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REPORT NO. 38  
HISTORICAL SECTION (G.S.)  
ARMY HEADQUARTERS

27 Jul 50

Tank Production in Canada

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INTRODUCTION

1. Prior to the Second World War the possibility of Canada being called upon to produce tanks was considered to be remote. It was felt that should Canada be called upon to provide armoured units in time of war, such units would be equipped with tanks produced from United Kingdom sources. On the other hand, Canada's automotive industry, which was highly developed, could be brought to bear for production of various types of useful vehicles as soon as drawings and specifications became available.

2. When, in 1940, large-scale production of tanks in Canada was requested by the British authorities, a problem of tremendous magnitude had to be faced in the light of Canadian production facilities. Tanks were essentially a product of the heavy engineering industry, in which Canada's facilities were all too limited. How the challenge was met is indicated in the following table (1) giving the numbers, types, etc., of tanks which eventually came off Canadian assembly lines: -

<u>Name of Tank, etc.</u>	<u>Assembled By</u>	<u>Production Commenced - Finished</u>	<u>Number Assembled</u>
Valentine (Infantry)	CPR Angus Shops, Montreal	1941-1943	1,420
RAM I & II (Cruiser)	Tank Arsenal, Montreal Locomotive Works	1941-1943	1,949 (RAM I 50, and RAM II 1,899)
Grizzly (Cruiser)	Tank Arsenal, Montreal Locomotive Works	1943	188
Command/OP	Tank Arsenal, Montreal Locomotive Works	1943	84
25 Pr. Sexton (S.P. Gun)	Tank Arsenal, Montreal Locomotive Works	1943-1945	2,150
AA 20mm Quad Skink	Tank Arsenal, Montreal Locomotive Works and Waterloo Mfg. Co.	1944	3

## VALENTINE TANK PRODUCTION

3. The first order connected with tank production was received in October, 1939. At that time a requisition for one hundred hulls for the Valentine (Infantry) Tank Mark III was submitted to the Canadian Defence Purchasing Board by the British Purchasing Mission in Canada. Drawings and specifications in connection with this order were received from the United Kingdom in January, 1940 and a conference was immediately held between representatives of the British Purchasing Mission, the Department of Munitions and Supply (War Supply Board) and the Department of National Defence (Branch of the MGO). At this conference it was decided that the logical plant in Canada to undertake the work was the Angus Shops in Montreal. The Canadian Pacific Railway Company, which owned the shops, was willing to undertake the work and began organizing production. On 2 Apr 40, however, the order was withdrawn. It was understood at the time that the order was cancelled because the British preferred to produce tanks in Canada from a later design (2). This was one reason. There was another, however, and that was the British belief that a suitable plant did not exist in Canada. This is brought out in a message dispatched by the British Ministry of Supply to the United Kingdom High Commissioner in Canada on 17 Mar 40. This message read:- "So far information in this Ministry is that Canada will not be able to get into production of Tanks until 1941. This is confirmed by two representatives of Canadian War Supply board, Messrs. Harrison & Bromley, who have seen drawings. Earle also indicates this in his reports. The fact that 250 assemblies had to be ordered in U.S.A. suggests non-existence of suitable plant in Canada. All existing drawings with you, few remaining sent to you on completion by Vickers. As this tank [Valentine] is now fully covered suggest you take no further action until later tank has completed trials as it will be more suitable for Canadian production" (3). Although this particular order was cancelled it appears to have had the effect of indicating the CPR Angus Shops as the plant that could be organized for tank production at the shortest notice.

4. The stunning reverses suffered in Belgium and Holland during May, 1940 appears to have altered the British view that Canadian tank production should be deferred until the later type tank had completed trials. It will be remembered that on 10 May, 1940 the Germans had attacked both the Netherlands and Belgium; on 15 May the Dutch Army surrendered and by 26 May the British Expeditionary Forces was withdrawing to the coast towards Dunkirk. On 27 May the King of the Belgians asked the Germans for an armistice. On this same day the Minister and Deputy Minister of Munitions and Supply were in New York conferring with the British Purchasing Commission regarding the possibility of producing tanks in Canada. While they were there an urgent cable arrived from the United Kingdom requesting information as to the possibility of manufacturing tanks in Canada and in the United States (4). Canada was prepared to build tanks and notified the United Kingdom to this effect. As a result, in June, 1940 the first order requiring the production of complete tanks was received. This was an order for 300 Valentine (Mark IIX) tanks and other contract to produce the tanks was awarded to the CPR Angus Shops (5). The word "produce" is used in a board sense; the Angus shops were only an assembly shop for tanks and very few of the components going into the tanks were manufactured in the shops. Most of the components were supplied to the shops by sub-contractors (6). During the same month (17 June, 1940) the Minister of National Defence authorized an order being placed for 488 tanks to equip a Canadian Army Tank Brigade (7). Details regarding the proposal to provide Canadian

Armoured units and equip them with Canadian built tanks are contained in Historical Section Preliminary Narrative Chapter thirteen.

