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DETAILED DESCRIPTION OF MATERIEL

BRITISH CENTURION II TANK

1. General. The British Centurion II is a 54-ton combat vehicle powered by a 640 horsepower at 2,550 r.p.m., V-12, Rolls Royce Meteor Mark IVA, gasoline engine. The engine drives through a mechanical shift transmission containing a differentially controlled epicycle steering system. Braking is accomplished by means of a foot pedal. The vehicle is supported by a horizontally opposed coil spring suspension system. Its maximum speed on hard roads is about 25 miles per hour; the maximum cross-country speed is approximately 18 miles per hour. A tank commander, gunner, loader, and driver comprise the crew. The compartment for the latter is located in the right-hand, front corner of the hull. The remainder of the crew operates within the fighting compartment, the loader being on the left of the main armament.

2. Turret. The turret is a one-piece casting with top plate welded thereto. It weighs around 13.5 tons fully loaded and the inside ring diameter is 74 inches. The size and configuration provide ample working space, especially for the loader. To the top plate is fitted a rotatable vision cupola, 22 inches in diameter, which allows the commander 360° vision. The turret basket is approximately a 90° segment attached to the turret by two supports, and it carries the gunner's seat and various electrical appliances for the gun control system. The loader's platform, the fighting compartment subfloor, is not attached to the turret and does not, as a result, rotate with it. The turret race is of three parts, two rotating and one fixed; the turret rotates on 1¼-inch ball bearings.

3. Main Armament. The main armament is the British Ordnance Q.F. 17-Pounder, Mark 6, Gun, which, together with its coaxial mounting, is a balanced installation. The tube is 55 calibers in length and mounts a lightweight, double baffle muzzle brake. The bore diameter is 3 inches (76.2-mm). The chamber is relatively large, having a rated chamber capacity of 300 cubic inches. Over-all length from muzzle brake to rear face of breech ring is 185 inches, while the complete weight of the gun, including muzzle brake, breech ring, and block is 2,032 pounds. The 17-pounder utilizes a semiautomatic horizontal sliding-type breech block. Recoil is controlled by two hydrospring recoil cylinders. It fires fixed ammunition, percussion detonated, with characteristics as follows:

CHARACTERISTIC	HE/Red*	APCBC**	APDS***
LENGTH			
Projectile	11.7 in.	12.5 in.	7.9 in.
Cartridge case	23.0 in.	23.0 in.	23.0 in.
Complete round	31.7 in.	34.5 in.	29.9 in.

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CHARACTERISTIC	HE/Red*	APCBC**	APDS***
WEIGHT			
Projectile	13.4 lb.	17.0 lb.	7.7 lb.
Propellant	1.6 lb.	8.1 lb.	6.8 lb.
Complete round	26.3 lb.	37.6 lb.	24.8 lb.
PERFORMANCE			
Muzzle velocity	1,800 fs.	2,950 fs.	3,950 fs.
Effective range	7,000 yd.	2,500 yd.	1,000 yd.
Rated penetration @ 30° obliquity at			
1,000 yards		5.1 in.	7.9 in.
2,000 yards		4.4 in.	6.3 in.

* High explosive, reduced charge.
** Armor-piercing cap, ballistic cap.
*** Armor-piercing discarding sabot.

4. Secondary Armament. A 7.92-mm, gas-operated, air-cooled, Besa machine gun is mounted coaxially with and on the left of the 17-pounder. It has an effective range of about 1,600 yards and fires conventional types of machine gun ammunition. In addition, a multibarrel smoke discharger is mounted on each side of the turret, and a 2-inch bomb thrower is located in a rotatable mounting in the turret top, left-hand side.

5. Gun Control Systems.

a. Mechanical and power gun controls are available to the gunner, there being a manual traverse handle, a manual elevation handwheel, a power traverse controller, and a power elevation controller. There is also an emergency controller. An Autolok and slipping clutch are interposed in the traverse gearbox. The former provides a positive lock in both directions of rotation when the turret is driven from other than the traverse handle end, thus eliminating the need for either a turret traverse or handle lock. The latter safeguards against overload conditions. The elevating gear, of the rack and pinion type, incorporates a shift lever which releases the gun from control of the manual elevation drive and, when the power system is operative, provides a choice of stabilized or nonstabilized control.

