

# AFV

# 13

## RAM AND SEXTON

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Profile

ILLINGS





*"Mount" — crews of 2nd Canadian Armoured Brigade mount their Ram tanks.*

## Ram and Sexton

by Chris Ellis and Peter Chamberlain

THOUGH a small Canadian Tank Corps had been formed in 1918, few Canadian officers had experience of tanks by the time of the Armistice. The most significant armour development in 1918 was the establishment of machine-gun companies using armoured lorries as carriers, a very early application of the idea of armoured infantry. The unit involved was a Canadian machine-gun battalion, one of whose officers was a young subaltern named F. F. Worthington. This same officer was destined some 20 years later to become the driving force behind the establishment of the Canadian armoured forces which served with such distinction during World War II.

After the Armistice of November 1918, the huge Canadian Army contracted rapidly to its tiny peacetime strength of a few thousand men, and Worthington resumed his career as an infantry officer with Princess Patricia's Canadian Light Infantry, though he maintained an interest in mechanical transport. In 1930 a dozen Carden-Loyd machine-gun carriers were purchased from Britain to equip the machine-gun platoons of the few Canadian regular infantry battalions, these being the first tracked AFVs to go into military service in Canada since 1918. The Canadian Tank Corps itself—which had had a handful of British Mark V and French Renault FT tanks—was disbanded after 1918. However, by 1936 the international situation was worsening rapidly and the Canadian Defence Department decided to resurrect an armoured element, initially in cadre strength, to train men in tank warfare in the event of war.

Selected to command the newly formed cadre was F. F. Worthington, now a Captain (Brevet Major) and one of the few serving officers in Canada with any experience at all of armoured warfare. A Canadian Tank School was set up at London, Ontario, commanded by Worthington who had five officers and 18 other ranks forming the entire personnel of the unit. At this time six cavalry militia regiments were re-organized as tank units on paper, which meant that they carried out training in tank handling and tank warfare even though they were not allocated any tanks. The dozen Carden-Loyd carriers were taken to London to provide training vehicles and these were supplemented by two Vickers light tanks purchased from Britain. The tiny defence budget of the period did not allow the purchase of spares, however, and prodigies of improvisation were needed to keep the vehicles running. Facilities at London were minimal so Worthington arranged for trainees to go to the nearby R.C.A.F. airfield at Trenton, Ontario, to learn about the mechanical aspects of tanks—using aero engines as a basis.

Meanwhile Worthington was sent on an intensive ten month course at the Royal Tank Corps depot, Bovington, England, to bring his knowledge of the subject up-to-date, and one of his first acts on returning to Canada was to arrange for the Tank School to be moved to Camp Borden where there were ample facilities for cross-country training as at Bovington. The fall manoeuvres of 1938 saw the first official use of tanks on exercises when all 12 carriers and the two

light tanks formed one squadron, while a horsed dragoon squadron was used to represent the "enemy" tanks. In the summer of 1939, 14 Light Tanks Mk VI were ordered from Britain and arrived in Canada just before the outbreak of war. No attempt had previously been made to acquire tanks in quantity for Canada, partly on the grounds of expense, but mainly because it was considered that any tank requirements would be met by Britain in the event of a Canadian Expeditionary Force being sent once more to Europe. Production of tanks in Canada was thought to be out of the question because government arsenals were far too small to build them.

When war was declared, all remaining cavalry militia units were re-designated as tank units, and Worthington's small—but now expanding—staff were fully engaged in an increased training programme despite the pitiful shortage of vehicles. At this time a Royal Tank Corps officer, Colonel E. J. Carter, who had been spending his retirement leave in Canada at the outbreak of war, was invited by the Defence Department to report on future tank training needs and organization. Predictably, Carter severely criticized the inadequate training facilities then available. Partly as a result of this and partly as a result of the almost complete inactivity on the Western Front in the early months of the war, influential members of the Defence Department were able to get the Tank School closed down in December 1939 on the grounds that it was not worth maintaining and that there appeared to be little requirement for Canadian tank forces in any case. Worthington and his staff had their task changed to training infantry in the operation and use of the Bren Gun Carrier.

Events in 1940, needless to say, brought a rapid change in the fortunes of Worthington and the Canadian tank forces. The German invasion of France and Flanders in May 1940 found Britain embarrassingly short of tanks, and likely to remain so until new production facilities reached full output. Even before the disaster of Dunkirk it was realized that additional production facilities would be needed outside Britain with the Americas as the obvious choice. One result of this was the eventual despatch of a British Tank Mission to Washington in June 1940 with the initial idea (soon changed) of getting British tank designs built by United States firms. Similarly, in May 1940, the newly-formed Ministry of Supply made contact with the Canadian Pacific Railway Co. and asked if they could undertake production of the latest British tank, the Infantry Tank Mk. III, Valentine, to meet British requirements. Initially Canadian automobile firms had been considered for the task, but these were all already committed to military truck and Universal Carrier production, and Canadian Pacific happened to be the one large firm with spare productive capacity at its workshops in Angus.

### THE CANADIAN VALENTINE

The formal contract for Valentine production was signed with Canadian Pacific in June 1940 and called for 300 complete vehicles, less engines, guns, and minor ancillary parts which would be fitted after the tanks arrived in Britain. The drawings would be supplied by Vickers, the builders in England. As it happened there was some delay with these; the



*To provide vehicles for training when the Canadian Armoured Corps was almost completely without tanks in 1940, these old M1917 6-tonners were purchased at scrap value from the U.S.A.; here a consignment arrives at Camp Borden in August 1940.*  
(Canadian Official)

Valentine had been ordered "off the drawing board" the previous July and the first production model, ready in May 1940, was also the pilot model with detail drawings being made almost literally as the vehicle was built.

With the fall of France at the end of June, the original arrangements were further changed, Britain now stood threatened with imminent invasion and the

*Colonel F. F. Worthington, Commandant of the Canadian Armoured Corps, takes a look at the engine of one of his newly acquired M1917 ex-U.S. Army tanks on its arrival at Camp Borden, summer 1940.*  
(Canadian Official)





*Valentine Mk. IV tanks lined up outside the Canadian Pacific Works at Angus, Montreal, awaiting installation of their 2-pdr. guns, early in 1942. (Canadian Official)*

virtual certainty of disruptive bombing of industrial areas. The majority of the British tanks had been lost in France and only a motley assortment of vehicles was immediately available for home defence. Canadian Pacific were now asked to build and deliver the complete Valentine tank, using Canadian-built 2-pdr. guns (which were made by Dominion Engineering Ltd.), and finding a suitable power plant in lieu of the AEC gasoline engine used in the British-built Valentines.

Meanwhile the Canadian Defence Department had not been inactive. The need for tanks had been amply demonstrated by the turn of events in Europe and on August 18, 1940, the Canadian Armoured Corps was formally embodied with Worthington—now a Colonel and soon to be a Brigadier—as commandant. Camp Borden was to be headquarters and training centre, and all the regular cavalry regiments were to become



*The pilot model of the Ram makes a ceremonial "roll-out" from Montreal Locomotive Works on June 30, 1941, watched by workers. On the stand on the left are the Hon. J. L. Ralston, Minister of National Defence, and the Hon. D. C. Howe, Minister of Munitions and Supply, who accepted the vehicle on behalf of the Defence Department. Censor has painted out interior of vehicle visible through open sponson door. Note absence of dustguards on this and early production Rams. (Canadian Official)*

tank battalions forthwith. The only flaw in these arrangements was the almost complete lack of tanks—just the few existing light tanks, now almost worn out, and absolutely no prospect of any further deliveries from hard-pressed Britain.