5. As anticipated, there were many problems to be overcome to obtain satisfactory tank production. Not the least of such difficulties was that of obtaining the necessary manufacturing information and drawings from the U.K. On 10 Oct 40 Mr. Howe, the Minister of Munitions and Supply, wrote Mr. Ralston, the Minister of National Defence. "I have never minimized the difficulties incidental to obtaining tank production in Canada, but the difficulties associated with the Mark III tank exceed my expectations. The chief trouble continues to be lack of manufacturing information and drawings which should come through from the U.K. Whereas the definite order for tanks was given last June, it was not until the middle of August that the C.P.R. received the main supply of drawings. At the present time about 90% of the drawings are on hand, but some very important ones and some other information have still to come from England" (8). The supply of armour plate also caused concern. The Dominion Steel and Foundries Limited which had contracted to produce the required armour for the Valentine was finding it difficult to meet requirements. In October, 1940 it was reported that seven complete sets of the pieces required for fabricating were promised by that Company for early in September and only seven pieces had been received. The difficulty in this connection appeared to be the Company's inability to develop plate that would pass all tests (9). On 10 Dec 40 it was reported that the Company was installing the necessary heat-treating capacity and would produce two sets of armour plate a day (10).

6. It has been originally understood that production of the tanks would commence in February, 1941 and achieve a maximum production of three tanks a day by mid-1941. On 3 May 41 a proposed delivery schedule promised one tank in May, three in June, 15 in July, 30 in August, 47 in September and so on until December when it was hoped to reach a monthly production rate of 78 (11). A pilot tank did come off the assembly line on 22 May 41, accompanied by considerable publicity (12). This still required some component parts and, immediately after the ceremonies, was returned to the production line for completion (13). Bearing in mind that a few of the first tanks were liable to have peculiarities common to initial production, it was proposed to despatch the first eight coming off the assembly line to Camp Borden for training purposes and to undergo user tests to determine any changes that should be made (14).

7. In June, 1941, the C.P.R. advised that the delivery schedule given in May had to be revised - anticipated deliveries were now given as one tank in June instead of three, five in July instead of 15, 10 in August instead of 30 and 14 in September instead of 47! It was made clear to the C.P.R. that this schedule was not at all satisfactory and the Department of Munitions and Supply named a special priority officer to go into the matter as the C.P.R. claimed that a great deal of the delay was due to sub-contractors being behind schedule (15).

8. Slowness in production could not be blamed entirely upon lack of drawings, armour plate, etc. Production methods employed by the C.P.R. Angus Shops were considered to be far from satisfactory. On 30 Jun 41 the Minister of National Defence wrote his colleague, the Minister of Munitions and Supply, regarding the slow progress being made in tank production (16). The following extracts from his letter give proof of his dissatisfaction: -

I do not want to be a nuisance in connection with Infantry Tanks but after listening today to what information I could get regarding them, I feel I must ask you to take some heroic action. From all I can learn the people in charge of tank production at the C.P.R. have no realization of the magnitude of the tank.

Between us and the British they have an order for \$50,000,000. worth of tanks. I am sure it is easily the biggest order they ever got. There is no weapon in this war more needed. Everybody is concentrating on it. And yet they seem to be hobbling along on one cylinder with little appreciation of the responsibility they have assumed and the dynamic organization required.

The Army Tank Brigade has gone over without a single Canadian Tank, although the schedule led us both to believe we would have some. I cannot stress too strongly my view that drastic notion should be taken.

Here is what makes it so important to deal fast with matters like that: I understand that until John Deere and Company get into production of transmissions to fill orders for us, we are depending entirely on the good graces of U.S. Ordnance for a few transmissions from the Mack Truck Company. They say that the U.S. Ordnance people have indicated that when we can show that we are ready for transmissions they will be forthcoming, but obviously, we cannot be ready for transmissions if components such as steel angles are to hold up fabrication. Ythe men in charge of tank production have to be vigilant Y To see that the Infantry Tank situation is dealt with firmly even though it involves putting someone in the C.P.R. shore and taking over the operations Y.

9. An army officer, after visiting the shops for three days in October 1941 was also far from pleased. He reported:-

These people are trying to assemble tanks. I am so disgusted with their production line I thought I would like to inform you and the M.G.O. of a few things I noticed. If we have to depend on the Angus Workshops to win the war, I am afraid it will be another ten years.

They are still using paintbrushes instead of spray guns. They are still installing Bogey wheel springs or shock absorber springs with a hand jack operated by two men instead of an air or hydraulic jack. They are still putting 70% to 80% of the electrical equipment and wiring in the tank with three or four men when it could be done by one man on the bench or in other words by setting up a jig and putting it all in one piece.

I think the Ordnance Corps or the Army ordered about 100,000 washers to be shipped to England and they have five or six men counting them whom I watched at this job for over two hours while I was there. About twenty-two washers should weight one pound.

I asked them for special tools and parts and they suggested snap on wrenches or spanners. I asked for training manuals and to see through their Part Department and they have

no training manuals or instruction books and no parts. One man took over two hours to fit a hinge on the door -- a piece of 600 mm. Plate to close the door over the top of the engine. All he used was a cold chisel and a file.

They are manufacturing practically everything by hand and certainly have not the equipment or machinery at the present time to increase their production. I think a good production man possibly from the United States could increase production to almost double in from thirty to sixty days (17).

10. By the spring of 1942, however, failure in delivery of tanks on schedule appeared to be caused solely by delays in receiving accessories from the United Kingdom. This was pointed out to Lord Beaverbrook by Mr. E.P. Taylor of the British Supply Council in Washington when replying to the former's message regarding lag in production and the necessity of tanks reaching Russia for the spring battles (18).