b. Power control is accomplished by the Metropolitan-Vickers all-electric gun control system in which stabilization in azimuth and elevation, when desired, is effected in relation to the rate at which the turret and gun are disturbed by vehicular movement. This rate-responsive system employs constrained gyroscopes, one in traverse and one in elevation, which are sensitive to small movements. Each supplies signals to a common amplifier so as to cause torque to be applied by the appropriate electric motor, one for traverse and one for elevation, in such a direction as to stop the movement which initiated the signal. The effect is to

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maintain the bearing and elevation of the gun constant in space when the tank is moving. It is still necessary, as a result, for the gunner to lay on the target and to manipulate the controllers to offset errors and to counter any relative displacement between the firing tank and the target. The Metrovick unit also provides nonstabilized power traverse. The same traverse controller is used for nonstabilized and stabilized operations. As a consequence, gun and turret movement can be carried out by the gunner, as follows:

(1) Manual traverse and manual elevation.

(2) Nonstabilized power traverse and manual elevation. Assuming the power system is operative, the gunner can switch from manual to power traverse merely by grasping the traverse controller, compressing the grip switch in the handle, and inclining it right or left as desired.

(3) Stabilized power traverse and elevation. Assuming that the power system is on, this condition can be effected by flicking the stabilizer change-over lever (on the elevating gear casing) to the right and proceeding as in subparagraph b, above. The elevation controller is tilted back and forth to cause the gun to elevate and depress.

(4) Emergency power traverse (nonstabilized) at a fixed rate right or left in event of failure of normal power control.

c. The power system itself is activated by two switches and proper functioning is dependent on a warm-up period. However, a stand-by condition from which the system can be made fully operational at any time by pressing one switch, is available.

d. Trimming controls are provided to correct creep in stabilized elevation and traverse. The tank commander is also supplied with a power traverse controller. It performs the same functions as the gunner's traversing controller and can, in addition, override the latter. A safety switch, available to the commander and loader, prevents power control of the turret in traverse in case of emergency. Additional safeguards, automatic in operation, are present to protect the equipment in event the gun reaches maximum elevation or depression and when the gun is over the rear deck of the tank.

6. Firing Gear. Both the 17-pounder and the coaxial machine gun can be fired either mechanically or electrically. The mechanical gear consists of a foot pedal on the gunner's footrest; a selector lever which provides a choice of main armament, secondary armament, or safe; and a Bowden cable to each weapon. The electrical firing control includes two-finger-operated firing buttons, one on each elevation control; a three-way selector switch which provides the same choices as listed above; a relay box with indicating lights; and a lead to the solenoid on each weapon. A loader's safety switch, which must be activated after the main armament is loaded, and a warning light, which indicates readiness to fire, complete the 17-pounder electrical gear.

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7. Fire Control Equipment.

a. The gunner utilizes a range gear and periscopic sight which, together, permit mechanical adjustment of range and axial aiming in elevation. The periscope protrudes from the turret roof and includes a 6-power telescope for the main armament and a unit-power window with a reticle pattern so constructed that it can be used as a range scale for the coaxial machine gun. The range gear is in two parts, the elevation bracket and the sight gear bracket. The former pivots in the turret roof and is linked to the gun mounting by a rod so that the two move in harmony when the gun is elevated and depressed. The periscope mounting is pivoted on a common axis with this bracket and connects to it through the medium of the sight bracket in such a way that the periscope pivots independently of the gun when putting on or taking off range and in harmony with the gun when laying in elevation.

b. Range is put on or taken off with a range adjuster. Rotating the head of the adjuster, which is part of the sight bracket, moves the sight bracket and periscope mounting and, in addition, rotates a range drum, which is also part of the sight gear. The range drum is inscribed with range scales for various types of 17-pounder ammunition and a degree scale marked in intervals of 5 minutes up to 14 degrees. These scales can be read through a viewer with an engraved hairline. In addition, a range scale reflector, fitted to the bottom left corner of the periscope, enables supplementary APCBC and APDS scales on the side of the range drum to be read without removing the right eye from the 6-power eyepiece. A quadrant, attached to the sight gear bracket, an azimuth indicator positioned in front of the gunner, and illuminating devices of variable intensity are also provided.

c. The commander operates from a vision cupola which can be manually rotated independently of the main turret. The cupola mounts a pair of 10-power periscopic binoculars which can be tilted by hand and which, by positioning the cupola, can be alined with the main armament in azimuth. Spaced elsewhere about the circumference of the cupola are eight fixed episcopes and one tilting and extending episcope. A vane sight is located on the turret roof in front of the commander's position. The loader is furnished with a tilting-type observation periscope in the same rotatable mounting as the 2-inch bomb thrower.

