

35p

Chars Hotchkiss, H35, H39, and Somua S35
by Major James Bingham, Royal Tank Regiment



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A line-up of Chars Hotchkiss H39 receiving a final check over before being issued. The Hotchkiss H35s and H39s in 1940 were deployed in the Divisions Cuirassées and for direct infantry support as well as in the French mechanised cavalry's Divisions Légères Mécaniques for which they had been primarily accepted. (E. C. Armées)

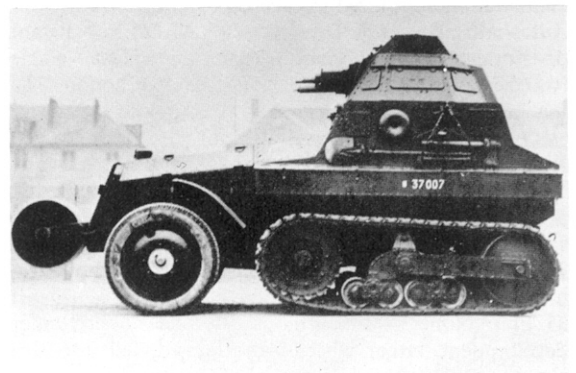
Chars Hotchkiss H35, H39 and Somua S35

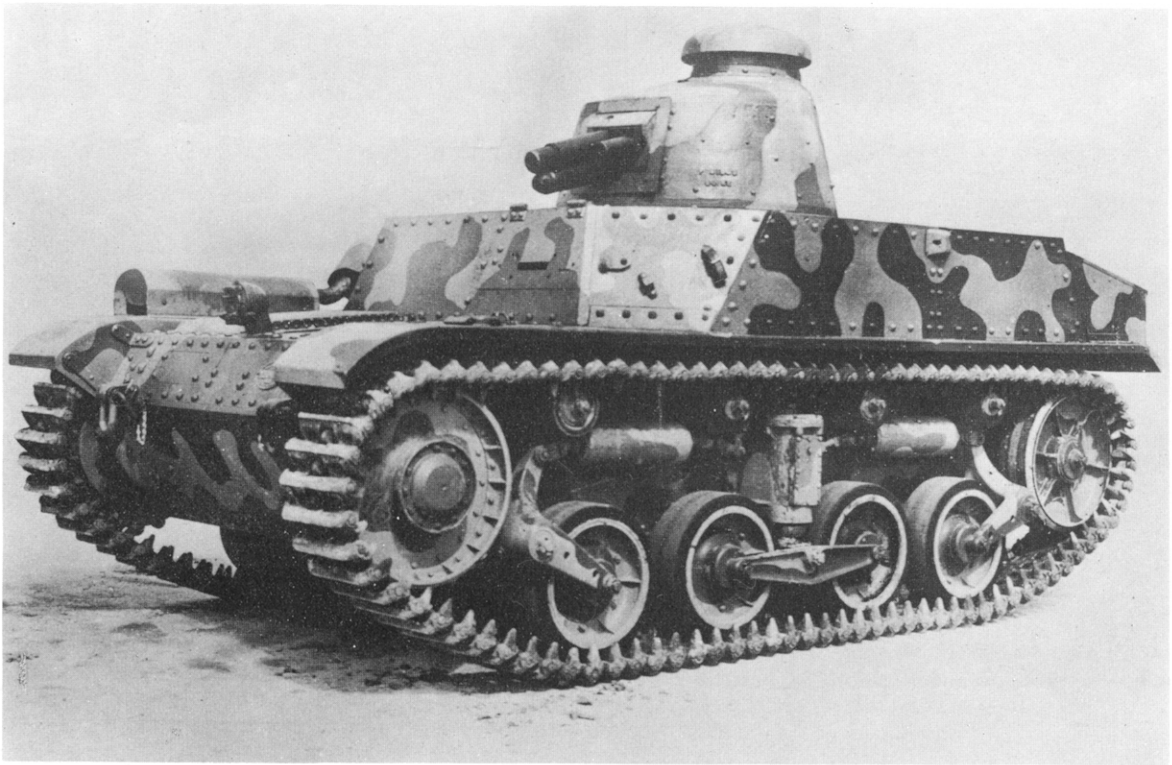
by Major James Bingham, Royal Tank Regiment

TRACKED VEHICLES FOR THE CAVALRY

THE French cavalry had had experience with armoured cars, which, in small numbers, had been allotted to horsed cavalry formations since 1914, but there was no marked enthusiasm for this new weapon. Nevertheless, after World War I a perfunctory interest was shown in the development of a tracked armoured vehicle, which, in having a cross-country mobility for the traditional cavalry rôle of reconnaissance and security, would provide a complement to the road-bound armoured car. In 1922 a design study was initiated at Army Headquarters and this led to specifications being laid down in 1923 for two types of *Autos-mitrailleuses de Cavalerie*. Type No. 1 was to be a wheeled armoured car, while No. 2 would be a light tracked vehicle with a three-man crew, mounting a Hotchkiss machine-gun and a light gun, capable of crossing trenches up to 1.20 metres wide and barbed wire entanglements. However, although both Renault and Citroën showed an interest in the

The Schneider P16, developed from 1923 for the cavalry by Citroën, with Kégresse suspension and rubber tracks, and armour by Schneider. It was a compromise between the two types of reconnaissance vehicle which the cavalry required at that time. In 1932 this half-track was designated an A.M.C (E. C. Armées)





Prototype of the A.M.R. Renault 33 VM mounting the Renault FT turret.

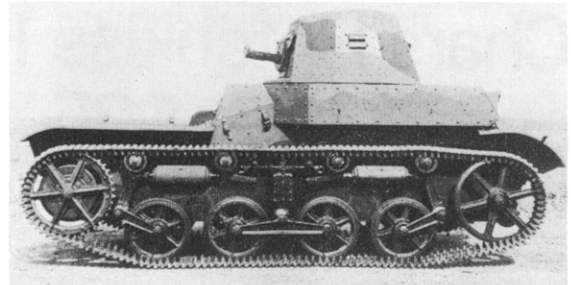
tracked vehicle (Type No. 2), there was little positive progress, and in 1927 the study on this particular type was suspended while trials continued on other vehicles; the experimental half-tracked Citroën-Schneider, designed for the cavalry, was a compromise between the two types, while the Renault NC light tank, which was being developed to infantry specifications, had some of the characteristics required in the *Auto-mitrailleuse de Cavalerie* No. 2.

The concept of these two types was dropped altogether, however, in 1931 when tentative ideas were considered in practical terms on forming an armoured force for the cavalry rôle, separate from the tanks of the infantry. A new armament programme defined three classes of armoured vehicles for the cavalry, and the definitions were quickly followed by detailed specifications of the characteristics required in each class. They were:

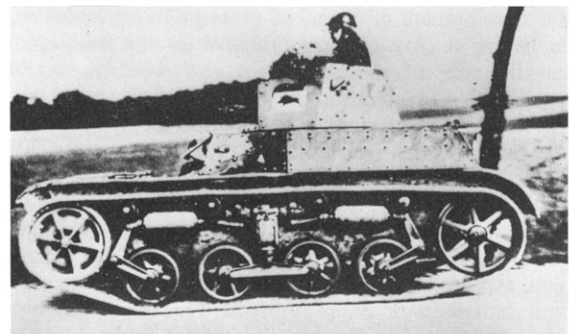
Autos-mitrailleurs de Découverte (A.M.D.) For distant or strategic reconnaissance, requiring a fast vehicle (wheeled or tracked) with a wide radius of action. The machines developed under this classification were all armoured cars and they are not dealt with further here.

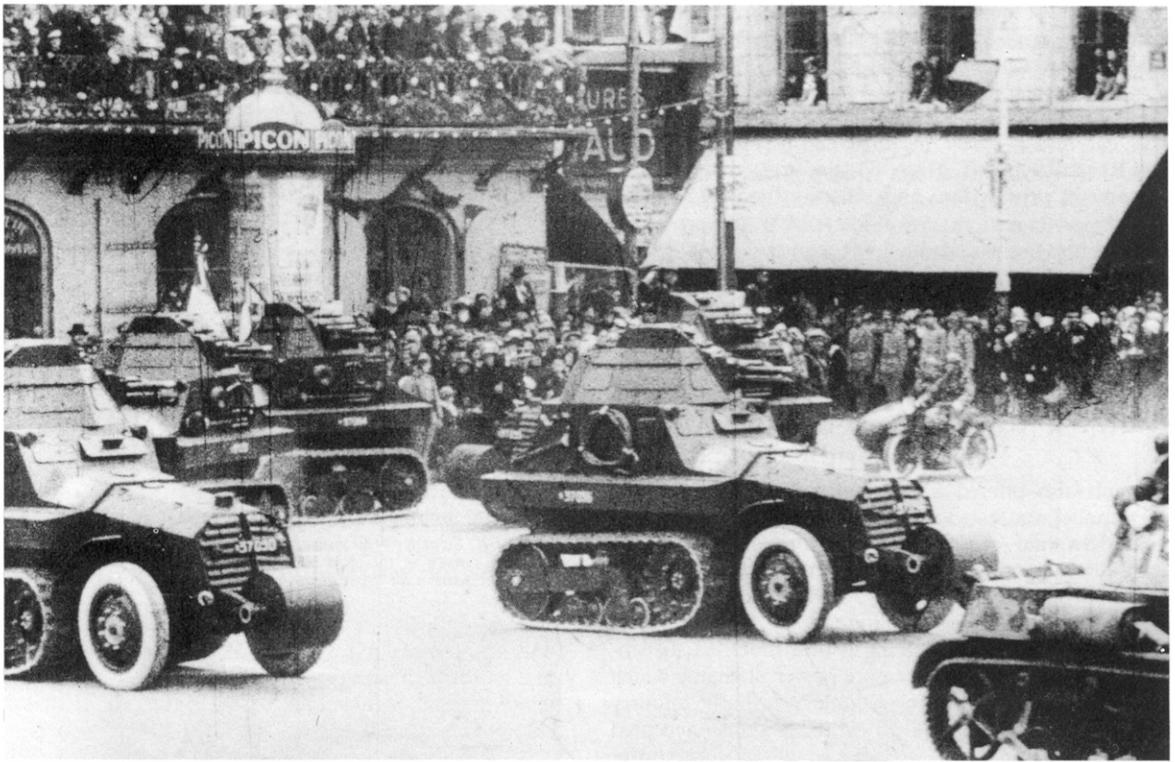
Autos-mitrailleurs de Reconnaissance (A.M.R.) For local reconnaissance, needing a light and lightly-armoured vehicle which was extremely mobile. The specifications, issued in January 1932, included a 2-man crew, armament of one 7.5mm machine-gun, an unladen weight of 3000 kg, and a road speed of at least 35 kph. None of the armoured vehicles then under development, either wheeled or tracked, fell into this class.