11. During October, 1941 the United Kingdom arranged to take over the entire output of Valentine tanks being built by the C.P.R. to the end of 1943. In view of the military situation at that time it was the intention to ship all Canadian-built Valentine tanks to Russia. The original British order of 300 tanks was increased to 1,420; this included the Canadian order for 488 which was accordingly cancelled. Canada, however, required a small number of the tanks for training purposes and the United Kingdom agreed to allot 30 of the 1,420 to Canada (19). The remaining 1,390 tanks were shipped to Russia in the course of the next two years (20). The Russians were pleased with the Valentine tank and continued to show a strong preference for this type after it was considered to be obsolete (21).

12. Following a meeting of the British Tank Mission on 26 Mar 42, it was decided that upon completion of the British order for 1,420 tanks, production of this type of tank would be discontinued (22). The final shipments of the Valentine were made in May, 1943 (23) and the C.P.R. Angus Shops discontinued assembling tanks and concentrated upon producing components for tanks being assembled by the Montreal Locomotive Works (24).

#### JOINT COMMITTEE ON TANK DEVELOPMENT

13. With the formation of an armoured brigade in Canada the question of tank production took on a great and even more urgent importance. The Minister of Munitions and Supply agreed with a suggestion of the Minister of National Defence that an Inter-Departmental Committee, composed of representatives from their respective Departments, be formed to effect the necessary co-ordination and to develop recommendations for a production policy (25). A committee (The Joint Committee on Tank Development) was accordingly formed and held its first meeting on 30 Aug 40 (26). In July, 1941 an Inter-Departmental Advisory Committee on Army Design, under the chairmanship of the Director-General of Army Engineering Design, Department of Munitions and Supply, had been authorized. This Committee, which included a representative each from the General Staff, MGO and QMG Branches, was charged with the responsibility of advising the Minister of Munitions and Supply on matters relating to Army engineering design and industrial production (27). With the formation of this Committee, and other developments in the organization of the Army Design Branch within the

Department of Munitions and Supply, it was decided that the Joint Committee on Tank Development was no longer necessary and it was accordingly disbanded in December, 1941 (28).

### RAM (CRUISER) TANK PRODUCTION

14. The possibility of Canada producing cruiser tanks arose during a conversation between Major-General V.V. Pope, Deputy Director Staff Duties (A.F.Vs.), British War Office, and Colonel E.I.N. Burns, General Staff Branch, N.D.H.Q. on 15 Jul 40. During this conversation Colonel Burns learned that it was probable that the establishment of the British Armoured Division would be revised in certain particulars and that one of the proposed changes would result in all tanks being cruisers. Major-General Pope was of the opinion that it would be excellent if Canada could manufacture such tanks (29). On 15 Aug 40 the Minister of National Defence approved the formation of a Canadian Armoured Corps and, in principle, an Armoured Brigade Group (30). Shortly after this, on 27 Aug 40, N.D.H.Q. requested C.M.H.Q. to obtain conformation that it was the War Office policy to equip regiments in Armoured Divisions with cruiser tanks only. If the answer was in the affirmative it was proposed to produce such tanks in Canada if possible (31). On 5 Sep 40 C.M.H.Q. replied that the War Office had confirmed this policy. C.M.H.Q. at the same time suggested that Canada should plan to produce the British Mark VI type of Tank which was being produced in the United Kingdom at the time. Deliveries of the first British Mark VI to units was scheduled for December, 1940 (32).

15. N.D.H.Q., however, considered that Canadian production should be concentrated upon the American N3 Medium Cruiser tank modified to meet British ideas (33). There were a number of reasons for this decision. The British had already made heavy commitments for this tank from American production sources (34), by way of orders placed in the United States by the British Purchasing Commission. The tank at that time was known as the M3 (Anglo-American) Cruiser Tank (35), and was in its pilot stage. This type was also selected due to the availability of heavy components, notably the engine and transmission, in the United States (36).

16. During September a general discussion took place, between representatives of the Canadian Department of Munitions and Supply and the British Purchasing Commission, on the British requirements of M3 Cruiser tanks to build on the North American Continent. These discussions terminated in a decision that all the British tanks would be built in the United States and none in Canada. The British Purchasing Commission in the United States, however, agreed to obtain, at Canada's expense, transmissions, engines, and machine guns (37). The difficulties encountered in obtaining these components will be dealt with under the heading SOURCES OF TANK COMPONENTS.

17. On 26 Sep 40, the MG wrote the Deputy Minister, Munitions and Supply indicating that 1,157 Cruiser tanks would be required at an early date and that a Contract Demand would be issued when the design and exact requirements were known (38). The Munitions and Supply Department apparently interpreted the MGO's letter as a request to take action and accordingly asked for, and on 23 Oct 40 received, Privy Council authority (by PC 5913) for expenditure of funds to provide 1,157 Cruiser tanks (39). This was contrary to the usual practice as Contract Demands were as a rule raised prior to Privy Council authorization. The Contract Demand, which stated that the tanks were required to equip and let Armoured Division and the 1<sup>st</sup> Army Tank Brigade and also to provide a number for Training Centers,



was in fact not raised until January, 1941 (40). The War Committee of the Cabinet did not approve the purchase of the 1,157 cruiser tanks until 29 Jan 41 (41). Although the Privy Council authorization of 23 Oct 40 appeared sufficient for the Munitions and Supply Department to proceed to make production arrangements with a Canadian Company, it was not used to make purchases in the United States. The following extract from a letter (42), to Mr. Carswell from the Deputy Minister of Munitions and Supply, dated 1 Feb 41, with regard to placing orders in the United States, appears to bear this out:-

I pointed out that it was not yet possible to give Mr. Dewar formal authority to proceed. This whole Tank Programme was finally cleared up by the Privy Council a day or so ago, and I gave a letter at once to General Steel Castings, covering the purchase of the 1,157 Tops.