8. Ammunition Stowage. The Centurion II stows 73 rounds of 17-pounder ammunition of which 4 rounds are quickly available in a ready bin on the turret basket.

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TEST NO. 4 - MOVING-VEHICLE FIRING

1. PURPOSE. To determine the rate and accuracy of fire when firing on the move from the Centurion II equipped with the Metrovick stabilizer and to compare results, with data obtained on halting-to-fire runs over the same course.

2. METHOD. Four series of firing runs were carried out on a single course at Salt River No. 3 Range. Series 1 and 2 were fired on the same day, in September 1949 and consisted of a number of continuous stabilized runs with the Centurion II using 17-pounder shell HE and shot APCBC, respectively. Series 3 in October was a moving-and-halting-to-fire exercise with the Medium Tank, M26, and the Centurion, both firing high explosive. Immediately thereafter, series 4, comprising nonstop stabilized runs with the British tank, was conducted. The course, in all cases, was a fairly straight, head-on approach, closing on the target from a 1,500- to 500-yard range. A detailed description of the surface of this course is contained in Appendix E, Charts, E-2.

3. RESULTS. Although it is unlikely that firing results were materially affected, it should be appreciated that the performance of the stabilizer was not at an optimum. On the other hand, the condition of the sight gear, which evidenced considerable backlash, may have had an adverse affect on sighting while moving. It was impossible, however, to carry out an assessment of backlash under dynamic conditions. Test firing, involving use of the coaxial machine gun from a moving vehicle, was not conducted. However, demonstration firing of this nature disclosed that this weapon, because of its cyclic rate and inconsequential obscuration, is more suited to firing on the move than the main armament of a tank. Nevertheless, creditable firepower was achieved with the 17-pounder in the Centurion II on nonstop, stabilized runs. Tabulated results obtained on both continuous and halting-to-fire runs and a discussion thereof follow.

a. Firing Results. In all runs, movement over the head-on course was initiated from a standstill at a point 1,500 yards from the target. Firing ceased when the tank crossed a line 500 yards from the target, giving a run of 1,000 yards. In all cases, a high explosive strike within a radius of 10 yards of the panel-type target was scored as a target effect without regard to fragmentation. On the other hand, a target or hit was adjudged only when the projectile, high explosive or shot, struck the panel.

(1) Series 1. Series 1 and 2 were conducted in September 1949 and the going was dry. Series 1 itself consisted of four nonstop, stabilized runs. The same highly trained crew, except for a relatively inexperienced and untrained gunner on the third run was used throughout. Each of the two gunners acted in his capacity on one of the two day runs allowed prior to the test firing. Each, during the test runs, was

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instructed to fire at will and to attempt to get hits regardless of the firing interval. The tank commander utilizing range markers placed at frequent intervals and the range adjuster, set in initial and subsequent ranges with reasonable exactness. Shell HE, 5 rounds per run, with a muzzle velocity of 1,800 feet per second was used.

Avg. Speed (m.p.h.)	Range Fired (yd)	Times Fired (sec)	Average Intervals Range (yd)	Average Intervals Time (sec)	Remarks
Centurion II			Run 1 - Continuous		Target: 12' x 12' Panel
	1,475	3	25	3	Target effect - short.
	1,150	61	(325)	(58)	Miss - over.
11.3	1,000	79	150	18	Target.
	930	87	70	8	Target.
	830	102	100	15	Target.
Avg.	1,077		86 (134)	11 (20)	
			Run 2 - Continuous		
	1,050	80	(450)	(80)	Target effect - short.
	970	95	80	15	Target.
12.3	925	100	50	5	Target effect - over.
	850	120	75	20	Target.
	780	145	70	25	Target effect - short.
Avg.	915		69 (145)	16 (29)	
			Run 3 - Continuous		
	1,100	82	(400)	(82)	Miss - over.
	970	93	130	11	Target effect - short.
12.8	940	100	30	7	Target effect - short.
	780	123	60	23	Target.
	700	130	80	7	Target.
Avg.	898		75 (140)	12 (26)	
			Run 4 - Continuous		
	1,200	59	(300)	(59)	Target effect - left.
	1,130	75	70	16	Miss - over.
11.0	1,070	95	60	20	Target effect - short.
	970	105	100	10	Target.
	830	127	140	12	Miss - over.
Avg.	1,040		92 (134)	15 (23)	

Note 1: On these four runs the driver attempted to pass the course at an average speed of 12 miles per hour. This necessitated speeds in excess of 15 miles per hour whenever the going was fairly smooth.