The A.M.R. Renault 33 VM. The suspension is curious, with a twin-wheeled bogie in the centre pivoting at the lower end of a vertical coil spring, and single wheels at front and rear on bell cranks.



The A.M.R. Renault 33 VM was a fast light tank (60 kph), but it was inadequately armed, even for reconnaissance, with only one 7.5 mm machine-gun.





A.M.C. Schneider P16s took part in the manoeuvres from 1932 to test ideas on forming an armoured force for the cavalry role. Here they are seen in a parade including an A.M.R. 33 VM.

Autos-mitrailleuses de Combat (A.M.C.) As the name implies, this was a more heavily armoured and armed fighting vehicle, capable of engaging enemy armoured vehicles in support of those in the other two classes. The specifications, also confirmed in January 1932, stated the need for a 3-man crew (or 4 if there was a second driving position to the rear), a 47mm gun and one 7.5mm machine-gun, an unladen weight of 7500 kg. and a road speed of 30 kph. The half-tracked A.M. Schneider P16 was detailed as the only existing vehicle which came into this classification; but development on that machine was soon stopped.

Inevitably, the cavalry's need for tracked armoured fighting vehicles produced machines which were very similar to those developed for the infantry, but two distinct type names were used to differentiate the vehicles according to their rôle and to identify the arm which was responsible for their development. The cavalry had *autos-mitrailleuses* ("machine-gun cars") and the infantry had *chars* (tanks). The difference in names may have maintained for a time the illusion that the cavalry were not making "tanks", but in 1935 a new, more rational term of *Char de Cavalerie* was introduced.

Autos-mitrailleuses de Reconnaissance

The firm of Renault was quick to respond to the new specifications of the A.M.R., and in March 1932 produced the mock-up of a fully-tracked vehicle which was based on experience with the light tank Renault NC. The design approximated to the general specification, mounting a single machine-gun, and five prototypes were ordered. In February of the following year, this machine

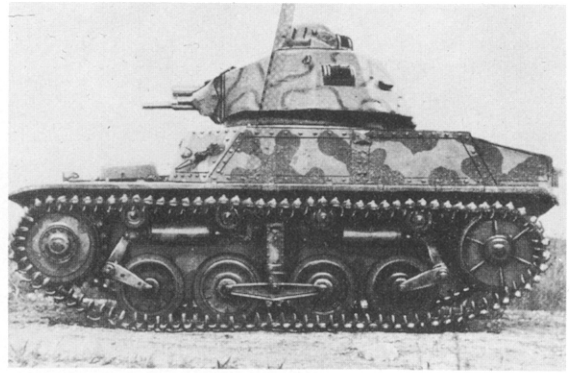
was accepted as the A.M.R. Renault 33 VM, and a total of 123 machines was made.

Service trials led to new demands and in 1934 Renault produced another model, which was heavier by 1000 kg. with a battle weight of 6000 kg., although it carried the same armour (13mm). It was a little slower, but it mounted more powerful weapons with the alternatives of a 25mm gun or 13.2mm machine-gun in addition to the 7.5mm. It was also generally easier to handle and it went into production as the A.M.R. Renault 35 ZT. A total of 200 was ordered.

A captured A.M.R. Renault 33 VM being examined with cautious curiosity by German soldiers in 1940.



Also under the classification of A.M.R., a 6-wheeled armoured car of revolutionary design appeared in 1935, and was known as the A.M.R. Gendron-Somua (See *Profiles French Armoured Cars to 1939* and *Panhard Armoured Cars*). Trials showed that, in some respects, this car had a better performance for this rôle than the Renault type ZT. However, the tracked vehicle was already in production, and although accepted by the Cavalry as its next, *modèle 1939*, A.M.R. this armoured car did not go into production because of the outbreak of war.



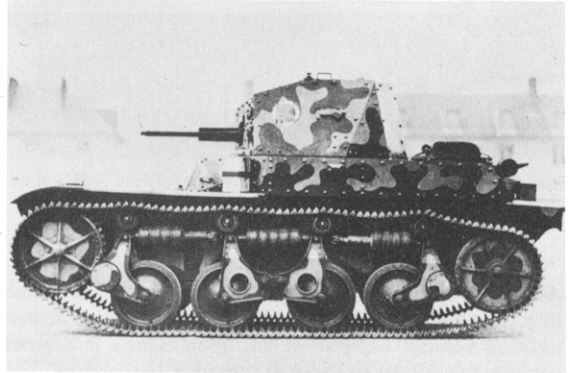
The A.M.C. Renault 34 YR was produced in small numbers for trials only; in this particular case mounting a cast turret which was also under development. The A.M.C. 34 YR was the first French light tank to carry a 3-man crew.

Autos-mitrailleuses de Combat (Chars de Cavalerie)

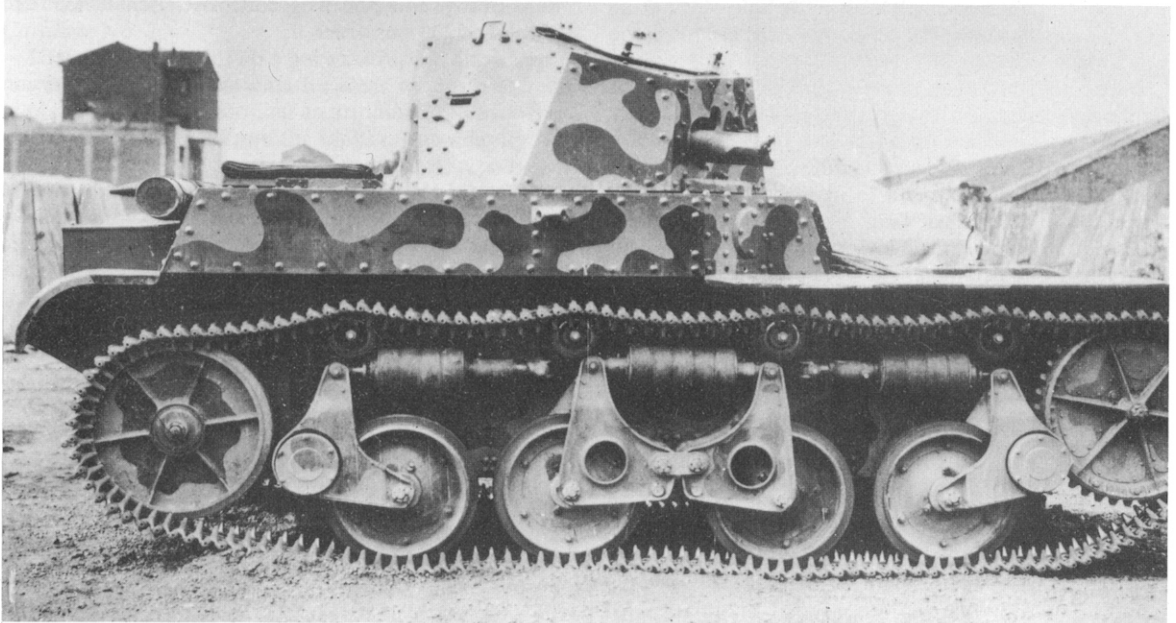
Renault also offered a design for the A.M.C., and a pilot model was tested at the end of 1933. Trials revealed an inadequate cross-country performance since the engine was too weak and the ground pressure was too high, but under the name of A.M.C. Renault 34 YR, twelve tanks were ordered for further trials. Renault then produced another model with a modified suspension, a longer track, and a more powerful engine which was a cut-down 4-cylinder version of that in the infantry Char B1. As a matter of urgency, this tank was accepted as the A.M.C. Renault 35 ACG 1, and an initial order was placed for 17. Production was taken up by *L'Atelier de construction d'Issy-les-Moulineaux* (AMX) which built 100, allocated to the French and Belgian armies.

Neither of these models had armour of greater thickness than 25mm and they were not then considered powerful enough for the combat rôle which was the reason for their existence. In June 1934 new specifications were drawn up, amending those of 1932. They

An A.M.R. Renault 35 ZT mounting a 13.2mm machine-gun. It was an improved version of the A.M.R. 33 VM, with a new suspension that formed the pattern for subsequent French light tanks.



The A.M.R. Renault 35 ZT mounting a single 7.5mm machine-gun.



included a 3-man crew, armament of a 7.5mm machine-gun with a new model 47mm gun or 25mm gun mounted in the Puteaux APX 1 type turret, armour thickness of 40mm and an unladen weight of 13,000 kg.

The *Société d'Outillage Mécanique et d'Usinage d'Artillerie* (S.O.M.U.A.) of St. Ouen, a subsidiary of the Schneider firm, had been working on a new design developed from the Renault D1 and D2 tanks of the infantry, and in 1935 presented their prototype, which was known at first as the A.M.C. Somua Type AC 2, in answer to the new specifications. It was demonstrated at the trials establishment at Vincennes in August 1935, and attracted immediate attention. The tank was powerfully armed, carried thick armour and showed a remarkable speed and mobility for its weight. The cavalry quickly accepted this tank, which went into production under the name of Char 1935-S, or more commonly known in English as the S35; about 500 were eventually built. The infantry would not accept the S35 as they had different views on the types of tank they needed and, in any case, were not entirely in favour of S.O.M.U.A., a comparative newcomer to tank production.