18. At the time when decision was reached to produce the M3 (later to be known as the Ram), the only firm assembling tanks in Canada was the C.P.R. Angus Shops. It was proposed to approach four other Canadian companies with regard to the production of this type of tank (43). Among the firms mentioned was the Montreal Locomotive Works. It was later brought to attention that the parent organization of this Company, the American Locomotive Company in the United States, was at the time working on an order from the American War Department involving the production of the M3 tank. The American company expressed its willingness to assist the Canadian company in every possible way if the latter should receive an order for the production of M3 tanks. Such assistance would be invaluable to a company becoming involved in tank production for the first time and it was accordingly obvious that the plant to do business with at this time was the Montreal Locomotive Works (44). Upon Privy Council authorization for the expenditure of the necessary funds being received in October, 1940, the Munitions and Supply Department authorized the Montreal Locomotive Works to build and equip a plant capable of producing two tanks per day (45). This plant was later known as Tank Arsenal, Montreal Locomotive Works (46).

19. Regarding the exact design of the tank to be produced it was agreed that it would not be practicable for Canada to contemplate changes in the U.S. type of M3 on any production obtained in 1941. Design work would, however, proceed in the meantime with the object of effecting changes at the end of 1941 (47). This decision was emphasized by the Director-General of Munitions, Department of Munitions and Supply, when he wrote to the Montreal Locomotive Works on 13 Dec 40 confirming authorization to proceed with production arrangements. He stated that the first 300 and possibly additional tanks would be identical in design with the vehicle being made by the American Locomotive Company at its Schenectady shops. He further advised the Company that a final decision respecting the design of the turret to be adopted had yet to be made and the Company was not to make final plans for this part of the assembly (48). The instructions regarding the first 300 tanks being identical in design with the American M3 tank were in effect for only a short time. During the first week in January, 1941, Canadian and United Kingdom representatives carried out an inspection of the United States M3 Tank Hull. The vehicle in the opinion of both Canadian and United Kingdom representatives was very disappointing. The main features objected to were: -

- (a) excessive height;
- (b) generally cumbersome and top-heavy appearance;

- (c) lop-sidedness on account of gun in the right hand sponson; and
- (d) the prevalence of vertical surfaces.

It was now apparent that the design of the M3 tank, as approved by the United States Ordnance, would not be satisfactory to the United Kingdom and Canada. As a result it was decided to develop, and produce in Canada, a tank utilizing the mechanical components of the United States designs, but including turret hull and armament features of Canadian design. It was proposed to develop a cast upper hull designed to permit the driver to take a lower position in the vehicle and allow a considerable reduction in over-all height (49).

20. On 26 Jun 41 Prime Minister Churchill cabled President Roosevelt that the possibility of British, American and Canadian tank design proceeding on independent line was giving him concern. He pointed out that the M3 American medium tank was already being produced in three types for orders from Canada, Britain and the United States. Although basically identical, these types, particularly as regards main armament, varied in several respects. The British and Canadians were using the six-pounder gun, with the 75mm and the two-pounder as interim steps, while the United States was retaining the 75mm gun. Mr. Churchill suggested that a Joint Anglo-American Tank Board be set up in the United States, to include Canadian as well as British representation, for the purpose of controlling and co-ordinating new types, design and production (50).

21. As a result of this message, and a directive issued by the President, matters moved apace and on 10 Jul 41 the British Purchasing Commission in Washington reported to the British Ministry of supply the agreements reached. Among these were:-

- (a) General B.C. Lewis of the U.S. Ordnance to be appointed as Co-ordinator of U.S.A. and U.K. Production with power to use combined resources of materials and components to secure maximum increase of production;
- (b) Steps were being taken immediately to increase production up to 1,000 medium tanks per month to be reached by earliest date in 1942, possibly May;
- (c) Full co-operation of D.M.S. Canada being invited in measures designed to increase production and eliminate any conflict in design in the Montreal Locomotive tank contract; and
- (b) Questions affecting design to be discussed and settled within the existing Joint Design Committee which the Canadians were invited to join (51).

Canada signified its desire to co-operate to the fullest extent but insisted that in order to achieve complete co-operation, Canada should have representatives on Committees dealing with all tank matters, both in relation to design and production. Canada also desired the Montreal Locomotive Works to receive equal treatment to U.S. tank manufacturers in respect to the delivery of components such as transmissions, engines, etc. which were manufactured in the U.S.A. and formed components of the Canadian tanks (52). General Lewis assured Mr. Carswell that the Montreal Locomotive Works

would be placed on parity with all American companies from the point of view of allocation of engines and transmissions (53). These agreements had the effect of placing Canadian tank production under the U.S. Ordnance Department (54).