With characteristic initiative, Worthington met the challenge by visiting the United States and purchasing all the 1919 vintage tanks he could lay his hands on. These vehicles, mainly M1917 light tanks (known as "Six Tonners", the U.S.-built version of the Renault FT), with a smaller number of Mk. VIIIs, had been withdrawn from U.S. Army service in the early 'thirties but had been laid up rather vaguely against further contingency needs. Already completely obsolete by 1930, in 1940 they were literally museum pieces but in Worthington's view they were better than nothing—at least for training. He bought the lot, 219

*The first 30 Canadian-built Valentines were kept in Canada for training where three of them are seen here at Camp Borden. These very early vehicles had fabricated noses of riveted construction, though most Canadian Valentines had the cast nose. (Canadian Official)*



WRC-2666

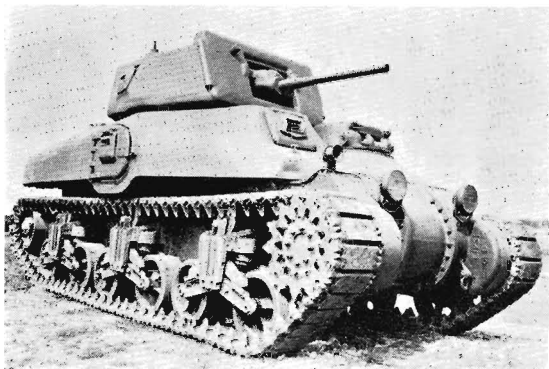
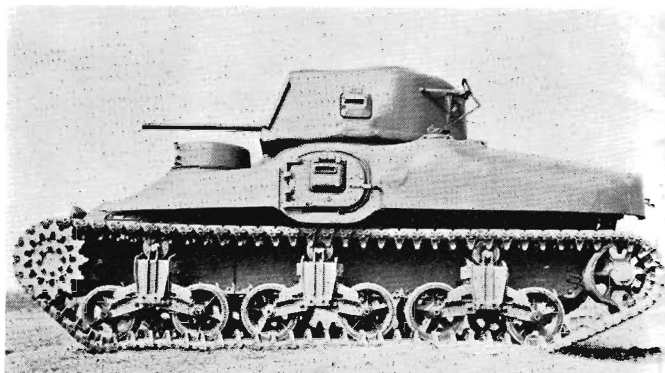
in all, with spare engines and spare parts at scrap value. This was, in fact, necessary to conform with American neutrality laws, and to maintain the fiction they were formally consigned to "Mr. Worthington, Camp Borden Iron Foundry".

The veteran American tanks saw hard service in the next year or so: 40 were allocated to each of the new armoured battalions. Though of negligible fighting value they did at least give crews an idea of tactics and maintenance problems, providing valuable experience all round.

The initial stage in the expansion of the Canadian Armoured Corps called for the establishment of the 1st Canadian Army Tank Brigade with a further expansion, announced in August 1940, involving the formation of two complete armoured divisions.

To equip the tank brigade, the Department of National Defence placed an immediate order with Canadian Pacific for 488 Valentines in addition to those which the British had ordered. Building the complete Valentine in Canada now meant a certain amount of re-design and, indeed, original design work. When drawings were eventually received in Canada numerous changes were needed to suit the vehicle for home production. Detail measurements were altered to match Canadian engineering standards, a completely new electrical system was designed and new electrical traverse gear was evolved using Canadian components. Major changes involved the engine and armament. The original British Valentine had an AEC gasoline engine, but for the Canadian version a GMC 6-cylinder two-stroke commercial diesel engine (made by General Motors of Canada) was adopted. This was later tested by the British, proved slightly superior to the AEC installation, and was subsequently used in some British-built Valentines. The Besa machine-gun used in the British Valentine was in short supply, so for Canadian vehicles after No. 16 the machine-gun mounts were adapted to take the American Browning .30 cal. machine-gun. The final, and most distinctive change on the Canadian Valentine was the replacement of the fabricated hull nose by a cast one-piece nose which was intended to simplify production. Later, in 1942, when British designers were up-gunning the Valentine from a 2-pdr. to 6-pdr. gun, the Canadian Army Engineering Design Branch (responsible for tank design from December 1941) drew up plans for a home-produced cast turret with 6-pdr. gun for the Valentine. The idea was shelved, however, for by then Valentine contracts were being run down and the development work involved could not be justified.

Altogether Canadian Pacific built 1,420 Valentines—for orders were subsequently increased—the first being delivered in June 1941 and the last in May 1943, by which time the design was well and truly obsolete. The Valentines built in Canada ran to three marks, designated Mks. VI, VII, and VIIIA, all with detail changes. By the time the first Valentines were produced, however, the 1st Canadian Army Tank Brigade had gone to Britain (in February 1941) where it was equipped with Matildas and, later, Churchills. Valentines never did see much service with the Canadian Army. The first 30 were kept for training at Camp Borden and the other 1,390 were shipped to Russia under Lend-Lease arrangements. Some, at least, of these were used in combat and the Russian



*Views of an early production Ram I, actually the pilot model, show the main characteristics of the design. Note the cast turret front, later replaced by a bolted front, the sponson side doors, the protectoscopes, and absence of dustguards.*

(Imperial War Museum)

Government paid rare and uncharacteristic tribute to their quality stating: "After proof in battle we consider the Canadian-built Valentine Tank the best tank which we have received from any of our allies and we propose to ask . . . for more." Rarely during the war, or after, did the Russians make any other mention or acknowledgement of the many types of weapon supplied to them under Lend-Lease.

## THE CRUISER TANK

For the two new armoured divisions it was estimated that there was an immediate requirement for about 1,200 cruiser tanks. In August 1940 the Defence Department had set up an Inter-departmental Tank Committee to co-ordinate tank requirements and procurement for the future. At this time the chances of ever receiving tanks from Britain were remote; similarly, purchasing opportunities in America were severely limited because tank production was only just expanding and Britain had placed prior orders which absorbed all spare capacity. The only alternative, therefore, was to build tanks in Canada. It was decided to set up a Tank Arsenal to be run by the Montreal Locomotive Works, a subsidiary of American Locomotive Co., which was already involved in tank production in the United States.

In the late summer of 1940, the U.S. Ordnance Department commenced work on the M3 medium tank design, the British Tank Mission having knowledge of progress since they proposed to order this vehicle for British use. First inclination on the part of



*A view which contrasts the two types of American rubber shoe tracks used on most Rams. (Canadian Official)*

the Inter-departmental Tank Committee was to commend production of the M3 at the Canadian Tank Arsenal in the interests of standardization. By late autumn of 1940, however, the M3 design was sufficiently far advanced for the British Tank Mission in Washington to report on the features which were unsatisfactory by British (and thus Canadian) standards. The major objection was the excessive height and the sponson-mounted main armament which imposed tactical limitations. Further, the armour protection was considered inadequate and the radio was carried in the hull instead of in the turret as was British practice. One result of the British Tank Mission's objections was a specially designed low turret (with radio in the rear bulge) to further meet British requirements, and this version of the M3 became the Grant.

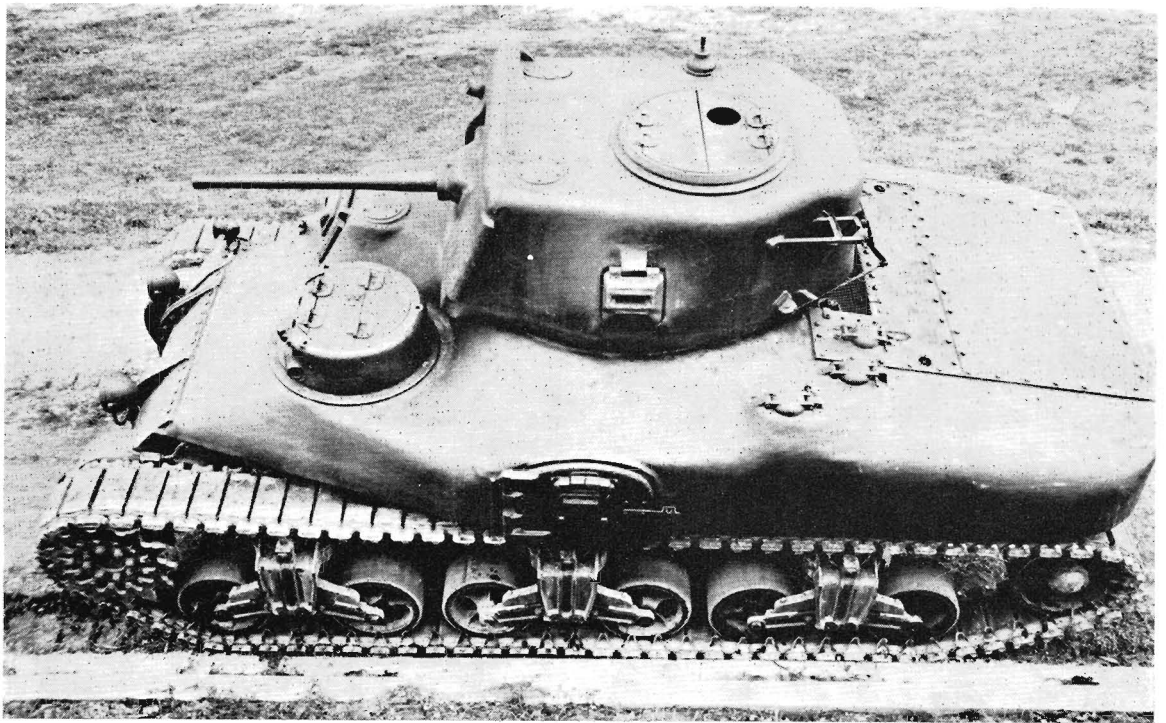
In January 1941, the Inter-departmental Tank Committee decided on a compromise. Worthington and other senior officers were convinced that Canada could design and build a cruiser (or medium) tank superior to the M3 design. The committee therefore decided to utilize the very satisfactory chassis and mechanical components of the M3, but to design a new superstructure and adopt a layout and armament which was in line with British requirements and standards. What was needed was a main armament of a 2-pdr. (subsequently amended to 6-pdr.) in a fully traversing turret, with a standard British No. 19 wireless set in the turret bustle, and a low overall height. Other contemporary British features then thought desirable were an auxiliary hull machine-gun turret and right-hand drive.