In the meantime, the creation of the first *Division Légère Mécanique* in 1934 led to the search for a light tank which would be a complement to the medium tank which, in fact, the S35 was. Following a different line of development, the cavalry adopted the Char Hotchkiss 35-H. This tank had been designed to meet infantry specifications for a light tank, and three prototypes had been ordered in December 1933. The first of these was delivered to Vincennes in January 1935, but after trials at the infantry establishment at Mourmelon, the Hotchkiss tank was rejected in July in favour of a similar

Renault tank, which was at roughly the same stage of development but had already been ordered in quantity (the Renault R35). The main weaknesses, from the infantry point of view at that time, were reported to be a lack of engine power, and a poor suspension which affected cross-country mobility. The cavalry were not convinced by these reports and accepted the Hotchkiss H35, which was a little faster, as suitable for the cavalry rôle. More than 1,000 of the Hotchkiss tanks were built, including the H35 and its successor, the H39, and the infantry later accepted the Hotchkiss tank for use in the *Divisions Cuirassées* in 1939/40, as well as for a few units tied directly to infantry support. In fact, the infantry were ultimately to deploy almost as many Chars H35 and H39 as the cavalry, and to use them in just the same rôle as the R35.

The A.M.C. Renault 35 ACG 1 appeared in two forms, differing only in the armament; here shown with the 25mm gun and 7.5mm machine-gun.



The suspension of the A.M.C. Renault 35 ACG 1 was similar to that of the Renault R35, but with five top rollers. Note the monocular periscope in the turret roof.



DESCRIPTION OF THE SOMUA S35

Although the S35 was developed from the D1 and D2, and retained the same basic shape and layout, it differed markedly from them both and contained a number of original features. In fact, the S35 was rated by some as the best tank in the world in its day, proving to be fast and reliable, with a good radius of action, and carrying a formidable anti-tank gun as well as heavier armour than its equivalents in other armies.

The hull itself represented a notable advance in the use of cast armour, a form of construction which the French had introduced as early as 1918 with the cast turret of the Renault FT. The hull was formed of three sections bolted together to make a rigid structure; the lower part, stretching the full length of the tank, provided a form of open, flat-topped container for the engine, transmission and controls, and to which the suspension assemblies were bolted on the sides; the other two parts formed the superstructure which covered the top of this container and was bolted to its rim; the rear part covered the engine and transmission units, while the forward part enclosed the fighting compartment and carried the turret. Cast armour hatches gave access to both compartments, and lifting hooks were incorporated in both the superstructure castings for use in assembly and dismantling. The hull design was ingenious, but the horizontal joint between the lower hull and the superstructure, secured by bolts all round, held a serious weakness. An anti-tank missile striking the hull at this joint would split the hull open.

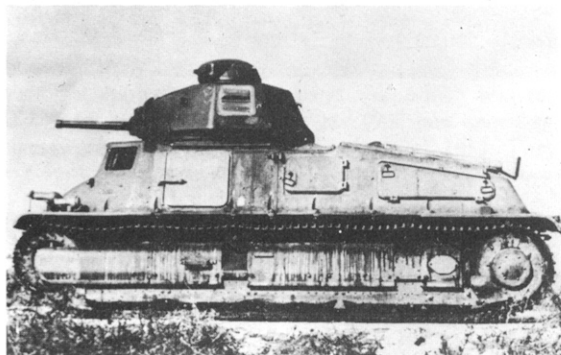
There were no partitions to separate the crew of three in the fighting compartment, to which access was by a door on the left side of the hull; an emergency escape hatch was provided in the floor below the commander. The driver sat at the front on the left, with normal brake, accelerator and clutch pedals; on his right the gear lever and hand brake with ratchet, and a steering wheel between his knees. An armoured visor, which could be opened, gave the driver a view forwards; when closed down his vision was restricted to a slit in the visor, with episcopes, and vision slits to right and left. The wireless operator, sitting on the right, had vision to the front only through a slit, and his principal task was control of the two wireless sets, one mounted below the front glacis plate and one on his right in the pannier above the track.

The commander, who was also the gunner in the one-man turret, sat on a saddle which rotated round a post bolted to the floor of the tank. Ammunition was stowed in racks on the hull sides, the majority on the right within easy reach.

The APX 4 turret on the S35 was the same as that on the Char B1 *bis* and the D2 tanks, mounting the 47mm SA 35 gun co-axially with the 7.5mm Reibel machine-gun. It was an unusual mounting, however, which gave the machine-gun a limited traverse independently of the main armament. The 47mm gun, on the right, was fired and controlled in elevation by trigger and hand-wheel in the right hand: movement in azimuth was by traverse of the turret, through the mechanism under the commander's left hand. The machine-gun was mounted behind a separate armoured mantlet in a frame having trunnions in the same horizontal axis as the 47mm gun, but with additional vertical trunnions that allowed a limited traverse of 10° each way. The machine-gun was



A prototype SOMUA S35 with the early, short pitch track plates. This picture shows how vision devices were mounted in separate frames inserted into the cast armour. Containers for stowage were sometimes strapped to the right side of the hull.



Left side of the SOMUA S35, showing the crew's access door below the turret and other hatches for access to the engine compartment. The cupola has the domed roof.

Three-quarter left front view of the SOMUA S35. The suspension was protected by armour plate; the curved, upper plates were hinged at the top and could be raised for access.



fired and controlled in movement by hand grip on the gun. A single sighting telescope was mounted above the machine-gun, and this was common to both guns which could quickly be coupled together by engagement of a spring plunger and socket. In order to minimise wear

on the plunger and socket caused by jolting movement of the tank, the guns were normally uncoupled and locked in position separately when the tank was out of action.



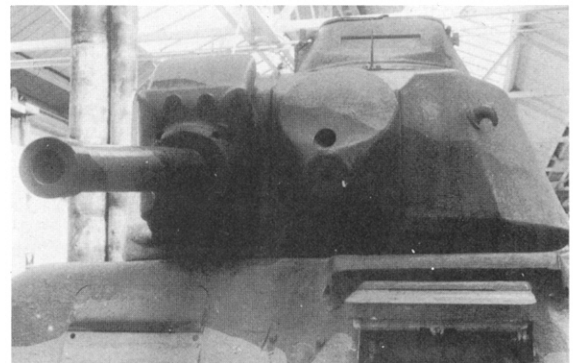
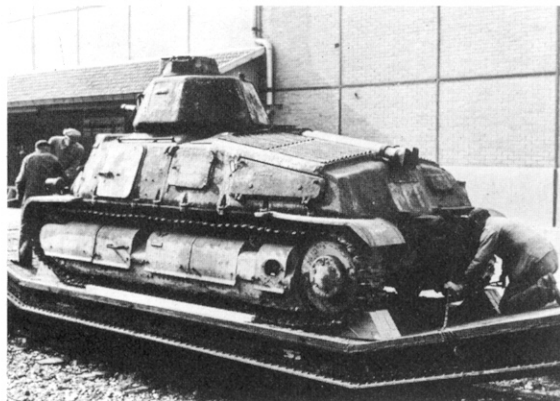
SOMUA S35. Note the round aerial base platforms moulded into the superstructure at the right front and rear corners; also, the additional aerial base bracket beside the turret; and the flat-topped cupola.

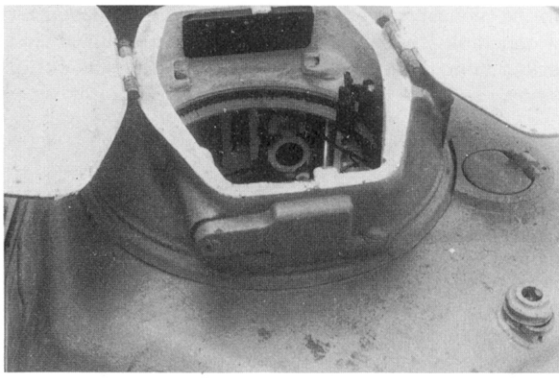
SOMUA S35 detail 1: turret of the S35, showing the commander's access door, one vision slit, and holder for anti-aircraft machine-gun mounting. (RAC Tank Museum)



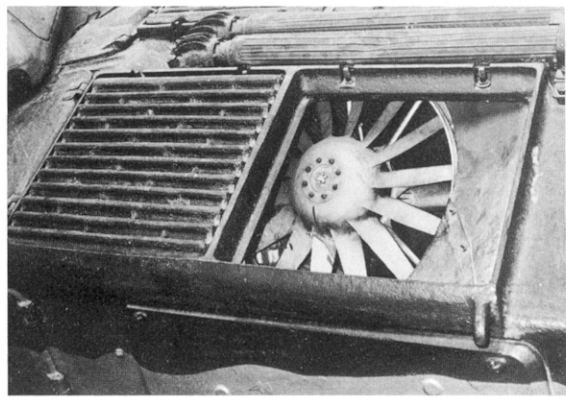
SOMUA S35. The twin exhaust pipes were led down the centre of the engine cover; both deflected exhaust to the left.