22. A pilot model of the Ram tank came off the assembly line on 30 Jun 41 (55). The U.S. War Department had expressed keen interest in the Canadian-built tank and requested that one be loaned to the U.S. Ordnance for study. Canada agreed to send the pilot model to the Aberdeen Proving Grounds, Maryland, to undergo trials and the tank was shipped to the U.S. on 18 Jul 41 (56). After undergoing tests it was returned to Montreal during October, 1941 (57). A schedule of delivery prepared on 26 Jul 41 promised the following output during the balance of 1941. This schedule was based on the assumption that transmissions and engines would be available as required (58):-

During July	- 2	complete tanks (the one at Aberdeen and one practically complete)
During August	- 3	complete tanks
During September	- 7	complete tanks
During October	- 17	complete tanks
During November	- 22	complete tanks
During December	<u>- 48</u>	complete tanks
Total for 1941	- 99	

23. On 4 Oct 41, C.M.H.Q. advised N.D.H.Q. that the War Office had decided to give names to existing, and all future, types of tanks to obviate confusion between different types and marks of armoured fighting vehicles. The Canadian Corps Commander recommended that the name RAM be adopted in the case of the Modified M3 Cruiser Tank being produced in Canada. The tank armed with the 2-pounder gun, was to be known as the RAM I and the tank armed with the 6-pounder gun, to be known as RAM II. This recommendation was approved by N.D.H.Q. and the policy established that future types of tanks produced in Canada would be named after animals (59).

24. By February, 1942, fifty Ram I tanks had been assembled and were either at, or on route to, destinations. Ten had been retained in Canada and the remaining forty shipped to the United Kingdom (60). This was the total number of Ram I tanks built and production was now concentrated upon the Ram II. The Ram I, as it came off the assembly line and delivered, was apparently not much of a fighting vehicle in the opinion of the Director of Mechanization (Col R.A. MacFarlane). He urged that production be changed to the M4 tank as soon as possible and had this to say of the Ram I tanks:-

A study of the defects of Ram I tanks already produced by Montreal Locomotive Works reveals a number of points to which inspection took exception but which were overlooked in order that a good production showing could be made. A number of the defects were minor, but unreasonable when it is considered that each tank costs between \$50,000. And \$100,000. In short, the Ram I tanks already produced are not, at present, fighting tanks but would require considerable modification before they would be in a fit condition to fight (61).

25. During the early part of 1942, the United States War Department asked the British if they were prepared to accept "Ram" tanks, as manufactured by the Montreal Locomotive Works, as Lease Land tanks. The U.S. Ordnance had in mind the desire to increase the output of tanks from the Montreal Locomotive Works with the assistance of the American Locomotive Company. The British signified their willingness to accept such tanks (62), and the United States accordingly placed an order for 1,351 tanks through War Supplies Limited (a Canadian Crown Company set up in May, 1941 to negotiate munitions orders placed by the United States in Canada). At the time this order was accepted the Department of Munitions and Supply accepted capital assistance from the U.S. Ordnance in order that the programme might proceed (63).

26. At a meeting of the British Tank Commission with Canadian authorities held in Ottawa on 26 Mar 42 it was decided that the Montreal Locomotive Works would go into the production of the U.S. M4A1 type of tank at such time as productive capacity could be established without interruption of production (64).

27. During the early part of 1943, the United States order for 1,351 Ram tanks was cancelled, permitting all Ram tanks being produced to be distributed to meet the requirements of the Canadian Army programme. The cancellation of the United States order brought about a re-arrangement of the Ram tank programme. The revised programme called for the production of a total of 1,899 Ram II tanks at the rate of 150 per month to be completed by 15 Jun 43 when the Montreal Locomotive Works would concentrate upon the production of 1,200 M4 tanks which were to be completed by February, 1944 (65).

28. Deliveries of the Ram tanks were completed on 11 Aug 43 (66). Statistics prepared by the Directorate of Mechanization, N.D.H.Q., show that a total of 1,948 (including 50 Ram I) tanks were delivered; 1,671 of these were shipped to the United Kingdom and 277 retained in Canada (67). These figures do not agree with those given by the Department of Munitions and Supply which show 1,949 tanks being produced. How this discrepancy of one tank came about has not been discovered.

29. The Ram did not go into battle as a tank, although it performed very valuable service in training Canadian armoured divisions. Considerable numbers of the Rams did reach the battle field, however, as armoured personnel carriers, ammunition vehicles and "Badger" flame-throwers. The Ram chassis also formed the basis for the Canadian "Sexton" self-propelled 25-pounder gun (68).

#### GRIZZLY (CRUISER) TANK PRODUCTION

30. During the spring of 1942 a British Tank Mission visited the United States and Canada. The object of this visit was to arrive at the maximum possible standardization of the armoured fighting vehicles being produced in the United States, Canada and the United Kingdom. At the first meeting, which was held in the United States, a sub-committee of the General Staffs of the United States and British Armies was appointed to agree upon requirements. As an indication of the similarity in views, it was reported at a later meeting that the sub-committee had reached agreement at one meeting. The sub-committee recommended, among other things, that the American M4 Cruiser tank be adopted as a

standard vehicle. This vehicle approached very closely the British General Staff requirements and was acceptable to them on the understanding that some changes would be carried out.

31. At a later meeting, held in Canada on 26 Mar 42 and attended by Canadian and American representatives, it was agreed that Canadian productive capacity should be used for the production of the American M4A1 (Sherman) type of tank as soon as it could be established with a minimum of dislocation. The Canadian General Staff agreed with this changeover as the American M4 was no heavier than the Ram and such agreement would be in the interest of standardization (69).