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Note 2: The initial and subsequent ranges were known. On run one the range was altered at 100-yard intervals without regard to firing interval or previous sensing. On subsequent runs, this procedure was amended to permit the commander to introduce a new setting immediately after a shot had been fired as well as at regular intervals. It should be appreciated that this firing was conducted at known ranges; hence, there was no reason to effect an adjustment of the range setting on the basis of a previous short or over.

Note 3: Figures in parenthesis are considered abnormal due to various uncontrollable test conditions.

(2) Series 2. This series of three runs, using shot APCBC with a muzzle velocity of 2,950 feet per second, followed immediately after the first series. No additonal dry runs were permitted; however, one check round was fired from a standstill prior to the commencement of the series. The same crew, omitting the inexperienced gunner, was used, and the procedure (including use of known ranges) was identical to that followed in the previous runs. The ammunition allotted to each run, in order, was five, six, and seven rounds.

Avg. Speed (m.p.h.)	Range Fired (yd)	Times Fired (sec)	Average Intervals Range (yd)		Time (sec)		Remarks
Centurion II			Run 5 - Continuous				Target: 12' x 12' Panel
9.4	-	-					
	1,340	37	(160)		(37)		Lost.
	1,200	75	140		38		Miss - short.
	1,130	94	70		19		Miss - short.
	1,000	117	130		23		Target.
	980	130	20		13		Lost.
Avg.	1,130		90	(104)	23	(26)	
Centurion II			Run 6 - Continuous				Target: 12' x 12' Panel
8.2	-	-					
	980	120	(520)		(120)		Target.
	940	145	40		25		Miss - over.
	900	155	40		10		Target.
	860	163	40		8		Miss - left.
	820	172	40		9		Target.
	780	180	40		8		Miss - over.
Avg.	880		40	(120)	12	(30)	

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Avg. Speed (m.p.h.)	Range Fired (yd)	Times Fired (sec)	Average Intervals Range (yd)	Time (sec)	Remarks
Centurion II			Run 7 - Continuous		Target: 12' x 12' Panel
8.0	-	-			
	1,100	105	(400)	(105)	Target.
	1,070	120	30	15	Miss-- left.
	970	131	100	11	Target.
	930	150	40	19	Target.
	-	-			(Remedy breech malfunction on move.)
	730	198			(Target.)
	680	207	50	9	Target.
	570	226	110	19	Target.
Avg.	864		66 (121)	15 (30)	

Note 1: On each of these runs the driver materially reduced speed whenever, in his judgement, it was warranted by the roughness of the going. On the other hand, an effort was made to maintain high speeds on smooth portions of the course.

Note 2: Again ranges were known and were set in as needed or, at least, every 100 yards. Obscuration usually prevented sensings.

Note 3: Figures in parenthesis are considered abnormal due to various uncontrollable test conditions.

(3) Series 3. Series 3 and 4 were run after a lapse of approximately a month on the same head-on course as used in previous testing. However, severe rains had made the going muddy and slippery. The same expert driver and gunner used in the previous series were employed, but the original tank commander and loader were replaced. Their substitutes had not participated in any firing of this nature in recent years and both were unfamiliar with the Centurion II. Moreover, the tank commander was unfamiliar with the course and he was given only the initial range to the target. His subsequent range settings, as a consequence, were based on visual estimations. In series 3 two halting-to-fire runs with a Medium Tank, M26, firing 90-mm shell HE, muzzle velocity of 2,700 feet per second, and one similar run with the Centurion II were made. It was necessary to interpolate for this shell on the standard sight for the M26. Prior to commencement of the test firing, one dry run was made with each tank and several check rounds were fired from a stationary position. Five rounds per test run were prescribed.