SOMUA S35 detail 2: APX 4 turret on the S35. Note the separate gun mantlets, with aperture for telescopic sight above the machine-gun; also the small blade vane sight in front of the cupola. (RAC Tank Museum)





SOMUA S35 detail 3: the cupola with hatches open. Note, nearside, the upward rotating visor which protected periscopic binoculars; farside, the mounting behind a vision slit; right, episcopes mounting behind hinged visor. (RAC Tank Museum)



SOMUA S35 detail 4: the fan was mounted in a sloping position behind the engine on the left side, to draw cooling air through the radiator mounted on the opposite of the hull. (RAC Tank Museum)

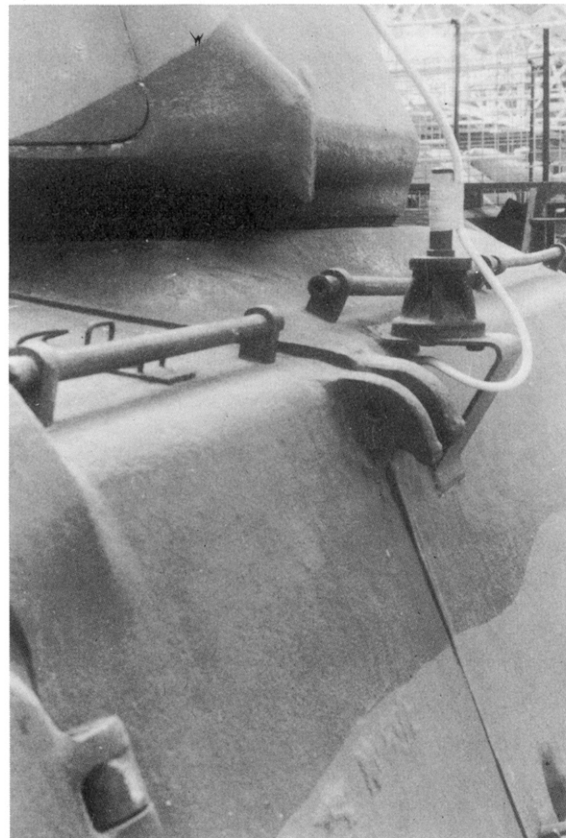
Electric power traverse of the turret was provided for wide and rapid variations of arc, operated by a lever on the top of the traverse mechanism box on the commander's left, but for fine adjustment in sighting the weapon, hand traverse had to be used through the handwheel on the side of the box. A Ragonot 12-volt electric motor, mounted at the left rear of the turret, provided power by shaft to the traverse mechanism, and was itself powered by the electric cable which ran up from the commander's seat post to a connector forward of the traverse box. There was no other electrical system fitted in the turret.

The commander's cupola on top was fully rotating. Two types are seen, one with a solid domed top, and the other—probably a modification in German service—with two opening hatches and a flat top, but both had the same three vision devices: a pair of periscopic binoculars was mounted behind an armoured visor which rotated upwards, whilst on the opposite side was a vision slit with episcopes of the same type as those in the hull. On another side was an episcopes behind a visor which hinged upwards. The commander also had two vision slits with episcopes on the turret sides, and an access door at the back of the turret. All embrasures in the turret, the door, vision slits, visors, gun mantlets and the turret ring were fitted with sealing materials as a protection against poison gas. Two other small features on the turret roof are of note: to the right of the cupola was a small circular hatch which was used for flag signals when the turret was closed down, and immediately above the turret door was a holder to mount a machine-gun for anti-aircraft use.

A fire-proof partition separated the crew from the engine compartment, and behind this, on the right side, was the self-sealing petrol tank fitted in accordance with standard French practice as a fire protection. On the left was the Somua V-8 engine and the power train running back to the gearbox which incorporated, through the transmission and steering drives, a double differential steering system. Engagement of the steering differential was controlled by dry plate clutches, operated by cables from the driver's steering wheel, which had the effect of slowing down, through epicyclic gears, the drive to the inner track and simultaneously increasing the speed of the outer track with a minimum loss of power and speed. It was a mechanical, regenerative

system that was similar to but simpler than the hydrostatic unit fitted in the Char B, and, as such, it was a much more advanced type of steering than the American Cletrac geared differential that was used on other and earlier French tanks.

SOMUA S35 detail 5: aerial base bracket on the superstructure, showing also the joint between forward and rear parts of the superstructure, with lifting hooks. The white cable shown here is used for lighting the interior of this tank in the RAC Tank Museum. (RAC Tank Museum)



The cooling fan was mounted on the left side, in a sloping position above the clutch housing, and driven by a shaft from the engine; the radiator was mounted on the opposite side of the engine compartment, parallel with the side of the hull and also in a sloping position so that cooling air was drawn down through the radiator and expelled through the grill above the fan.

The track and suspension was unlike that of any other contemporary French tank, although the same principle of leaf spring suspension is seen on the Czech light tank 35(t) and, later, on the Italian M 11/39. On each side there were two assemblies of four bogie wheels which were mounted in pairs on articulated arms controlled by semi-elliptic leaf springs. A ninth bogie wheel at the rear was fitted independently with a coil spring. The wheels were of steel, with rims rising to a centre flange that ran in a groove in the centre of the track plate, and so guided the movement of the track since there were no horns on the track plates to prevent

the track from sliding off sideways. Two return rollers, with similar flanges, and two skids with guiding keys on top, carried the track forward to the tensioner wheel at the front. The lower part of the suspension assemblies was protected by fixed armour plate, while access to these units was obtained by raising the hinged armour plates over the upper parts.

Certain exterior fittings may need explanation. At the right front and the right rear, moulded in the superstructure castings, were the round platforms for two aerial bases; these were similar to but in positions different from those on the D2 tank. In addition to these aerial base platforms, which may not have been found entirely satisfactory, another aerial base was mounted on a simple bracket fitted to the superstructure at the right of the turret. On the mudguard at the left front was mounted a single headlight with an armoured body and hood; the shape is most unusual, resembling a bird's beak, but similar lamps are seen on other French tanks.



Captured S35s with German crews driving in line ahead through the Arc de Triomphe in Paris after June 1940. (Imperial War Museum)

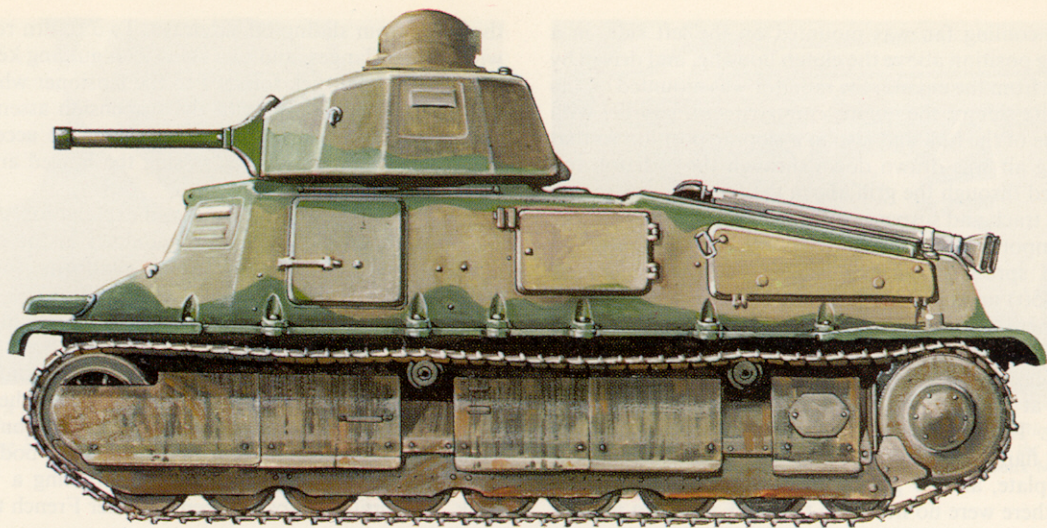


S35 (right) and German crew patrolling an airfield in occupied France. This picture shows the use of the German wireless aerial base, and a stowage pannier strapped to the hull side. (Warpics)

Note that the front superstructure of the S35 seen here in German hands has been shaped to give the driver a small slit for vision to his right front.

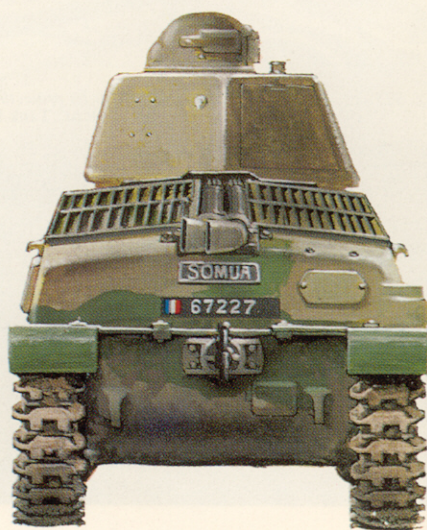
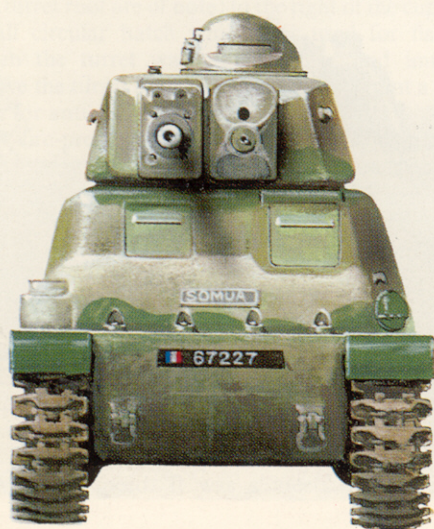
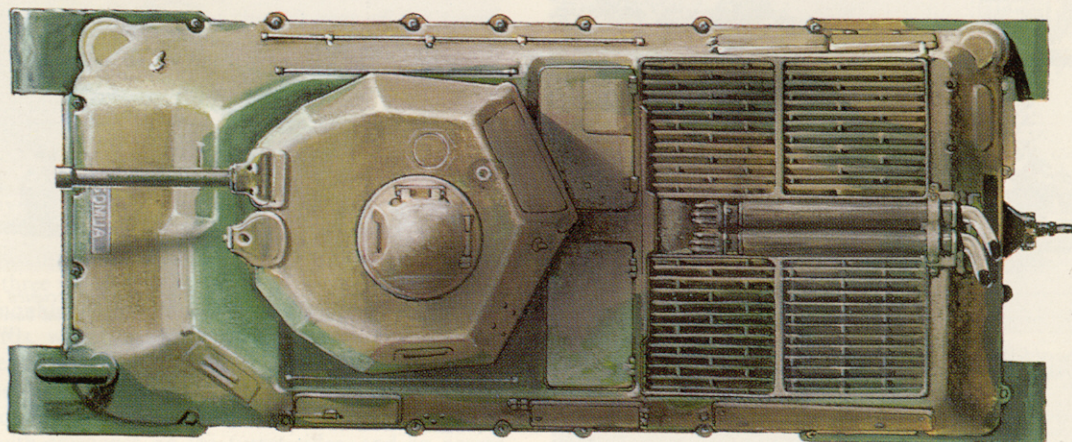
SOMUA S35 detail 6: the rear of the tank with its projecting towing hook. (RAC Tank Museum)