Montreal Locomotive Works were given responsibility for detail design under the direction of the Department of Munitions and Supply via the Inter-departmental Tank Committee. Features retained from the M3—apart from the chassis—were the sponson side doors and the 60-in. diameter turret ring. The British Tank Mission and the Defence Department were involved in the design and planning of the new vehicle in a consultative capacity.

Colonel Worthington contributed enthusiastic advice, his main contention being that the new vehicle should have a larger turret ring and mount the 75-mm. gun in the turret, so overcoming the main objection to the M3. Unfortunately his advanced view was not heeded and the Inter-departmental Tank Committee kept rigidly to the conventional British "rule" of the period that cruiser tanks should have 2-pdr. guns. The need for a tank with a 75-mm. gun had been appreciated in the U.S. Army from as early as May 1940 when the Germans first invaded France, and this had been the very reason for the design of the

*Production Ram Is on first delivery to Canadian troops at Camp Borden in 1942. Note that they lack guns, and the turrets are trained from the camera to conceal this fact in this "official" photo which was among the first released of the new vehicle. (Canadian Official)*





*In July 1941 the pilot model Ram was sent to Aberdeen Proving Ground where the U.S. Ordnance Department ran comparative trials with the M3 medium tank. Col. R. J. Icks was in charge of the tests. This is one of the official pictures taken of the vehicle at the time. Note that it lacks the commander's periscope. Later the U.S. Ordnance Department gave this vehicle the "paper designation" M4A5 in the M4 tank series. (U.S. Official)*

M3; it was not until nearly a year later, in the spring of 1941, that the British fully appreciated the urgent need for a heavier gun than the 2-pdr. and ordered the 6-pdr. (57 mm.) into production for use in tanks.

Thus the opportunity was missed of having an Anglo-Canadian tank with turret-mounted 75-mm. gun in production and in service by 1942, a crucial error of judgement in the otherwise creditable history of the Ram, though it was not, of course, realized to be an error at the time. In fact the Ram had a very advanced design feature by British standards of the period in that the turret incorporated a completely separate bolted front plate which made provision for up-gunning when the 6-pdr.—then (February 1941) going into production—was available. Up-gunning the

*Many production Ram I tanks were sent to equip Canadian divisions in Britain. Here one is seen in January 1942. Note the added mudguards. This vehicle also has mud chutes between the bogies, features added to most Canadian M3 Lee tanks but rarely seen on the Ram. (Canadian Official)*



design would merely involve replacing the front plate and 2-pdr. mount with a new front plate incorporating the 6-pdr; there would be no need to re-design the complete turret as was the case in some of the British tanks which were retrospectively fitted with 6-pdrs.

It should be remembered that at the time Worthington was mooted the 75-mm. gun turret idea, the U.S. Ordnance Department had not even started work on the design of the M3's successor, the M4 (Sherman), which was to be built from the start round a turret-mounted 75-mm. gun. Ironically, the British did not begin to consider the 75-mm. gun *officially* until the M3 and M4 medium tanks had given proof of their effectiveness in British hands during the latter part of 1942 and it was late in 1943 before the first British tanks appeared with a 75-mm. gun. By 1944 when British tanks so armed were available in quantity, the German tanks had guns which were superior still.

Worthington went to Britain in February 1941 to organize the reception, training and equipment of the 1st Canadian Army Tank Brigade which actually arrived and took over its Matildas and Churchills in June. Though he had been severed from direct contact with development of the new tank, Worthington's interest in the design and the important part he played in establishing the Canadian Armoured Corps was recognized in the name bestowed on the vehicle—Ram. This was taken from the central feature of the Worthington family crest which incorporated such a beast with suitably pugnacious horns.

The prototype vehicle was completed by Montreal Locomotive Works in June 1941, a considerable feat considering that detailed design had started only six months previously. Of course, work was somewhat



*A fine line-up of Ram IIs from one of the Canadian armoured regiments in Britain in April 1944. The nearest three vehicles have the Mk. III 6-pdr. gun and the next two have the longer Mk. V 6-pdr. gun but with the usual muzzle counterweights removed. Note that the nearest vehicle is a late production Mk. II with the sponson doors eliminated but retaining the ventilator and the auxiliary machine-gun turret.*  
(Canadian Official)

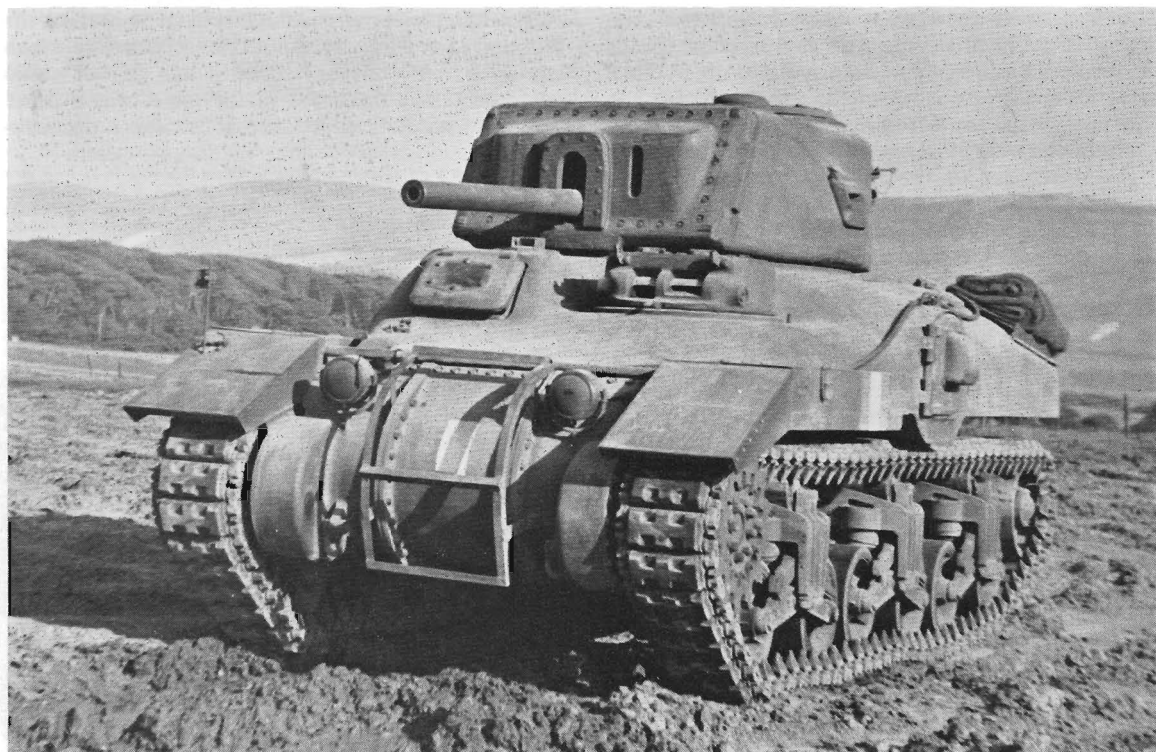
simplified by the use of the M3 medium tank chassis, Wright R-975 radial engine, transmission, and vertical volute suspension all virtually unchanged. A major alteration which presented problems was the re-siting of the driving position on the right to conform with the practice in British cruiser tanks. The driving seat which was high (and to the left) in the M3, was placed on the floor and all the controls were re-designed, shortened, and placed on the right. The floor position also allowed the overall height of the hull to be reduced. In July 1941 the prototype Ram was sent to Aberdeen Proving Ground for comparative

trials with the M3 medium. Colonel R. J. Icks was the testing officer, with a British/Canadian crew. While legend has it that the Ram influenced the Sherman design as a result, this is not strictly true for the T6 (Sherman prototype) was already designed by this time and any features derived from the Ram would have affected details only.