32. N.D.H.Q. proposed to name the Canadian version of the American M4A1 tank "Buffalo" but the GOC-in-C First Canadian Army pointed out that the buffalo was a heraldic animal of a British Armoured Division and that the name should not be used. He recommended the name "Grizzly", a Canadian fighting animal, and his choice was accepted by N.D.H.Q. (70).

33. It was anticipated that the Grizzly tank would be in production at the Montreal Locomotive Works by July, 1943 and that the tank would resemble the United States model in all respects except that a few items of standard stowage would be used where they could be conveniently inserted in lieu of the United States items (71). By the middle of January, 1943 orders had been placed for 80% of the materials which would be required to produce 1200 Grizzly tanks by February, 1944 (72). In view of the decision to adhere to the design of the American M4 few new production problems arose during the assembly period. The drawings and specifications, as provided by the United States Ordnance, were followed closely and very few revisions made. Among the changes were the installing of a two-inch Smoke Mortar and a No. 19 Wireless Set in the Canadian tank. The possibility of coming up against difficult production problems was further lessened by the fact that the M4 tank was already being produced in large numbers by the United States (73).

34. The Grizzly tank programme in Canada was, however, to be short-lived. By June, 1943, tanks were becoming available from United States production in such quantities that it was felt that the requirements of the Canadian Army Overseas could be met from this source without Canadian assistance (74). By September, 1943 a definite agreement had been reached with the War Office whereby all four Canadian Armoured Brigades and two Armoured Reconnaissance Regiments would be equipped with Sherman tanks from United States production (75).

35. This agreement with the War Office to equip the Canadian Army overseas with American Shermans, coupled with the fact that the satisfaction of increasing British demands for 25 pdr SP mounts was wholly dependent upon Canadian production, brought about the decision to discontinue the production of Grizzly tanks as soon as practicable. When this point was reached the Montreal Locomotive Works would concentrate solely upon the production of the 25 pdr SP equipments (76).

36. Production of the Grizzlies commenced during August, 1943 (77), and the first delivery, twenty-three, was made during the week ending 23 Oct 43 (78). By mid-January, 1944, 188 tanks had been delivered and the Grizzly programme was discontinued (79).

#### TANK, COMMAND/OP

37. In August, 1942, C.M.H.Q. requested N.D.H.Q. to obtain Armoured Observation Post Vehicles (80). A request was later received to provide Command tanks (81). As the requirements of the Armoured OP and Command tank closely paralleled one another, it was decided that one vehicle would be capable of performing both functions.

38. It was decided that the tank would be constructed by converting Ram tanks. The vehicle consisted of a standard Ram hull or turret from which the 6-pdr. or 2-pdr. gun and .30 cal. Browning co-ex gun had been removed. The turret basket had been entirely removed creating one large room within the vehicle (82).

39. By December, 1942 a mocked-up tank had been produced and shipped to the Montreal Locomotive Works in order that drawings could be made and production started (83). By mid-September 1943, thirty-one vehicles had been produced and shipped to the United Kingdom (84). Upon the production of the eighty-fourth vehicle late in 1943 the production of this vehicle was discontinued. The majority of the tanks were shipped to the United Kingdom (85).

#### 25-PR. SELF-PROPELLED TRACKED (SEXTON)

40. The design of this vehicle was developed by the Army Engineering Design Branch, Department of Munitions and Supply, to replace the conventional 25-pr field gun and carriage together with its limber and field artillery (86). It was used by SP. Regiments to give close fire support to Armoured Brigades and operated effectively because of cross-country performance, armour and fire power (87). It was officially designed the "Sexton" in May, 1943 (88).

41. A prototype was completed at the Tank Arsenal, Montreal Locomotive Works on 23 Jun 42 and, upon completion of trials at Petawawa, was shipped to the United Kingdom on 5 Nov 42 for further trials (89). These latter trials were completed at Larkhill, England on 9 Jan 43 and the results were highly satisfactory. General McNaughton (GOC-in-C, First Cdn Army) cabled General Stuart (CGS):

"25-pr an outstanding success Y Both these equipments [the 25-pr and 3.7 S.P. mountings] have won high praise from British authoritiesY." (90).

42. The first Canadian contract for the Sextons had been placed in June, 1942 and provided for the production of 24 which were to be built around the Ram chassis (91). The Canadian orders eventually called for 124 of this type of vehicle (92). During the summer of 1943, the United Kingdom submitted an order for 300 and by the spring of 1944 had ordered 2,026 vehicles (93).

43. Although the 124 Sextons produced on the Canadian contract used the Ram chassis, the Sextons built for the United Kingdom orders used the Medium Tank M4A1 (Grizzly) chassis and incorporated a number of British modifications (94).

44. A total of 2,150 Sextons were produced from 1943 to 1945 (95); 124 for the Canadian contract built around the Ram chassis and 2,026 for the British contract built around the Grizzly chassis.

#### TANK, A.A., 20MM., QUAD, SKINK

45. This vehicle was a modified Grizzly (M4A1) Medium Tank, which had a specially designed turret mounting four Polsten 20 mm., Mark I machine guns, instead of the usual turret and main armament. Its purpose was to provide protection for armoured units and assault troops against low flying aircraft and ground targets (96).

46. The original programme called for the production of 135 complete Skinks for the use of the Canadian Army and an additional 130 Skink turrets to meet British requirements (97). Allied air supremacy in NWE, however, eliminated the demand for this type of vehicle (93) and on 23 Aug 44 the Department of Munitions and Supply was advised by the Department of National Defence that the programme should be cancelled and only three vehicles would be required (99).