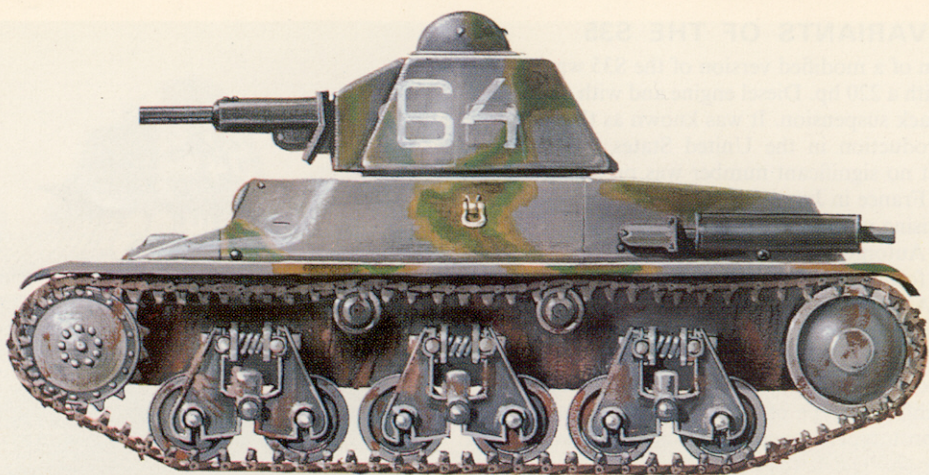




Four views of the Char SOMUA S35, rated by some as the best tank in the world in its day. It was fast and reliable, with a good radius of action, a formidable anti-tank gun (47mm SA35), and heavier armour than its equivalents in other armies.

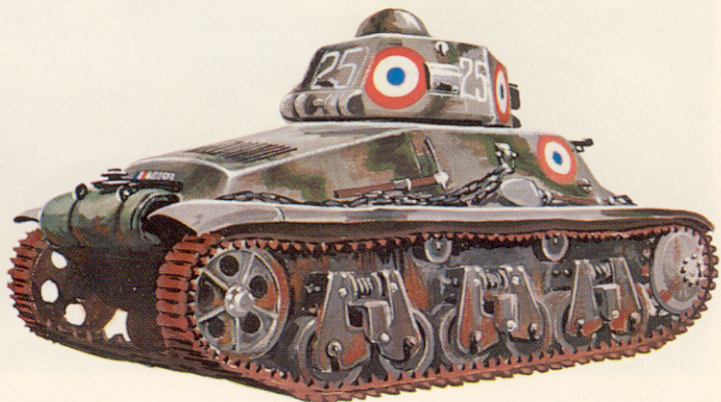
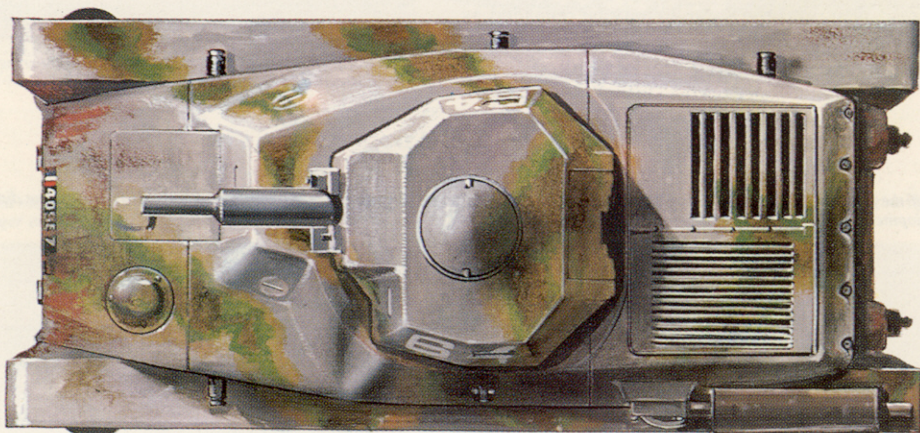
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Three views of the Char Hotchkiss H39 which had an almost horizontal engine deck compared with the downward sloping engine deck of the H35 (*bottom right*).

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VARIANTS OF THE S35

Production of a modified version of the S35 was started in 1940, with a 220 hp. Diesel engine and with a different form of track suspension. It was known as the S40, and further production in the United States was contemplated, but no significant number was produced before the fall of France in June 1940.

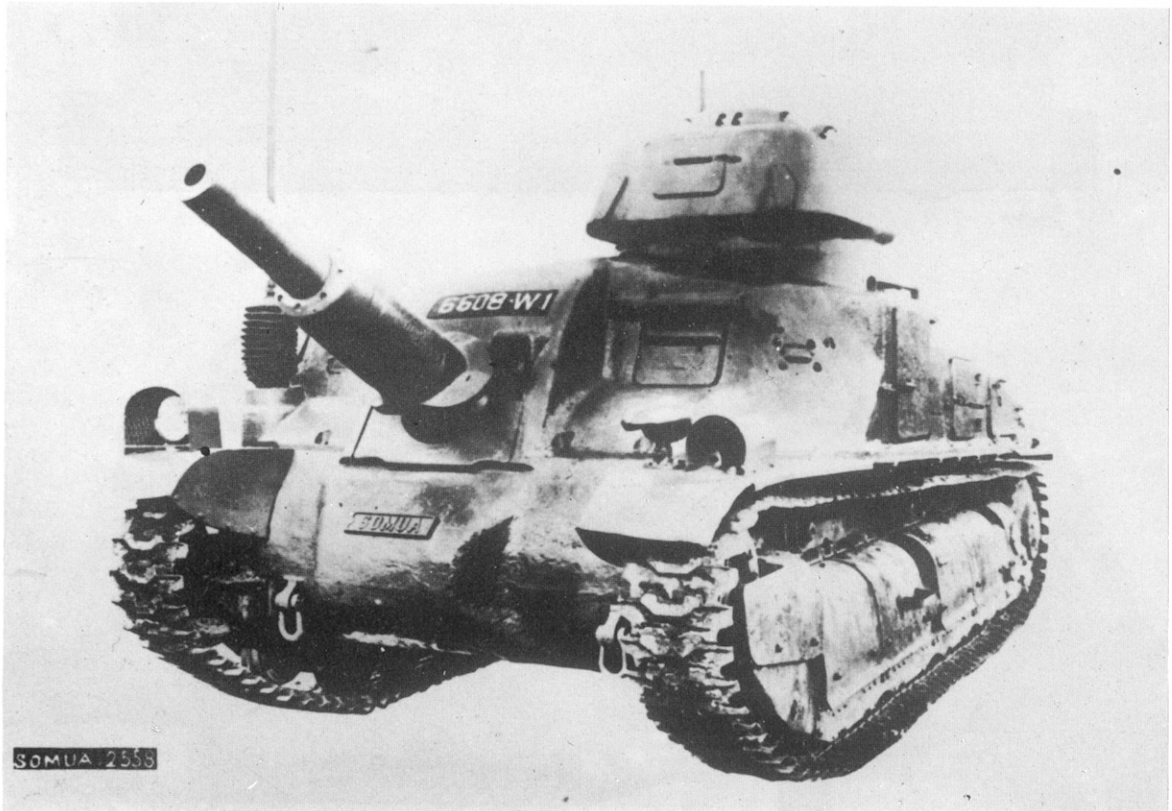
A promising variant, which also came to naught, was the Char Automoteur Somua S Au 40, appearing in prototype form as a result of demands for self-propelled artillery. A modified S35 hull was used to mount a 75mm gun, apparently with limited traverse, in a hull mounting beside the driver. The suspension, engine and transmission was the same as on the S35, but the machine carried a different type of turret without armament; at least as a prototype, no gun was mounted other than the main weapon. The battleweight of 21.5 tons was two tons more than that of the S35, and the maximum speed was 30 kph.