#### THE RAM DESCRIBED

The entire hull top and turret was cast, a considerable design feat for the period. At the time the pilot model was built such extensive armour plate casting was

*The Ram Mk. II had a 6-pdr. gun which necessitated a new turret front, clearly shown in this view. Another production change visible here is the replacement of the protectoscope in the side door by a ventilator.*  
(Canadian Official)







Another late production Ram II in Britain, November 1943, this time lacking the ventilator and side doors. (Imperial War Museum)

beyond the capabilities of any Canadian engineering plant and General Steel Castings in U.S.A. undertook this work, later assisting in establishing casting facilities at Montreal Locomotive Works' Tank Arsenal for production vehicles. The turret ring was identical to that used on the M3 medium tank and the turret was offset slightly to the right. The chassis structure was of riveted rolled plate, and layout followed that of the M3 in that the Wright R-975 9-cylinder radial air-cooled engine was mounted in the rear of the hull. The drive shaft led forward above the hull floor to the transmission which was of the controlled differential type with five forward speeds and reverse as in the M3. Final drives and differentials were at the extreme front of the vehicle driving the front sprockets. A three-piece bolted nose casting protected the transmission and final drive.

The driver sat to the right of the transmission housing with his steering levers, clutch and accelerator pedals immediately ahead of him. Forward vision was via an opening port which incorporated a protectoscope offering a limited view ahead when closed down. In these conditions the main vision device was a periscope in the hull roof just behind the vision port. The instrument panel was mounted in front of the driver but to his left, immediately over the transmission casing. To the left of the transmission was the hull gunner's position. In the early Rams he had a free-turning auxiliary turret which was, in fact, identical to the turret cupola of the M3 medium tank. This featured a hatch in the top and a Browning .30 cal. machine-gun pivoted for elevation only. The machine-gun traversed the turret. The hull gunner had a circular seat on a rotating pintle attached to the hull floor. In later Rams the auxiliary turret was dispensed with, the hull shape was modified to match the driver's side, and a .30 cal. machine-gun in a ball mount was provided in the hull front as on the Sherman tank. The other major feature of the cast hull was the sponson

door in each side. Each door incorporated a pistol port but it was mainly intended as an escape hatch. Though a convenient feature for the crew and useful for re-ammunitioning, the sponson door was soon eliminated from production vehicles. Not only did the openings weaken the hull, they also complicated manufacture. As a substitute a belly escape hatch was provided when the side doors were discontinued. The hull rear had bolted cover plates giving engine access, and fuel filler caps. In the hull backplate were engine servicing doors and muffled exhaust pipes.

The cast turret had a bolted front plate holding the gun and mantlet and a small bolted backplate which could be removed for servicing the gun or radio equipment, etc. Each side of the turret was a pistol port incorporating a protectoscope. These protecto-

Ram IIs of a Canadian armoured division training in Britain are subjected to a mock air attack by U.S.A.A.F. Mustangs, December 1942. (Imperial War Museum)





*A late production Ram II in 1944 exhibiting all the final modifications. The auxiliary machine-gun turret is eliminated as are the side doors and the pistol ports in the turret. It has U.S. type steel tracks and bogies with trailing return rollers as fitted to the Sherman tank. Note the long Mk. V 6-pdr. gun with muzzle counterweight. Vehicle at rear is the earlier production type with pistol ports, auxiliary turret and Mk. III 6-pdr. gun.*

(Imperial War Museum)

scopes were later eliminated, and in later vehicles still the pistol ports themselves were dispensed with. From the early production Ram II the protectoscopes were also removed from the hull side doors and replaced by ventilators.

Vision devices in the turret consisted of a periscope for the commander in one flap of his rotating hatch with another periscope for the gunner in the turret roof. In the Ram II the gunner's periscope was replaced by a mushroom ventilator.

As originally envisaged the Ram was to have the 2-pdr. gun, but while still being designed at Montreal Locomotive Works the decision was taken that all future British tanks should have the 6-pdr. gun, and provision was made for future installation as previously recounted. The story of the 6-pdr. gun was one of bureaucratic muddle and monumental indecision

*Another view of a very late production Ram Mk. II, this time fitted with C.D.P. steel tracks. Note the Mk. V 6-pdr. gun and the absence of the auxiliary turret. Date: May 1944.*

(Canadian Official)

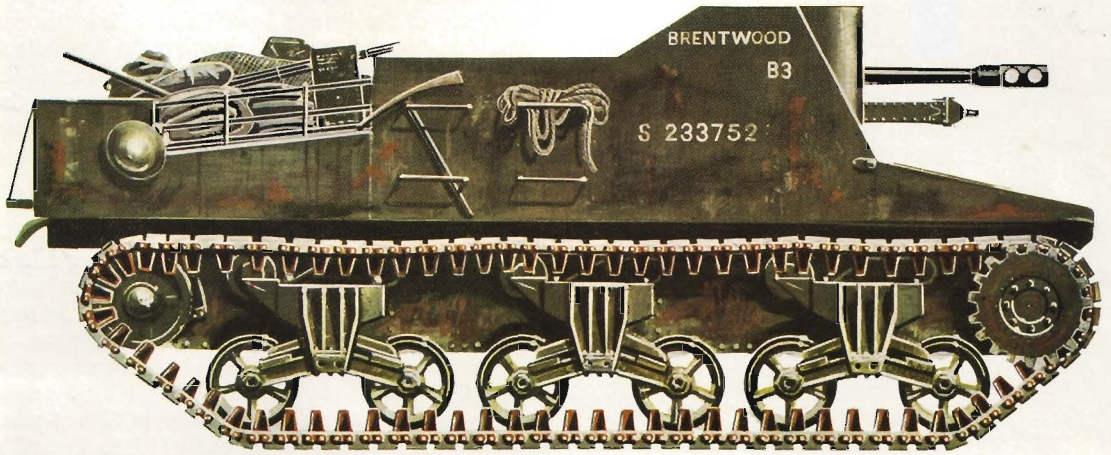


which delayed its appearance in British tanks. Suffice it to say that no clear go-ahead for production was given until spring 1941 when Rommel's early successes in the Western Desert fighting finally showed up the inadequacy of the British 2-pdr. It was clear that no 6-pdr. guns would be available by the time Ram production was scheduled to start in November 1941. So as an expedient it was planned to fit 2-pdrs. in the first 50 vehicles. The gun and mount was the same as used in the Valentine and was simply adapted to a suitable front plate. This version of the Ram was subsequently designated Mk. I.

In the planning stages for the Ram the British had undertaken to supply 6-pdr. drawings and information for the tank mountings. However, possibly due to the confusion surrounding the 6-pdr. programme, nothing arrived. Fortunately the Canadian Department of Munitions and Supply had acted on its own initiative in October 1940 and asked Dominion Engineering Ltd to go ahead with a Canadian version of the 6-pdr., with production to start at the end of 1941. A suitable tank mount and elevation gear was designed by the Montreal Locomotive Works, so Rams with 6-pdr. guns were in production early in 1942 at the same time as the 6-pdr. was being fitted to British tanks. With the 6-pdr. the vehicle was designated the Ram Mk. II and all subsequent production vehicles after the first 50 were of this type. The turret traverse mechanism (hand and hydraulic) in the Ram was copied from the M3 medium and the same gyro-stabilizer (which worked in elevation only) was installed. In terms of fire-control the Ram was thus superior to British tanks with 6-pdr. guns. In both the Ram I and II there was a co-axial .30 cal. machine-gun in the mantlet and a .30 cal. weapon could be pintle-mounted on the turret for AA defence, though this was very rarely fitted.