47. Of the three vehicles produced, one actually saw service in NWE during February and March, 1945. At the request of First Cdn Army this vehicle was provided to carry out operational trials and demonstrations with armoured regiments of the first Cdn Army. The vehicle was demonstrated to all but one of the Cdn armoured regiments serving in the theatre at that time and on several occasions it was engaged in actual fighting (100).

#### SOURCES OF TANK COMPONENTS

48. Persons interested in tank production will invariably attempt to obtain the answer to the question "what percentage of the material and component parts used in the production of tanks in Canada was actually procured in Canada?" For the purpose of this report a large number of files created by the Departments of National Defence and the Munitions and Supply were searched; individuals connected with tank production, by association with the Departments of National Defence and Munitions and Supply and the Inspection Board, United Kingdom and Canada, were also approached. The Bureau of Statistics was asked for statistics regarding the matter but replied that the Bureau had already attempted to obtain an authoritative answer without success and therefore could not assist. The results of this research, although failing to come up with definite percentages, are summarized below and may be of some assistance.

49. Colonel E.C. Mayhew, now Chief Engineer, Canadian Arsenals Limited, who was with the Inspection Board, United Kingdom and Canada during the war, expressed his personal opinion that 40% of the material used in the production of the Valentine tank and 80% of the material in the Ram was obtained from the United States. On 6 Apr 43, Mr. Howe (Minister of Munitions and Supply) was asked, in the House of Commons, to give the percentage of component parts of the Valentine tank actually manufactured in Canada. He replied: "I could not say offhand; perhaps about eighty per cent. If my memory is correct, the only imported component is the engine" (101).

50. The following statement gives the source of major material and component parts in the case of the Valentine Tank during May, 1941 (102).

CANADIAN SOURCES

Rolled Armour Plate	Smoke Mortars
Rivets and Bolts	Telescopic Sights
Assembly Steel Bulkhead	Optional Equipment
Radiators	Radio Equipment
Tankage	Pioneer Equipment
Sprocket Assemblies	Fitments
Tracks	1/3 of the suspensions
Castings	1/4 of the transmissions.
Turret Traverse Gear (first 100 from the U.K.)	It was necessary however, to obtain a large number of the finished parts from the American Company also engaged in supplying transmissions.
Turret Ring Gears	
2-Pounder Guns	

UNITED STATES SOURCES

Power Units (Engines, etc)	3/4 of the transmissions, including controls
Co-axial gun mounts	2/3 of the suspensions
Browning machine guns	Top Hulls.
Brakes	

Out of the 1,420 Valentine tanks assembled at the Angus Shops, 1,320 received cast turrets; 120 of these were cast by the General Steel Casting Corporation, Granite City, Illinois and the remaining 1,200 by the tanks were supplied with cast armour noses which were also cast by the Dominion Steel Foundry Limited (103).

51. It has been possible to obtain an estimated dollars and cents breakdown of the cost of a Ram tank giving cost of materials, etc., obtained in Canada and the United States. The following statement (104) was prepared in January, 1941:-

	<u>Canadian</u>	<u>American</u>	<u>Total</u>
Engines		\$ 7,125	
Transmissions		8,000	
Steel Hull		6,650	
Miscellaneous		3,500	
Armour Plate (other)	\$ 1,200		
Steel Casting	1,600		



Fittings	3,000		
Cannon and Machine Guns	9,500		
Miscellaneous Items	3,500		
Labour and Overhead	<u>37,211</u>		
	<u>\$56,011</u>	<u>\$25,275</u>	<u>\$81,286</u>

Disregarding the figure \$37,211 for Labour and Overhead it will be noted that \$25,275 was to be spent in the United States for material, etc., compared to \$18,800 to be spent in Canada.

52. The following additional information (105), regarding the source of material and parts required in the production of the Ram tanks, was prepared in May, 1941:-

CANADA

Rolled Armour Plate	6 Pounder Guns
Telescopic Sights	Smoke Mortars
Radios	Pioneer Equipment
Steel for assembly	Rivets and Bolts
Propeller Shafts	Sprockets
Tracks	Suspensions
Idler Wheels	Tankage
Controls	Brake Assemblies
Optical Instruments	Shall Armoured Castings

UNITED STATES

Cast Hull Tops
Cast Turrets
Power Units (Engines, etc)
Transmissions
Browning Machine Guns

53. How dependent Canada was upon the United States for major components is revealed in the story of the supply of engines and transmissions. Sometimes it appeared that the whole Canadian tank-production organization would come to a standstill due to lack of these components.

54. One hundred per cent of the engines and almost one hundred per cent of the transmissions for Canadian-built tanks were obtained from the United States. The difficulties encountered in obtaining adequate supplies of these components were numerous and their procurement was the source of one of the greatest problems to be faced by the Canadian authorities charged with the responsibility of tank production in Canada.

55. The case of procurement of engines and transmissions for the Ram tanks is a good example of the difficulties encountered.

56. During September, 1940, when Canada decided to embark upon the M3 Cruiser tank production programme, the British Purchasing Commission agreed to obtain, at Canada's expense, the required transmissions, engines and machine guns. In November, 1940 this procedure was confirmed when it was decided that all equipment for the Canadian M3 tanks, which had to be purchased in the United States, would be purchased from the same sources of supply used by the British Tank and Transport Division (Dewar Mission) of the British Purchasing Commission.