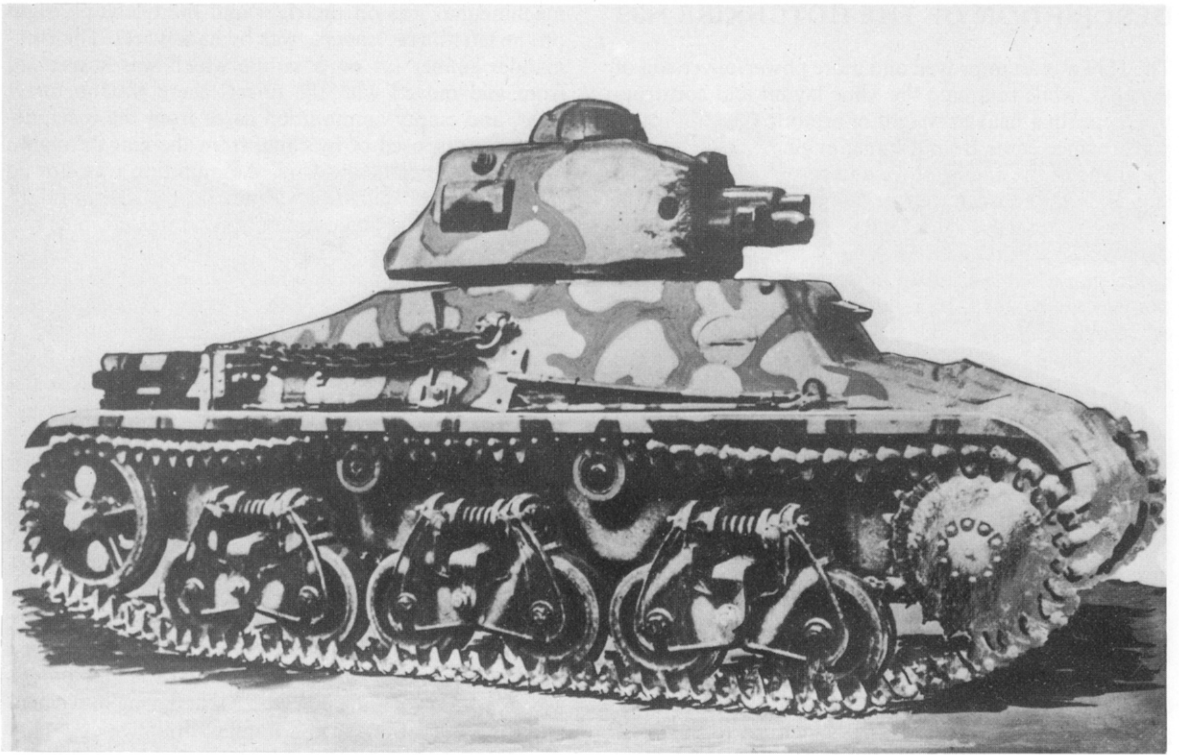
The development of self-propelled guns had been pursued intermittently in several countries since before the First World War, but had not been supported officially with much enthusiasm. France, however, which had lagged like others in this field, was the only country to undertake seriously the development of self-propelled artillery in the years immediately before the Second World War, and the S Au 40 may be regarded as one of the very few artillery weapons of the period mounted in a modern, armoured, tracked hull.



A dilapidated S35 after the 1939-45 war, still bearing French markings, in a graveyard of other tanks.

A prototype of the S Au 40, which mounted a 75mm gun as a self-propelled artillery weapon in a modified S35 hull. This machine did not go beyond the stage of development seen in this picture.





Hotchkiss H35. Note the downward slope of the engine deck, which is a feature of this tank that distinguishes it from the H39.

Hotchkiss H39, still mounting the short-barrelled 1918 model 37mm gun, but distinguished from the H35 by the almost horizontal engine deck, caused by the fitting of a larger engine.



DESCRIPTION OF THE HOTCHKISS H39

The H39 was an improved and more powerful version of the H35, while retaining the same layout and construction beneath a heavier weight of armour. The improved performance came from a larger engine which changed the shape of the engine cover and raised the level of the engine deck almost to the horizontal; this was the main visible difference between the two tanks. Another point of recognition is the long-barrelled 37mm 1938 model gun which was taken into service on the H39, but this cannot, by itself, be regarded as an infallible means of recognition. The old 1918 model, short-barrelled 37mm gun, in the same turret, was also mounted on the H39 hull.

The hull was constructed as a rigid box made up from cast armour sections bolted together. There were six main parts; the nose section, which incorporated the lower half of the driver's door; the rear section and two side plates, which extended upwards to just above the level of the track guards; the superstructure, which included the turret ring and the upper half of the driver's door; and the engine cover with two grill hatches. The floor consisted of three sheets of armour plate, bolted and detachable for access to interior components.

The fighting compartment at the front enclosed the crew of two, with the driver sitting on the right of the gearbox and steering differential which led to the front sprockets; his controls included clutch and accelerator pedals, gear lever on the left, steering levers on each side and a hand brake. The driver's door in front gave easy access to that position, being in two parts which lifted upwards and forwards. A visor, with periscope, was fitted on the almost vertical front face of the upper door, while the driver could look out to both sides through two small vision slits. An emergency escape hatch was provided in the floor, just big enough to crawl through.

The APX turret of cast armour was the same as that on the Renault R35 and R40 tanks, with the 37mm gun and 7.5mm machine-gun mounted co-axially. The

machine-gun was on the right and the telescopic sight on the left; turret traverse was by handwheel. The commander/gunner sat on a saddle which was suspended from and moved with the turret; there was no turret floor, and empty ammunition cases from the machine-gun were disposed of by chute from the gun through a hole in the floor of the tank. Ammunition was stowed in racks on the hull side, 37mm on the right and 15 boxes of machine-gun ammunition on the left, plus one on the gun.

Above the commander's head was a rotating cupola, with a fixed dome and a form of visor. This must have restricted his vision considerably, and it is noticeable that in the H39 tanks taken into service by the Germans, this form of cupola was replaced by one with a flat top and a pair of hatches so that the commander could put his head out.

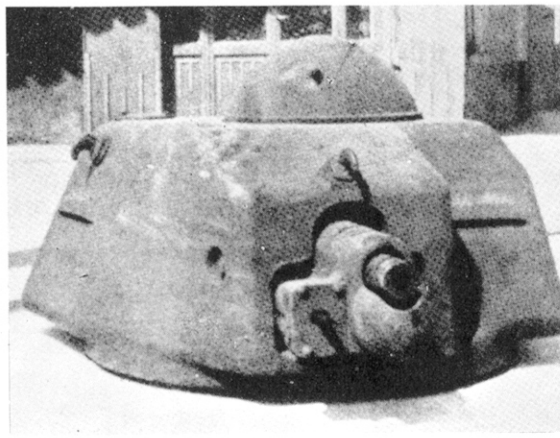
From within the turret the commander had a limited view to three sides through protected glass vision devices, one on the front face on the left of the guns, and one on each side wall. There were two such types of vision devices mounted, having a minor effect on the turret shape; one type was in the form of periscopic binoculars with protective armour projecting from the turret wall, and the other a simpler episcopes with narrower vision slit. A turret door at the back served for the commander's access, while providing him with a seat during movement and for observation when not under fire.

In the engine compartment, on the right side immediately behind a fire-proof partition, was the petrol tank which provided fuel to the engine by pump, whilst incorporating a separate reserve tank at the top with gravity feed when necessary. Behind the petrol tank was the radiator, and behind that the belt-driven cooling fan which, by drawing air from the front through the radiator, was also intended to reduce the temperature of the petrol tank. The 6-cylinder Hotchkiss engine was on the left; it was a unit of 6 litres, which was nearly double the cubic capacity of the engine in the H35 with 3480cc.

Abandoned in 1940, an H35. Note the commander's door at the rear of the turret, and the protrusions on the turret side to protect the periscopic binoculars.



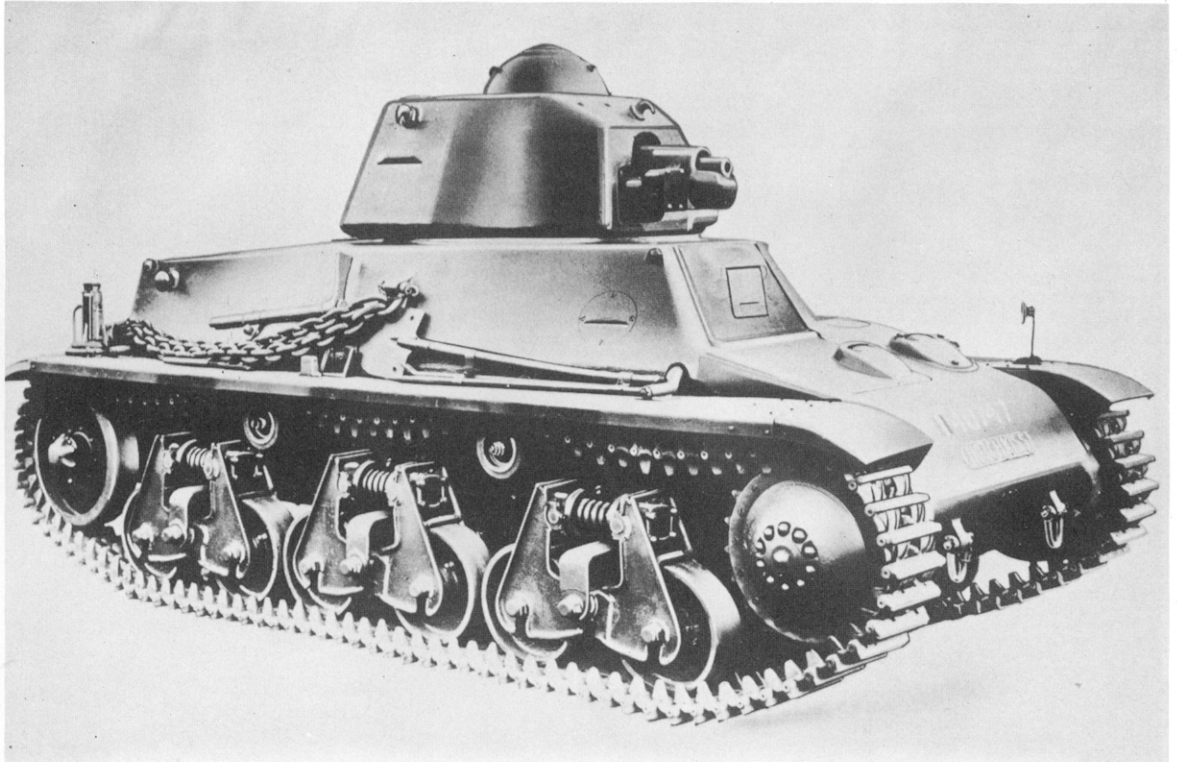
The APX turret with the short-barrelled 37mm gun in a heavily armoured casing, mounted on the Renault R35, the H35, and sometimes on the H39. There was a visor in the cupola, but not shown on this side.