## PRODUCTION CHANGES

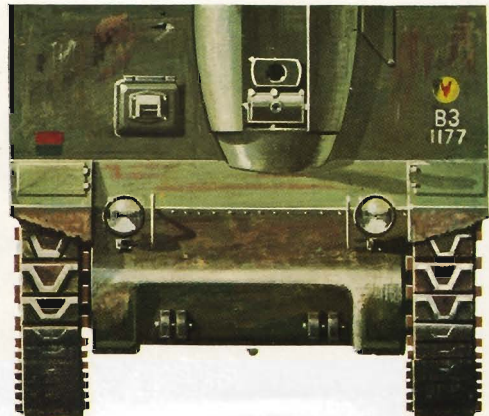
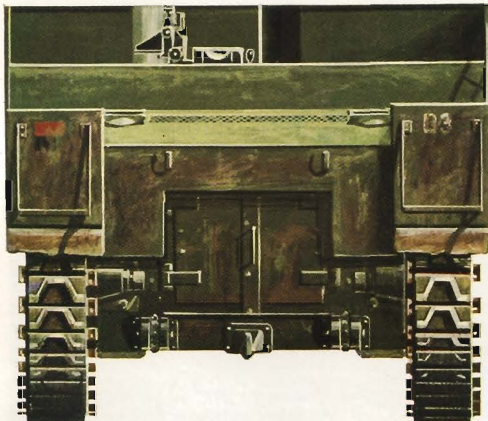
The Ram was designed with the benefit of very little 'user' experience, other than that which came second-hand from Britain *via* the British Tank Mission. Thus it became subject to numerous detail modifications during its production life once units in the field had a chance to report back. It says much for the soundness

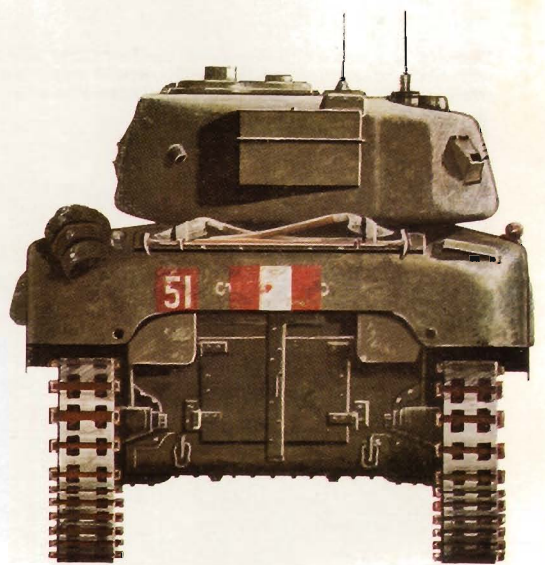
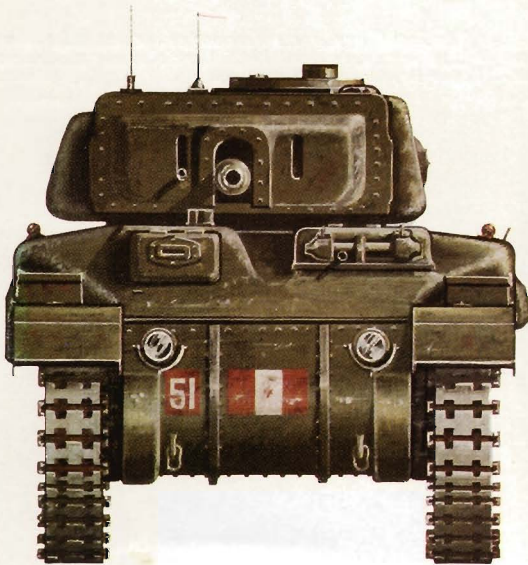
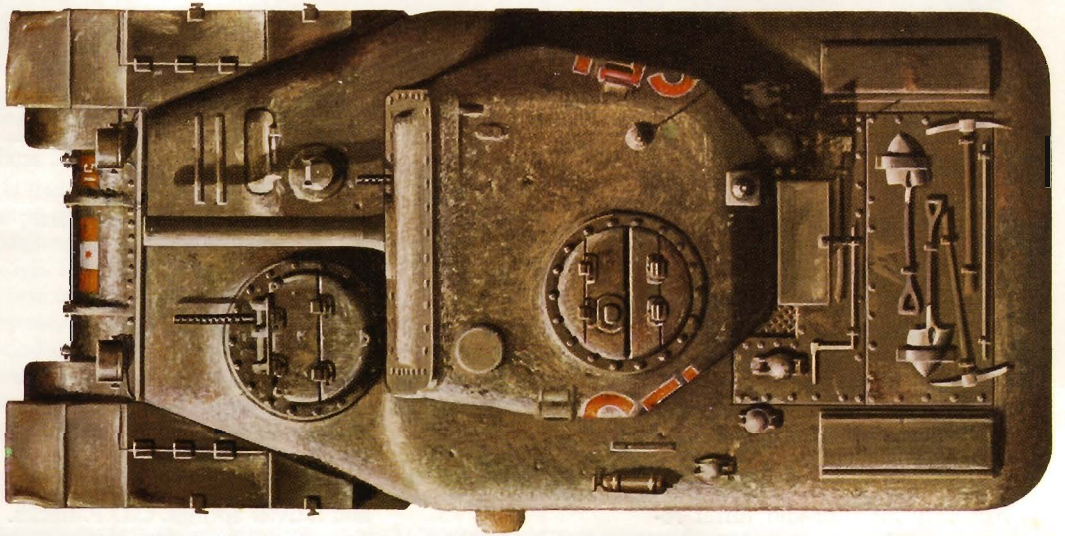
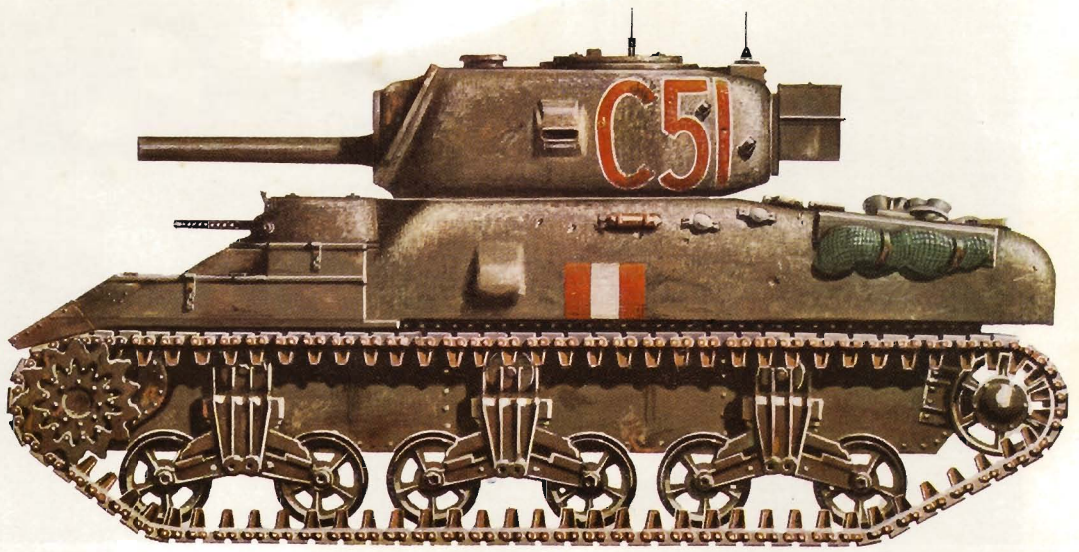


25 pdr. S.P. Tracked, Sexton of 147 Field Regt., (Essex Yeomanry), 8th Armoured Brigade, October, 1944.

Variation of 8th Armoured Brigade formation sign as carried on this particular vehicle.

Ram Mk II of 'C' Squadron. Lord Strathcona's Horse, 5th Canadian Armoured Division, April, 1943.