57. On 11 Dec 40 a formal request was made to the British Purchasing Commission to make reservations for the transmissions and engines. This was followed on 14 Feb 41 by a requisition authorizing the B.P.C. to negotiate contracts. On 9 Jun 41 Mr. Carswell, Washington Liaison Officer of the Department of Munitions and Supply, wrote to the Director General British Supply Commission (Sir Clive Baillieu) complained that although over eight months had passed since the B.P.C. had agreed to assist in the procurement of the transmissions and engines, no contracts had been placed. Sir Clive Baillieu replied that immediate action would be taken to place the transmission contract and a number of engines, ordered for the British Account and considered surplus, would be transferred to Canada.

58. By July, 1941 it appeared that the problem connected with transmissions and engines had been overcome. Mr. Howe writing to Mr. Carswell on 21 Jul 41 stated "I understand from our last conversation that the matter of engines and transmissions for the Montreal Locomotive Works is now in a reasonably satisfactory position, and that we will at least have received our share of productionY" This satisfactory situation would appear to have been brought about by the placing the Montreal Locomotive Works on parity with American Companies from the point of view of allocation of engines and transmissions (see para 21 above). By November, however, the supply of these components was again causing Mr. Carswell concern. This is indicated in the following extract from a memorandum he sent to Mr. Howe and Sir Clive Baillieu on 24 Nov 41:-

"This afternoon Major Taylor and myself interviewed General Lewis, Colonel Christmas and Major Crawford on the above subject. We pointed out: (a) That Montreal Locomotive Works had received 16 transmission and 17 engines, all of which had been installed in completed tanks. We pointed out that tanks 18 - 41 were lying on the floor waiting on the engines and transmissions and that the whole programme was threatening to come to a standstillY."(106).

There appeared to be a lack of liaison in this case on Mr. Carswell's complaint was not supported by a report made by Major J.R.K. Taylor, of the Department of Munitions and Supply, at a meeting of Washington Representatives of the Canadian Government held on 18 Dec 41. One portion of the minutes of this meeting stated:-

"Major Taylor reported that he had gone to Montreal and spent two days surveying the situation, during which he discovered 23 tanks sitting on the shop floor. The hold-up on these was not due to engines and transmissions, but to stowage problems"(107).

Allocations of transmissions and engines to the Montreal Locomotive Works now appeared to be satisfactory to all concerned and were being delivered on schedule.

59. In February, 1942 Canadian authorities were advised that the question of "shipped" tanks had been raised by the U.S. Ordnance and that indications were that, if Canada did not manage to make a better report in the future, showing its position as comparable with that of American manufacturers, the U.S. Ordnance would suspend shipments of engines and transmissions (108). Fortunately this difficulty had been anticipated. In November 1941 the Army Procurement Officer stationed in Washington advised the Resident Technical Officer, Department of Munitions and Supply, Montreal Locomotive Works, regarding the situation. He pointed out that all American manufacturers of M3 Cruiser Tanks considered a tank complete when the runner tank only was complete - the armament and fittings were added later. As a result the U.S. Ordnance were under the impression that the Montreal Locomotive Works were very slow and were unwilling to allocate engines and Transmissions because they claimed that the Canadian company was not completing tanks as quickly as the American manufacturers. The Army Procurement Officer suggested that in future the Montreal Locomotive Works follow the same practice as the American manufacturers and report tanks as complete as soon as the runner tank was finished and all the armament and fittings later (109). It was proposed to rope off a portion of the Montreal shop to be in effect, the delivery point so that when tanks had reached that stage at which American manufacturers considered them completed they could be "delivered" and not continue to be shown as incomplete while problems of stowage, etc, were settled (110).

60. As late as October, 1942 difficulty in obtaining transmissions still existed. In that month the United States reduced the allocation of transmissions throughout the North American programme by 40%. This of course retarded the production schedule of the Ram tanks. Whereas it had been hoped to have the first thousand tanks delivered by November, time of delivery was set as the middle of December, 1942 (111).

## CONCLUSION

61. The preceding paragraphs have given a mere sketch of the problems that had to be met in carrying out Canada's tank programme during the Second World War. It has not been possible to go into the details regarding the innumerable production difficulties encountered due to inexperience of personnel, the want of correlation of component deliveries from the United States and Canada and the constant demand for major changes in design as vehicles came off the assembly lines.

62. Although most of the difficulties were eventually overcome, there is every possibility that they will be used as the basis for any argument against Canada entering the tank production business in the event of another emergency. Those favouring such an argument will emphasize the production difficulties encountered during the Second World War programme and undoubtedly claim that Canadian industry would be better suited for concentration upon the production of the lighter types of military vehicles.

63. The following tank production records of Great Britain, the United States and Canada (112) may be of interest.

U.S.A.

July, 1940 - December, 1941	4,258	
January, 1942 - June, 1944	60,954	65,212

Great Britain

September-December, 1939	314	
1940	1,397	
1941	4,844	
1942	8,611	
1943	7,476	
January-June, 1944	2,474	25,116

Canada

June, 1940 - 1945	5,794	5,794
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Note:

Production figures given for Great Britain and Canada include tank chassis produced for mounting self-propelled artillery or anti-aircraft equipments or for use as special purpose tanks. It is not certain whether this applies to U.S.A. figures.

64. This report was prepared by Capt. L.R. Cameron.

(C.P. Stacey) Colonel  
Director Historical Section

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