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Overall Avg. Speed (m.p.h.)	Avg. Speed Less Halts (m.p.h.)	Range Fired (yd)	Halted (sec.)	Time To Fire (sec.)	Remarks
M26		Run 8 - Halting			Target: 12' x 12' Panel
6.7	9.1	1,380	17	14	Target effect - short 5 yd.
		1,210	18	16	Target effect - short 7 yd.
		1,000	12	11	Miss - short 20 yd.
		770	12	10	Target effect - short 2 yd.
		610	11	9	Target effect - short ½ yd.
	Avg.	994	14	12	
M26		Run 9 - Halting			Target: 6' x 6' Panel
7.7	9.7	1,370	13	11	Miss - over.
		1,210	15	14	Target.
		1,000	13	12	(Miss) - accidental brush burst.
		770	13	11	Target.
		620	10	8	Target effect - short ¼ yd.
	Avg.	994	13	11	
Centurion II		Run 10 - Halting			Target: 12' x 12' Panel
7.8	9.7	1,350	10	8	(Miss) - wrong ammo scale used.
		1,190	13	11	(Miss) - wrong ammo scale used.
		1,000	11	9	Target.
		800	10	8	Target effect - short ¼ yd.
		630	10	8	Target.
	Avg.	994	11	9	

Note 1: On all runs the crew was ordered to press the attack and to fire at feasible points along the course.

Note 2: The commander selected the point to halt, gave the command to halt to the driver and estimated the range. In the M26 the range was given verbally to the gunner who then fired at will. In the Centurion ranges were set in by the commander using the range adjuster, and readiness to fire was indicated to the gunner by tapping his shoulder. After firing, the driver put the tank, either the M26 or Centurion, in motion without command.

(4) Series 4. For comparative purposes, series 3 was followed immediately by series 4 which consisted of two nonstop stabilized runs with the Centurion II. No change was made in the

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crew and they were allowed one stabilized dry run pri[or to] the test firing. Again the commander was given only the initial range. Subsequent changes were based on visual estimates. Eight rounds were allotted for run 11, 6 for run 12.

Avg. Speed (m.p.h.)	Range Fired (yd)	Times Fired (sec)	Average Intervals Range (yd)		Time (sec)		Remarks
Centurion II			Run 11 - Continuous				Target: 12' x 12' Panel
10.5	1,320	37	(180)		(37)		Miss - over 125 yd.
	1,210	58	110		21		Miss - over 100 yd.
	1,050	98	160		40		Miss - over 50 yd.
	970	108	80		10		Target.
	870	125	100		17		Target effect - short 3 yd.
	780	139	90		14		Target.
	750	146	30		7		Target.
	680	157	70		11		Target.
Avg.	954		91	(102)	17	(20)	
Centurion II			Run 12 - Continuous				Target: 6' x 6' Panel
11.5	1,320	34	180		34		Miss - over 60 yd.
	1,000	99	(320)		(65)		Target.
	930	109	70		10		Miss - over 35 yd.
	750	134	180		25		Target effect - left 1 yd.
	670	144	80		10		Target effect - short 2 yd.
	600	156	70		12		Target effect - left 1 yd.
Avg.	878		116	(150)	18	(26)	
Centurion II			Run 13 - Continuous				Target: 6' x 6' Panel

Going away from 500 yards, 1 round was fired at 750 yards with a range setting of 800 yards. A direct hit on a 6' x 6' was achieved.

Note 1: Again the crew was instructed to simulate an attack.

Note 2: The commander estimated ranges and set in changes at approximately 200-yard intervals, correcting when necessary for sensed overs and shorts. It was impossible to record range estimates. Except for the initial estimates in run 11, there is no reason to believe they were more inaccurate than those cited in halting to fire. However, there is a very pronounced likelihood that the firing ranges differed more from the actual range than noted in the halting-to-fire runs. This stems from the 200-yard interval between changes. In the case of Run 11, the first range estimate was appreciably off and it took the commander two additional rounds to get oriented.

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Note 3: Figures in parenthesis are considered abnormal due to various uncontrollable test conditions.

b. Discussion. It should be appreciated that the rate and accuracy of fire on the move are directly affected by the nature of the terrain and the speed and adeptness with which it is negotiated. This relationship, at least under the conditions of the testing, is illustrated in chart No. 2, Appendix E.

(1) Accuracy.

(a) Firing on the Move. Only a relatively few shots, 15 percent, were fired between 1,500 and 1,150 yards when the tank travelled the comparatively rough portion of the course. Of these, only one-quarter were hits or target effects. However, 70 percent of the total shots fired were between 1,150 and 750 yards, of which 72 percent were effective. The remaining shots were fired within 750 yards of the target and all were scored as hits or target effects.