Late production Ram IIs displaying the absence of side openings in hull and turrets. These are on exercises in England in December 1943. (Imperial War Museum)

of the design, however, that there were no fundamental changes necessary. Like the Sherman—which it pre-dated in design by a few months—the Ram

proved relatively viceless, being mechanically reliable and easy to maintain. The detail changes are best given in summary form:

Vehicle	WD Numbers (range)	Features
Ram I	CT-39781—CT-39830 (50)	2-pdr. gun, no gyro-stabilizer, auxiliary machine-gun turret, side doors.
Ram II	CT-39831—CT-40937 (1107) CT-159402—CT-160193 (792)	6-pdr. gun with gyro-stabilizer; splash beading added round turret.

Ram II Modifications	From vehicle	Ram II Modifications	From vehicle
Side doors removed from hull	CT-40131	Improved 6-pdr. gun mantlet	CT-159599
Pistol ports added in hull in place of side doors	CT-40131	Improved R-975-CI engine, new silencers, improved air cleaners, improved clutch, and transmission oil cooler	Late production
Pistol ports eliminated	CT-40546		
Access plate in turret rear eliminated and belly escape hatch provided	CT-159502	Improved volute suspension brackets with trailing return rollers and heavier springs. C.D.P. tracks.	Very late production
Auxiliary machine-gun turret removed from hull	CT-159502		

This view of a production Ram I with the Fort Garry Horse shows very clearly the origin of the 2-pdr. mantlet which was taken straight from the Valentine tank. (Chamberlain Collection)

The Fort Garry Horse were one of the first units to receive Ram IIs in Britain, in April 1942. Here they are pictured on the first exercise, the vehicles still painted with shipping instructions. (Canadian Official)





*Farewell to the Rams . . . one of the new Shermans arrives to replace the Rams of a Canadian armoured regiment in April 1944 during the invasion preparations.*  
(Imperial War Museum)

Early Ram IIs had the OQF 6-pdr. Mk. III gun and later vehicles had the longer OQF 6-pdr. Mk. V which was distinguished by its muzzle counterweight. The engine changes listed above were to allow for the use of a lower octane fuel. One feature unique to the Ram and its derivatives was Canadian Dry Pin track, designed in Canada as a substitute for the American type track, rubber bushed, used on the Sherman. This was both heavy and expensive and C.D.P. track

proved very successful. American tracks were used on the early Rams, however.

### RAM IN SERVICE

First Ram Is were completed at Montreal Locomotive Works in November 1941 and the change-over to the Ram II came in January 1942. By the time the Ram started to appear the Canadian Armoured Corps had started to expand at a rapid rate. By late 1942 the

*The first Canadian regiments with Rams frequently had M3 Lees or Grants (as here) to make up the numbers. This picture was taken on an exercise in England in December 1942.*  
(Canadian Official)



4th and 5th Armoured Divisions had been formed, the 4th by converting an infantry division with Worthington appointed its G.O.C. In mid-1942 these two divisions were shipped to Britain, equipped with a mixture of Rams and M3 Lees.

The majority of the Rams built, including the Mk. Is, came to Britain in this way, equipping the Canadian armoured divisions, but none were to see service in their primary fighting rôle. By the time of the invasion of Europe in June 1944, tanks with 75-mm. guns were to equip the British/Canadian armoured divisions and the Canadian tank battalions had their Rams replaced by Shermans in the months preceding D-Day. In early 1943, in fact, consideration had been given once more to mounting a 75-mm. gun in the Ram in place of the 6-pdr. One vehicle had a 75-mm. gun installed and firing trials were said to be successful. However, no decision was made to produce Rams with 75-mm. guns. No precise reasons have been traced for this, but undoubtedly the main reason was that the turret was too small to hold the 75-mm. gun in comfort. It was a tight fit even with the 6-pdr. and to be wholly satisfactory it would have been necessary to use a larger turret ring and a redesigned turret. The vast amount of work this would have involved could not be justified in late 1943 by which time Ram production had ended and sufficient M4 series vehicles were being turned out in America to suit all Allied medium tank requirements for the year ahead.

A decision to terminate production of the Ram was taken as early as August 1942, when production of

the M4 medium tank was in hand on a grand scale in the United States. In the interests of standardization it was planned that the M4A1 would also be produced in Canada at the Montreal Locomotive Works after completion of the Ram contract. In fact, another year was to go by before the last Ram was built in July 1943. The delay was mainly due to the difficulty of introducing the new plant and components needed to build M4A1s in Canada without interrupting production at the Montreal works for too long a period. Also there was an increased demand for M4 series vehicles in the winter of 1942-43 which diverted attention from setting up new production lines when it was simpler for existing facilities to increase their output.

## RAM VARIANTS

### Ram OP

It was in the last six months or so of Ram production that the first of several variants appeared. This was the Ram OP, which was designed to act as a command and observation vehicle for SP artillery, specifically to complement the Sexton SP 25-pdr. which was then just going into production at the Montreal Locomotive Works. As described later, the Sexton shared a common chassis with the Ram and it was logical to utilize the Ram as an OP vehicle. The last 84 Rams built were completed as OP vehicles and the conversion entailed removal of the 6-pdr. gun and its replacement by a dummy barrel. The interior was completely re-arranged with elimination of the turret

*A Ram II used for infantry training in 1943 with its 6-pdr. gun removed.*

(Canadian Official)





*Above and below. The Ram converted experimentally as a SP AA mount for the 3.7-in gun. This project was abandoned at an early stage, 1943. (Canadian Official)*

basket and the siting of an observation position (with stereoscopic telescope) in the turret front. Vision slots were cut in the front plate. The hydraulic traverse gear was removed and the turret was limited in hand traverse to 45° each side. The commander's hatch was calibrated and marked so that the hatch periscope could be used as a direction finder and sight. Two No. 19 and one No. 58 wireless sets were carried, and field telephone cable reels were mounted behind the turret.

The detail design for this conversion was carried out by the Canadian Army Engineering Design Branch to meet Royal Artillery requirements. Subsequently a number of standard Ram II tanks were converted as OP vehicles to the same standards and these Ram OPs were widely used by the field regiments equipped with Sextons in the N.W. Europe campaign.



### **Kangaroo**

The other important rôle for which the Ram is best remembered is the Kangaroo troop carrier. This was a significant development as far as the British Army was concerned for it demonstrated, in 1944, the value of the tracked armoured troop carrier for the infantry battalions of armoured brigades; this type of vehicle, latterly in a specially developed form, has been used by the British ever since. Appropriately enough, the Kangaroo as developed in 1944 was a Canadian idea, though at first it did not involve the Ram at all. Lieut.-General Guy Simonds, the young 41-year-old commander of 2nd Canadian Corps, first thought of carrying up troops in tracked armoured vehicles during "Operation Totalise", the offensive against Falaise in early August 1944. Here infantry had to be transported over the big expanse of open ground in the Orne valley to support a tank attack and occupy villages beyond the German defence lines. While a limited number of half-tracks was available, this was nothing like sufficient, for it was necessary to carry up six infantry battalions for this major assault. However, at that time the Priest had just been replaced in British and Canadian SP field regiments by the Sexton, and Simonds arranged for R.E.M.E. workshops to remove the 105-mm. howitzers from as many displaced Priests as were available. Known popularly as "Unfrocked Priests", and later as Priest Kangaroos, these vehicles had the gun embrasure plated in and carried 12 infantrymen. Though the overall operation was not entirely successful, the idea of using the makeshift armoured personnel carriers proved highly satisfactory. Strictly speaking, the Kangaroo idea at this time was simply a revival of what had been done in the first world war, and what the Germans had been doing in the second; but immediately prior to 1944 the British had not used APCs save for a limited number of half-tracks in armoured divisions.