Renault R35, captured in Syria in 1941, being examined by American armour specialists. The R35 was of similar general shape to the H39 but distinguished chiefly by the suspension—five wheels compared with six.

Three-quarter right front view of H39 showing external stowage arrangement. The two mountings on the front glacis plate were headlamp fittings. This tank has the short 37mm gun.





The H39 with detachable skid tail fitted to improve cross-country performance. An external fuel tank could be carried here on the tray in front of the spare bogie wheel.

The drive was taken forward through the fighting compartment to the gearbox with differential and steering mechanism assembled as one unit beside the driver; mounted at the front end of the gearbox unit there was a brake drum with external contracting brakes, which served as a parking brake operated by a hand brake with ratchet. The controlled differential steering system

used in the H35 and H39 (commonly known as Cletrac after the commercial tractor built by the Cleveland Tractor Company in the late 1920s) was of the type used widely in the other French light tanks, and also in American light and medium tanks.

The suspension consisted of six wheels on each side mounted on bell-cranks arranged in pairs—in a so-called

A captured H39 with long-barrelled 37mm gun in 1940. Note the vision slits in the turret in place of the earlier periscopic binoculars.





Another German modification on the H39 was the installation of a wireless set. Seen here is the aerial mounted in its base on the track guard. Note also the skid tail and the tank commander seated in a comfortable travelling position.

H39, still with short 37mm gun, in German service carrying infantry during winter operations.



“scissors” arrangement—with double springs between the upper arms. It was a type of suspension used also in all the Renault light tanks since the AMR 33 (which mounted single bell-cranks at front and rear), but Hotchkiss made use of coil springs in place of the thick rubber washers that are seen on the Renault tanks. Two top rollers supported the steel track which had twin guide horns. The suspension, in fact, provides a quick recognition point in comparison with the Renault R35 which was very similar in appearance; the R35 had five wheels on each side (or two and a half “scissors”) with three top rollers.

VARIANTS OF THE H39

The Germans converted a limited number of French tanks in 1943/44 for use as self-propelled artillery by the occupation troops in France. The work was mainly done by the firm of Alfred Becker in Krefeld, and, amongst the several types used for these conversions, the H39 was the basis for mounting a 75mm anti-tank gun and a 105mm field gun. 72 H39s were sent to Krefeld for adaptation.

The anti-tank weapon mounted the standard PaK 40 within an open-topped, armoured box on a platform which extended forward over the driver's position. It was known under its German designation as *7.5 cm PaK 40 L/48 auf Gw 39H(f)*; 24 of these conversions were made. The field gun was similarly carried on top of the



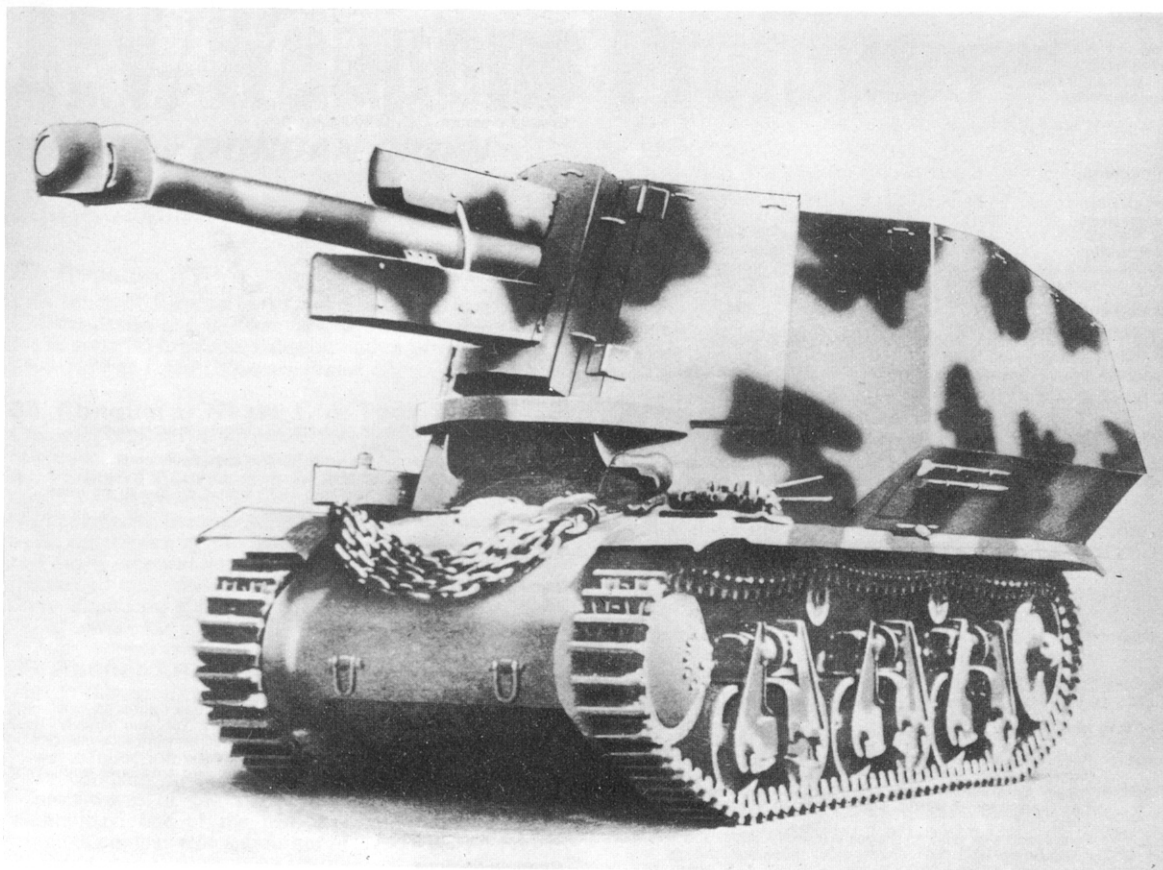
Re-captured—an American soldier examining an H39 with German markings taken during the winter 1944–45. This tank has the long-barrelled 37mm gun. Note the Panzerfaust projectile stowed on the hull side.



H39s in German service. These tanks mount a searchlight above the gun, and the cupola has been changed to one with flat top and hatches.

*The H39 hull was used in a German conversion for a self-propelled 75mm anti-tank gun, known as the *7.5 cm PaK 40 L/48 auf Gw 39H (f)*: 24 of these conversions were made.*





Self-propelled field artillery on the H39 hull—the 10.5 cm Panzer-feldhaubitze 18 auf Sfl. 39H (f)—converted by the Germans and used by their occupation troops in France. There were 48 of these conversions which were also known as 10.5 cm 1eFH 18 auf GW 39H (f). (Imperial War Museum)

H39 hull, and was known as the 10.5 cm Panzerfeldhaubitze 18 auf Sfl. 39 H (f) or 10.5 cm le FH 18 auf Gw 39H(f); it had a crew of 5. There were 48 of these conversions.

Not surprisingly, the hull and transmission were seriously overloaded and performance suffered; and the

high, ungainly superstructures reflect the nature of these make-shift conversions. Fortunately they were not likely to be used in protracted battle, but they indicate the increasingly desperate straits in which Germany had to make use of all available material at that period.

AFV Series Editor: Duncan Crow

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CAVALRY TRACKED ARMoured FIGHTING VEHICLES

	Weight (tons)	Crew	Armament		Armour	Remarks
			Main	MG		
A.M.C. Schneider P 16	5.8	3	1-37mm.	1-7.5mm.	11 mm.	A half-tracked vehicle, designated A.M.C. in 1932
A.M.R. Renault 33 VM	5	2	—	1-7.5mm.	13 mm.	
A.M.R. Renault 35 ZT	6	2	1-25mm.	1-7.5mm. or 1-13.2mm. 1-7.5mm. or 1-7.5mm.	13 mm.	An improved version of the A.M.R. 33 VM, with more powerful armament and a changed suspension which formed the pattern for subsequent light tanks.
A.M.C. Renault 34 YR	11	3	1-25mm.	1-7.5mm.	25 mm.	The first French light tank to carry 3 men. Trials vehicles only produced.
A.M.C. Renault 35 ACG 1	14.5	3	1-47mm.	1-7.5mm. or 1-7.5mm.	40 mm.	A more powerful version of A.M.C. 34 YR.
A.C.C. 1938	13	3	1-25mm. 1-47mm.	1-7.5mm. 2-7.5mm. or 1-7.5mm.	25 mm.	Similar to but lighter than the A.M.C. Renault 35, with less armour and an additional hull-mounted MG.
Char Somua S 35	20	3	1-25mm. 1-47mm.	2-7.5mm. 1-7.5mm.	55/40 mm.	Mounted the same APX turret as the infantry Char B1 bis and D 2.
Char Hotchkiss H 35	11.4	2	1-37mm.	1-7.5mm.	34 mm.	Designed initially to infantry specifications and very similar to the Renault R 35.
Char Hotchkiss H 39	12	2	1-37mm.	1-7.5mm.	45/40 mm.	Improved version of H 35. Normally mounted the long barrelled 37mm. gun.

SPECIFICATION—SOMUA S 35**General**

Crew 3—Commander/gunner, driver, wireless operator.
 Battle weight 19.5 tons.
 Power/weight ratio 9.7 to 1 b.h.p./ton.
 Ground pressure 0.85 kg./sq.cm.

Dimensions

Length overall 5.38 m.
 Height overall 2.63 m.
 Width overall 2.12 m. Width over tracks—2.05 m.
 Track width 36 cm. Track centres—1.69 m.
 Ground clearance 42 cm. Length of track on ground—3.62 m.

Armament

Main 47mm. SA 35 (Length 34 calibres, muzzle velocity 2200 ft./sec.)
 Auxiliary 7.5mm. Reibel machine-gun co-axially mounted behind separate mantlet giving limited traverse independently.

