gun fired and controlled in elevation by trigger and handwheel (+18° to -18°). Electric power traverse from 12 volt Ragonot motor with hand traverse for sighting. Machine-gun in same horizontal axis as 47mm gun, but independent traverse 10° each way, fired and controlled by handgrip on gun. |

Ammunition

| | |
|---------------|-------------------------|
| 75mm: | 74 rounds (HE). |
| 47mm: | 50 rounds (AP and HE). |
| Machine-guns: | 5100 rounds (32 boxes). |

Sighting and Vision

| | |
|---------|---|
| Turret: | Rotating commander's cupola with periscopic binoculars (mag x4, field 9.9°) and two episcopes. Telescopic sight (mag x4) in machine-gun mounting common to both guns. Two episcopes in turret sides. Sighting vane externally on turret roof. |
| Hull: | In the driver's hood; monocular periscope in the roof (180° field), episcopes with armoured visor, binocular sights for 75mm How mounted below the episcopes, two vision slits (right and left sides). |

Communication

Wireless set ER 53.
Intercommunication set between crew.

Aids to Navigation

Binnacle mounted compass, Vion QS 29.
Gyroscopic direction indicator, type Fieux, with Tel meter complementary to compass. Driven by Luchard air compressor from engine water pump drive, through compressed air bottle.

Armour

| | |
|-----------------|---|
| Hull: | Formed by armour plates bolted with some cast components. |
| Turret: | Cast. |
| Hull: | Front and sides: 60mm Rear: 55mm Top: 25mm Floor: 20mm |
| Turret (APX 4): | Sides: 56mm Top: 30mm |

Engine

Renault, petrol 6 cylinder in line, modified aircraft engine, water-cooled (140 x 180), 16.5 litres, 307 b.h.p. at 1900 r.p.m.
Fuel: 400 litres.
Twin carburettors Zenith Type 70 AR 172; twin magnetos SEV G6 Type 160; two sparking plugs each cylinder.
Viel compressed air starting system in addition to normal electric starter motor.

Transmission

| | |
|-----------|--|
| Clutch: | Fieux, centrifugal. |
| Gearbox: | Five speeds forward, one reverse; synchromesh. |
| Steering: | Double differential steering controlled by hydrostatic Naeder system operated by chain and rod from driver's steering wheel. Braked differential operated by levers and pedal, Athimon servo-assisted. |

Suspension

Sixteen double steel bogie wheels each side running on centre rails of track; three assemblies each of four wheels, each assembly controlled by vertically mounted coil springs with semi-elliptic leaf springs acting under extreme compression. Three independently mounted bogie wheels forward and one at rear, with quarter-elliptic leaf springs. Front idler wheel (tensioner) coil sprung. Six return skids on top.
Track plates: steel soles riveted to bearing surfaces. 63 plates each side, 213mm pitch.

Electrical System

Two 12 volt Cadmium Nickel batteries, 103 A.H., mounted beside the driver.
24 volt system for self-starter and wireless.
12 volt system for lights, controls, power traverse.

Performance

| | |
|--------------------|----------------|
| Maximum speed: | 28 k.p.h. |
| Maximum gradient: | 40° |
| Vertical obstacle: | 93cm |
| Trench: | 2.75m |
| Wading depth: | 1.47m |
| Radius of action: | 6 hours, 150km |

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Edited by DUNCAN CROW

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by Major James Bingham

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Major Bingham concludes this Profile with a critical examination of the French use of tanks, not only in direct support of infantry but in armoured formations, whose development, limitations and demise in action he recounts ("Within a period of three weeks the entire armoured force had been presented for destruction or neutralisation, successively and in detail").

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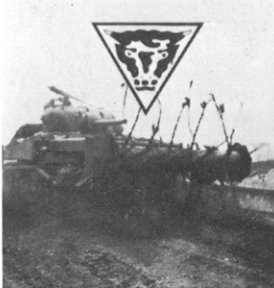
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by Nigel Duncan

The 79th Armoured Division was formed as a normal British armoured Division in 1942. In Spring 1943, however, its role was changed and it became a unique all-armoured formation. In this guise, it was responsible for the operation of the special purpose armoured equipment that cracked open Festung Europa on the beaches of Normandy in June 1944, and then smashed into the Channel ports, assaulted Walcheren, fought in Operation "Veritable" to clear the Reichswald, and took part in the crossing of the Rhine, the liberation of the Netherlands and the conquest of northern Germany. Excitingly told in this book by Nigel Duncan, who commanded the division's 30th Armoured Brigade.

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