The Kangaroo idea was later taken up by 79th Armoured Division which was responsible for 21 Army





*Ram OP tank of a Sexton-equipped SP field regiment passing through a village street in Holland in January 1945.*

(Imperial War Museum)

Group's specialized fighting vehicles. By September 1944 the Canadians had formed a special Kangaroo unit, 1st Canadian Armoured Carrier Regiment, this time using converted Ram tanks of which plenty were available. The turret was removed and the No. 19 wireless set was moved into the left sponson. Rungs and footsteps were welded to the hull sides to provide a means of getting aboard, and bench seats were fitted in the turret space to hold eight to eleven infantrymen. Crew of the vehicle was two, driver and commander/wireless operator. The Ram Kangaroos were used by the Canadians in the taking of Boulogne

and were so successful that it was decided to equip a British regiment for the specialized APC rôle. One armoured brigade workshop converted 120 Ram tanks for British use as Kangaroos within a month, and the 49th RTR was redesignated as 49th APC Regt. to operate them. From the end of 1944 until the cessation of hostilities in Europe the two APC regiments operated under 79th Armoured Division control and gave valuable service, despite the limited numbers available and the improvised nature of the adaptation a major failing of which was the lack of an armoured top. In Italy, meanwhile, 8th Army took

*Below and top facing page: Two views of the Ram ARV Mk. I shows the simple nature of this conversion.*

(Imperial War Museum)





nearest the Ram came to action in its original tank configuration.

### Ram ARV

Other special-purpose variants of the Ram were produced in smaller numbers. The Ram ARV Mk. I was a recovery vehicle which featured tool boxes on its rear hull decking and a winch fitted to the hull front. This was a towing vehicle only and the few vehicles so altered were mostly Ram Mk. Is. The Ram ARV Mk. II was a more sophisticated conversion, produced in Canada to the same design as the British Sherman ARV Mk. II. This vehicle had all the same fittings as all British "Mk. II" standard ARVs of the time, including dummy fixed turret and dummy gun, rear jib, earth spade at rear, and electric winch (with 25-ton pull) installed in the former turret space. The Ram ARV II was more widely used than the ARV I but no precise figure for the number of vehicles so converted appears to have been recorded.

### Experimentals

Minor versions of the Ram included a few test vehicles or prototypes. After Dieppe, when a special engineer assault tank was proposed, the Ram was considered as a possibility for the rôle. Two test vehicles were converted for trials in 1943, but in the event the Churchill proved a more suitable vehicle for what was later known as the AVRE. One project tried in Canada in 1942-43 was a SP AA version of the Ram which featured a cut down hull and a 3-in. gun, later replaced by a 3.7-in. weapon, in place of the turret. In its final form, a shield was incorporated for the gun, but the project was abandoned, possibly because it was unstable. The strangest rôle of all for the Ram, however, was as a searchlight carrier for the C.D.L. functions, some of which were also used to illuminate forward airstrips. The outfit simply consisted of a complete 40-in. searchlight mounting carried in a Ram Kangaroo. So far as is known, only very few vehicles were so fitted in the winter of 1944-45.

up the Kangaroo idea using Priests once more, plus some "war weary" Shermans which were converted in similar style to the Rams. Ram Kangaroos remained in British Army service for some years in small numbers post-war until specialized APCs like the Saracen became available. Rams were also used as tractors for 17-pdr. anti-tank guns and as ammunition carriers for Sexton-equipped SP field gun regiments; in this latter form they were known as Wallabies. The Canadians also fitted some Ram Kangaroos with Wasp II flame-throwing equipment, the flame projector replacing the hull machine-gun. These vehicles were called Badgers and post-war some Canadian Shermans were similarly altered. Badgers were first in service in February 1945 and were used to great effect by the Lake Superior Regt. (4th Canadian Armoured Brigade) during "Operation Veritable". They were also used by 5th Canadian Armoured Brigade in Holland in March 1945, but in this case standard Rams were used, retaining their turrets, perhaps the

*Picture shows Ram Kangaroo, a troop carrier made by removal of the turret from the standard Ram tank, in Holland in October 1944. (Imperial War Museum)*



## THE SEXTON

Destined to become much better known and more widely used than the Ram was the Sexton, more formally designated "25-pdr. SP, Tracked". The design owed much to that of the Priest or M7 105-mm. Howitzer Motor Carriage which had been developed for the U.S. Army. Priests had been ordered early in 1942 and were delivered to the 8th Army in time for the Battle of Alamein where they were an immediate success. The British General Staff had put out a requirement for a similar vehicle which mounted the British 25-pdr. howitzer instead of the American 105-mm. howitzer. This led to a prototype being built in July 1942, the T51, by the U.S. Ordnance Department. It was virtually a M7 with a 25-pdr. howitzer replacing the 105-mm. weapon. However, U.S. resources could not be devoted to producing this vehicle specially for British service. Hence the Canadian Army Engineering Design Branch were asked via the Canadian Defence Department to utilize a Ram chassis to mount the 25-pdr., incorporate British features, and produce a vehicle embodying the general layout of the M7.

Superstructure of the new SP 25-pdr. was very similar to that of the M7 but the driving position was, of course, on the right as in the Ram. Considerable problems were experienced in mounting the 25-pdr., though all were very successfully overcome. A new saddle and pintle was needed for the cradle, and new traverse gear was necessary to speed up traverse and make it easier. Traversing shields were fitted each side of the gun aperture, features not found in the M7 Priest. In order to give 40° elevation it was necessary to limit the normal recoil throw of the 25-pdr. from 36 to 20 inches. Finally the weapon had to be re-balanced to compensate for the absence of the trail and carriage used on the normal 25-pdr.

The pilot model of the new vehicle, now called the Sexton, was shipped to Britain for trials at the beginning of 1943. Approved subject to minor changes, the Sexton entered production at Montreal Locomotive works early in 1943 and 424 had been completed by the end of the same year. When production ceased at the end of 1945, 2,150 had been built. Since Ram tanks were in production in the Montreal works, the howitzer assemblies and other parts were made at Sorel and assembled into the vehicle at

*The Grizzly was simply the Canadian-built version of the M4A1 Sherman with only minor detail changes.* (Canadian Official)

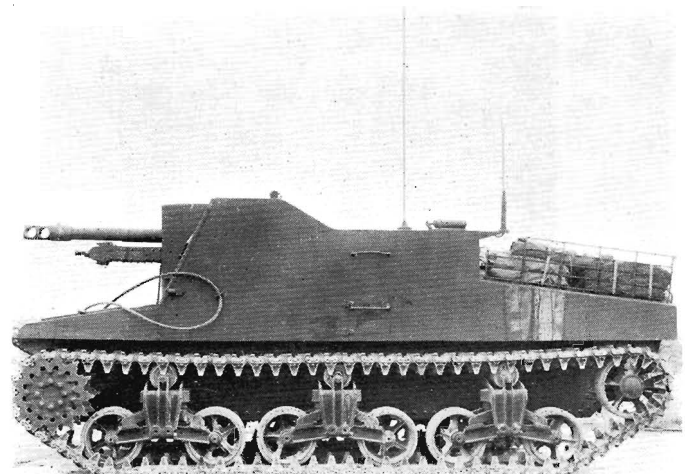


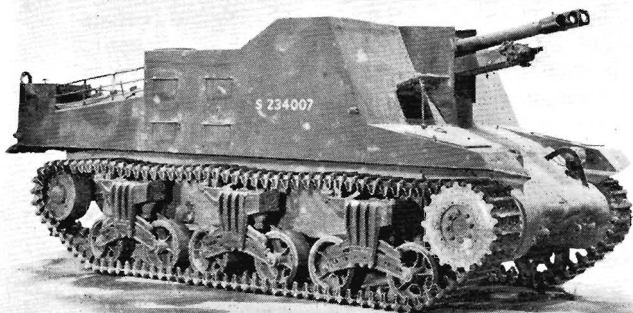
*The Badger was a Kangaroo with Wasp flame-throwing equipment replacing the hull machine-gun. This picture shows the same conversion on a Canadian Sherman just post-war with the flame projector arrowed.* (Canadian Official)

Montreal. The Sexton long outlived the Ram in production and numerous detail modifications were made as time went by to bring the Sexton chassis up to later standards similar to those of the M4. For instance, early Sextons had three-piece bolted nose assemblies and the original type of bogie bracket. From 1944 these fittings were changed respectively to cast one-piece noses and the M4 type bogies with trailing return rollers. Later additions included provision of a tow-hook for an ammunition trailer, mounting of an auxiliary generator, and provision of pintles for AA machine-guns.

Sextons went into wide service with the British and Canadian divisions in 21 Army Group in June 1944 just after the Normandy landings. They replaced Priests under an agreement with the U.S. Army so that all stocks of 105-mm. ammunition—then in big demand—could be made over to U.S. divisions at Normandy. The displaced Priests were converted to Kangaroos, as previously described. In British service the Sexton remained in use for many years post-war and did not finally disappear until the late '50s.