Fire Control

Main armament fired and controlled in elevation by trigger and hand-wheel in right hand (+18° to -18°). Electric power traverse from 12 volt Ragonot motor for wide variations of arc (10° per sec.), with hand traverse for sighting.

Machine-gun mounting in same horizontal axis with main armament, independent traverse 10° each way; fired and controlled by hand grip on gun. Guns linked together and aligned by engagement of spring plunger in socket.

Ammunition

47mm. — 118 rounds (AP and HE)
 Machine-gun — 3000

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 Four vision slits with episcopes in hull for driver and wireless operator.

Communications

Two wireless sets in hull, below front glacis plate and above right track. Intercomm between crew by voice tube or telephone. Flag signals.

Armour

Cast steel hull and turret. Armour plates over suspension assemblies bolted to hull.
 Hull: Front and sides—40 mm. Top and Floor—20 mm.
 Turret (APX 4): Sides—56 mm. Top —30 mm.

Engine

Somua, petrol 60° V-8, 8 cylinder, water-cooled, (120 x 140) 190 b.h.p. at 2000 r.p.m. Fuel—410 litres.

Transmission

Clutch: Dry, double plate.
 Gearbox: Five forward speeds, one reverse.
 Steering: Double differential, controlled through dry plate clutches operated by cable from driver's steering wheel.

Suspension

Nine bogie wheels each side; two assemblies each of four wheels controlled by semi-elliptic leaf springs, and one mounted independently at rear with coil spring. Two return rollers and two skids with front tensioner. Steel bogies and return rollers with centre flange on rim running in groove in centre of track plate.
 Track plate: Manganese steel, no guide horns. 144 links each side at 75 mm. pitch (on early models), or 103 links at 105 mm. pitch.

Electrical System

24 volt system, battery 118 AH

Performance

Maximum speed — 40 k.p.h.
 Maximum gradient — 40°
 Vertical obstacle — 75 cm.
 Trench — 2.13 m.
 Wading depth — 1.00 m.
 Radius of action — 260 km.

SPECIFICATION—H 39**General**

Crew 2—Commander/gunner, driver
 Battlweight 12 tons (H 35—11.4 tons)
 Power/weight ratio 10 to 1 b.h.p./ton (H 35—6.8 to 1 b.h.p./ton)
 Ground pressure 0.90 kg./sq. cm.

Dimensions

Length 4.22 m.
 Height 2.14 m.
 Width overall 1.85 m.
 Width over tracks 1.80 m.
 Track centres 1.53 m.
 Track width 27 cm.
 Length of track on ground 2.50 m.
 Ground clearance 37 cm.

Armament

Main 37mm. SA 38 (Length 33 calibres, muzzle velocity 2300 ft./sec.)
 (37mm. SA 18 on H 35 and sometimes on H 39—
 Length 21 calibres, muzzle velocity 1273 ft./sec.)
 Auxiliary 7.5mm machine-gun 1931 model, co-axially mounted.

Ammunition

37mm. — 100 rounds
 Machine-gun—2400 (16 boxes)

Sighting and Vision

Turret Rotating cupola with visor. Telescopic sight co-axial with guns. Three periscopic binoculars (or alternatively three episcopes with vision slits) mounted on front face and one on each side wall.
 Hull Periscope in visor in driver's door, two episcopes with vision slits.

Communications

Flag signals. Voice tube between crew.

Armour

Cast steel in six main sections bolted together to form hull.
 Cast steel turret (APX) armoured to 45 mm.
 Hull: Front and sides—40 mm.
 Top —18 mm. Floor—20 mm
 (H 35—34 mm. max./12 mm. min.)

Engine

Hotchkiss, petrol 6 cylinder, water-cooled, 6 litre (105 x 115), 120 b.h.p. at 2800 r.p.m.
 (H 35—3480 cc. (86 x 100), 75 b.h.p. at 2700 r.p.m.)
 Solex carburettor. Magneto ignition.
 Fuel—207 litres (H 35—180 litres)

Transmission

Clutch —Single dry plate.
 Gearbox—Five forward speeds, one reverse.
 Steering—Single differential (Cletrac) controlled by steering levers.

Suspension

Six bogie wheels each side, mounted on bell-cranks in pairs with double springs between the upper arms. Two top rollers and rear tensioner.
 Track plate: Manganese steel, die stamped, with two guide horns.

Performance

Maximum speed —36 k.p.h. (H 35—28 k.p.h.)
 Maximum gradient —40° (H 35—35°)
 Vertical obstacle —50 cm.
 Trench —1.80 m.
 Wading depth —85 cm.
 Radius of action —150 km. (H 35—129 km.)

AFV/Weapons Profiles

Edited by **DUNCAN CROW**

FORTHCOMING TITLES:

37 Russian BT

This series of Russian tanks was based on the American Christie design and its final variant was the forerunner of the famous T-34: BY JOHN MILSOM, author of *Russian Tanks 1900-1970* and *AFV/Weapons Profile 22*.

38 Conqueror Heavy Gun Tank

Changes between conception and production are not infrequent in the development of military equipment, yet the history of Conqueror is probably more bizarre than most. Intended originally for the support of infantry it was then adapted to become the so-called Universal tank—only to be superseded by the design it was meant to replace—and finally emerged into service for a short time as a highly specialized tank killer: BY MAJOR MICHAEL NORMAN, Royal Tank Regiment, author of *AFV/Weapons Profiles 17, 18, 19, 23 and 27*.

39 Panhard Armoured Cars

This Profile covers the remarkable eight-wheeled EBR and the compact AML, now used by more than a dozen different countries and both built by Panhards who have a longer connection with armoured car development than any other company in the world still in this field: BY R. M. OGORKIEWICZ, of the Imperial College of Science and Technology, one of the world's leading experts in the design of combat vehicles, author of *AFV/Weapons Profiles 28 and 34*.

40 U.S. Armoured Cars

Although armoured cars, a familiar sight in many countries, have never been popular in the United States, more varieties have existed there than is generally realised. This Profile recounts the whole story of U.S. armoured cars from the Davidson car of 1898 to the XM808 on the Lockheed Twister chassis of today: BY COLONEL ROBERT J. ICKS, the famous American armoured expert, author of *AFV/Weapons Profiles 16, 24, 26 and 32*, and *Profile Book AFV/Weapons Series No. 1 Modern U.S. Armored Support Vehicles*.

41 M103 Heavy + M41 Light (Walker Bulldog)

The Berlin airlift and the beginning of the so-called Cold War placed new emphasis on the U.S. post-World War II tank programme. The result was the emergence of three basic designs, the T41 Light Tank, the T42 Medium Tank, and the T43 Heavy Tank. This Profile deals with the first and third of these—the T41 which was standardized as the M41 and named the Walker Bulldog, and the T43 which became the M103 Heavy Tank: BY COLONEL ROBERT J. ICKS, author of *AFV/Weapons Profiles 16, 24, 26, 32 and 40*, and *Profile Book AFV/Weapons Series No. 1 Modern U.S. Armored Support Vehicles*.

42 Modern Swedish Light Armoured Vehicles

Included in this Profile are the Pbv 302 armoured personnel carrier and its derivatives—the Bgbv 82 recovery vehicle, the ingenious Brobv 941 bridgelayer and the IKV 91 infantry gun intended for operation in the north of Sweden, the Noorland: BY R. M. OGORKIEWICZ, author of *Design and Development of Fighting Vehicles and Armoured Forces*, and of *AFV/Weapons Profiles 28, 34 and 39*.

43 PanzerKampfwagen IV

While the Panther and Tiger have tended to capture the limelight, it was in fact the PanzerKampfwagen III and IV which established the reputation of the German armoured forces. The Panzer IV, whose first prototype was built in 1934, eventually became the only German tank which remained in production and troop service throughout World War II, a fact which demonstrates its sound basic design and the brilliant foresight shown in its specification. It was still in service in the Syrian Army as late as 1967.

44 Ferret and Fox Scout and Reconnaissance Cars

Ferrets, developed from the Second World War experience with the Daimler scout cars, have become some of the world's most widely used armoured vehicles. Thus, they are in service not only with the British Army, but also with the armed forces of more than twenty different countries. The successful experience with them has, in turn, led to the even more effective Fox armoured car (or Combat Vehicle, Reconnaissance, Wheeled). This has aluminium armour and much more powerful armament but otherwise retains many of the characteristics of the Ferrets: BY R. M. OGORKIEWICZ.

45 Vickers 37-ton Main Battle Tank (Vijayanta)

46 Light Tanks M22 (Locust) and M24 (chaffee)

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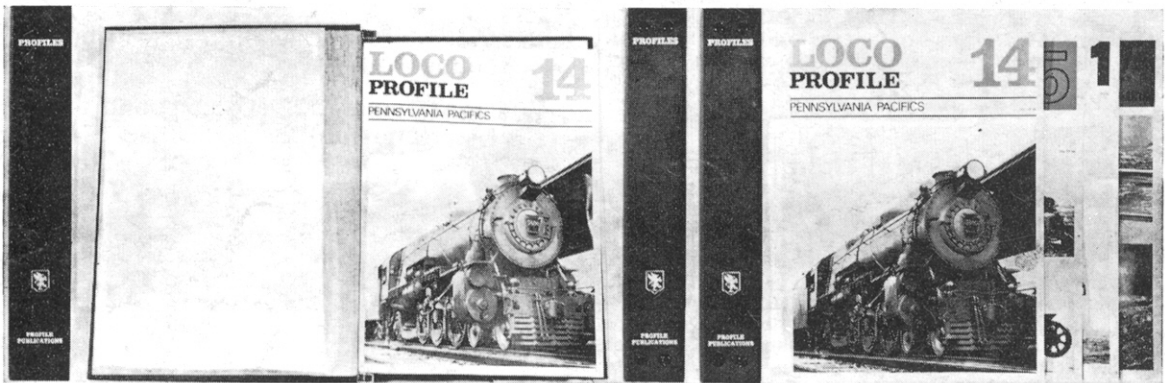
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