*Early production Sexton with riveted chassis and early type bogies. Note the very crude weld seams on the essentially simple superstructure.* (Imperial War Museum)





*Late production Sexton with later Sherman type bogies and cast one-piece nose. C.D.P. tracks are fitted.*  
(Imperial War Museum)

Though a very large vehicle for such a relatively small weapon, the Sexton, like the Priest, was a very successful and much-liked vehicle with all the inherent virtues of its M3/M4 pedigree. One variant produced based on the Sexton was the Sexton GPO (gun position officer) which was simply a Sexton with the gun removed and fitted out to carry map tables, extra radio and telephones, and Tannoy equipment for the battery control rôle.

### THE GRIZZLY

Closely related to the production of the Ram and the Sexton was the Grizzly. It has already been related how Ram production was to be phased out in favour of the M4A1 which was to take over the Ram assembly lines at Montreal Locomotive Works. This changeover took place in the summer of 1943, Ram production ceasing in July and M4A1 production starting in September. The Canadian-built version of this vehicle was called Grizzly and it was identical in all respects to the M4A1 except for the installation of the British 2-in. Smoke Mortar in the turret roof,

*The Skink AA tank with its four Polsten 20-mm cannon was based on the Grizzly with re-arranged interior layout and new Canadian-designed turret.*  
(Canadian Official)



and the British No. 19 radio set in the turret. The Wright Continental engine and many other components were similar to those being used already in the Ram, and there was little technical difficulty in effecting the change of production. It is interesting to note that the installation of the 2-in. Smoke Mortar was a feature subsequently adopted for U.S.-built M4 series vehicles. However, Grizzly production was short-lived and terminated in December 1943. By this time it had become apparent that American plants could produce sufficient M4 series tanks to meet all Allied medium tank needs for 1944 and that Grizzly production was an unnecessary duplication of resources. Montreal Locomotive Works was thus left to build only the Sexton and this type was, in the event, built in larger numbers than any other Canadian AFVs except carriers.

### THE SKINK

Final Canadian design of the war was the Skink AA tank, an ingenious adaptation of the Grizzly, which was not ultimately required. The Skink originated in 1943 when there was a need for anti-aircraft tanks for the planned invasion of Europe. Several types were designed in Britain as adaptations of existing tanks and the Canadian Department of Defence were asked to produce a similar type. The Waterloo Manufacturing Co. undertook development using the Grizzly as a basis. The Grizzly hull was used with revised interior layout which included armoured racks to hold the magazines for the automatic 20-mm. guns which were to be fitted. At first Hispano guns were specified, later changed to Polstens. A new cast turret was designed to hold the quad gun mount, and this itself presented problems since the shape was difficult to cast and precision was necessary to achieve perfect balance for high speed traverse. A new electro-hydraulic traverse and elevation system was designed, operated by handlebar joystick from the aimer's position in the turret. A much modified auxiliary generator was necessary to provide higher power for the fast traverse system.

The guns could be fired singly, in pairs, or all together. The aimer/gunner was provided with a reflector sight which fitted in the turret roof. This necessitated exposing his head through the turret roof, but for ground fire—a secondary rôle—tracer ammunition was used and the guns were aimed by direct sights from within the turret.

The pilot model of the Skink was completed early in 1944 and production plans were made. Aside from complete Skinks, it was proposed to make conversion kits consisting of the turret and internal equipment so that existing Grizzlies and Shermans could be altered to Skink configuration. However, immediately after the invasion of Europe in June 1944 it became apparent that the expected aerial threat from the Luftwaffe against field forces was negligible. Existing AA tank troops were disbanded and the orders for the Skink were cancelled after only three vehicles and eight conversion sets had been completed. One of the Skinks was brought to England for War Office trials but no further work was done on the project and this promising design ended Canada's energetic and inventive contribution to Allied AFV development in World War II.

## THE ROYAL CANADIAN ARMoured CORPS

By 1945 the Canadian Armoured Corps had grown mightily; Worthington's 24 men of 1936 had become 20,000 by 1945, five times the strength of the entire Canadian Army of pre-war days. Canadian tank men had fought with distinction in Italy and North-West Europe, and a Canadian tank regiment spearheaded the gallant but abortive Dieppe raid in 1942 when much was learned to influence the use of tanks in the Normandy landings. Worthington's lusty infant had indeed grown fast and learnt much inside nine years. Worthington was probably the proudest "father" of all in August 1945 when the Canadian Armoured Corps, which was virtually his creation, was awarded the title "Royal" by King George VI in recognition of its outstanding wartime record.

A.F.V. Series Editor: **DUNCAN CROW**



### SPECIFICATION:

#### RAM CRUISER TANK/25 pdr. SP TRACKED, SEXTON

	<i>Ram II</i>	<i>Sexton</i>		<i>Ram II</i>	<i>Sexton</i>
<b>General</b>			<b>Armour</b>	Cast armour steel	
Crew:	5 (Driver, co-driver, gunner, loader, commander)	6 (Driver, co-driver, commander, gunners (3))	Hull	Chassis: Armour plate, riveted and/or welded	
Combat weight:	65,000 lbs.	57,000 lbs.	Front:	1 3/4 in.	3/4 in.
Power/weight ratio:	12.3 h.p./ton	14 h.p./ton	Nose:	1 1/2 in.	1 1/2 in.
Ground pressure:	13.1 lbs./sq. in.	11.5 lbs./sq. in.	Sides:	1 1/2 in to 2 1/2 in.	3/8 in.
Bridge class:	30	30	Belly:	1 in.	1/2 in.
			Rear:	1 1/2 in.	1 1/2 in.
			Top:	1 1/2 in. to 3 in.	1 1/2 in.
<b>Dimensions</b>			Turret		
Length overall:	19 ft.	20 ft. 1 in.	Front:	3 1/2 in.	
Height overall:	8 ft. 9 in.	8 ft.	Sides:	2 1/2 in.	Not applicable
Width overall:	9 ft. 10 in.* 9 ft. 6 in. †	8 ft. 11 in.	Rear:	1 1/2 in.	Front shields: 1/2 in.
Track centres:	83 in.		Roof:	1 1/2 in.	
Track width:	16 1/2 in. (U.S. T54E1 or T49)	15 1/2 in. (CDP tracks)	<b>Engine</b>	Wright Continental R-975/C1 or R-975/EC2 ‡ Gasoline/petrol, 9 cylinders radial, air-cooled 400 h.b.p. at 2,400 r.p.m.	
Ground contract:	147 in.	147 in.	<b>Transmission</b>	Borg-Warner or Lipe clutch, controlled differential gearbox	
<b>Armament</b>			<b>Suspension</b>	Vertical volute spring bogies	
Main:	OQF 6 pdr. Mk. III, IV	OQF 25 pdr. 'C' Mk. II or III	<b>Performance</b>		
Secondary:	3 x .30 cal. MG 2 in. Bomb Thrower Gyro-stabilizer in elevation.	2 x Bren .303 cal. LMG	Maximum speed:	25 m.p.h.	25 m.p.h.
Fire control:	Direct sight telescope	Direct sight telescope and sight dial for indirect fire	Vertical obstacle:	2 ft.	2 ft.
			Trench crossing:	7 ft. 5 in.	8 ft. 3 in.
<b>Ammunition</b>			Wading depth:	3 ft. 4 in.	3 ft. 10 in.
Main:	92 rds.	112 rds.	Road radius:	144 miles	180 miles
Secondary:	880 rds., 24 bombs	1,500 rds.	Fuel capacity:	150 gals. (Imp.)	146 gals. (Imp.)
<b>Sights/vision devices</b>			<b>Special features/remarks</b>		
	Protectoscopes and periscopes	Protectoscope for driver		Ram I as for Ram II but with OQF 2-pdr. Mk. IX or X gun. Wt.: 64,000 lbs. OP version had dummy gun and carried second No. 19 wireless set, plus portable No. 54 set.	Could be fitted with canvas tilt over fighting compartment. G.P.O. version lacked gun and carried extra Tannoy and telephone cable reels.
<b>Communications</b>	No. 19 set	No. 19 set Loudspeaker (Tannoy)			

\*Vehicles with side doors

† Vehicles without side doors but with vents

‡ R-975/C4 in later Sextons



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