1. Shell HE. In the nonstop runs firing shell HE, an over-all average of 73 percent effectiveness was achieved. Thirty-eight percent of the shots were direct hits on 12- x 12-foot panels and 35 percent were classed as target effects. The average range of engagement, considering seven runs, was about 980 yards.

a. Considering only those stabilized runs wherein known ranges were applied, 80 percent effectiveness was experienced, the number of target effects equalling the number of actual hits. In moving firing, applying known ranges at intervals, it will be exceptional for the range setting to agree with the exact range.

b. On corresponding non-stop runs using estimated ranges, 35 percent hits and 29 percent target effects were obtained, a combined percentage of 64. Allowing for the aforementioned differences in procedure, results firing high explosive were remarkably consistent throughout. In fact, employment of a relatively untrained gunner did not affect the number of hits. This consistency was credited to the characteristics of the shell HE trajectory which was apparently relatively unresponsive to fine manipulation of the gun controllers and, in addition, to the scoring criteria used.

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2. Shot APCBC. With shot APCBC, 55 percent hits were experienced on 12- x 12-foot panels when firing on the move under the conditions of the test. The average range of engagement on these three nonstop runs was 960 yards. In contrast to experiences with high explosive, the number of hits obtained with APCBC increased with practice, culminating in six hits out of seven shots. The relatively lesser effectiveness achieved with APCBC, as compared to HE, stemmed from applying a more restrictive scoring criteria to the former. Firing at known ranges partially offsets the inability to spot the tracer of the shot-type round. However, the flatter trajectory of shot makes range a less critical factor than with HE.

(b) Halting to Fire.

1. In the halting-to-fire runs, range settings were primarily based on visual estimates. The errors recorded averaged slightly over 60 yards, the error exceeding 100 yards in only a few instances. The resultant effectiveness with 90-mm and 17-pounder shell HE amounted to an over-all 83 percent, discounting a brush burst and two faulty range settings. Thirty-three percent hits and 50 percent target effects were scored. The average firing range was 995 yards.

2. In the comparable nonstop runs (series 4) over the same course with the Centurion II, the effectiveness with high explosive, as previously mentioned, was 64 percent. Thirty-five percent hits and 29 percent target effects were scored. The average firing range was 915 yards. It proved impossible to record the estimated range settings, but in an appreciable number of instances material range errors were introduced because of faulty estimates. In each remembered case, a miss of considerable magnitude resulted. Sensings were possible and succeeding shots were adjusted accordingly. This was of distinct benefit in at least one instance in reestablishing the range.

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(2) Rate of Fire.

(a) Firing on the Move. As previously pointed out, relatively few shots were fired between the 1,500- and 1,150-yard markers. It should be noted that in test firing, the gunner, in general, tried to achieve the same fineness of aim throughout the course. This was obviously impracticable over the relatively rough going encountered between the aforementioned markers and, in addition, it distorted the over-all rate of fire.

1. However, under the conditions of the test, firing intervals were, as follows:

   a. Thirty percent of the intervals between moving out and the first shot and between subsequent aimed shots were of 10 seconds duration or less.

   b. Fifty percent were 15 seconds or under.

   c. Sixty-five percent were 20 seconds or less.

   d. Seventy-five percent did not exceed 25 seconds.

2. Over what might be termed fields or pasture land and trails, the interval between aimed shots would appear to be on the order of 15 seconds or less. This rate, in the main, was achieved on the last half of the Salt River course. On the other hand, when considering the entire course, the average interval was about 25 seconds in spite of some rather large intervals.

3. The minimum interval between shots was 5 seconds. This confirms observations that the loading time, providing ready rounds are available, is not a limiting factor when firing on the move with the Centurion II.

(b) Halting to Fire. In the halting-to-fire runs using manual elevation and power traverse, it required between 11 and 12 seconds to fire one shot from the Medium Tank, M26, after coming to a standstill. The corresponding interval with the Centurion II was slightly less, averaging 9 seconds. This saving resulted from the superior fire control equipment in the British tank. Two additional seconds, irrespective of the tank, were habitually required to resume movement, the driver initiating the same on hearing the shot.

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1. Eleven to twelve seconds appeared to be about minimum standstill time to be expected for firing one round from a tank which halts to fire.

2. In the comparable nonstop runs (series 4) on the same day, the stabilized Centurion took offensive on an average of once every 125 yards or every 23 seconds. In 50 percent of the instances, the interval between aimed shots was 15 seconds or under. In only about 30 percent of the instances did the interval exceed 25 seconds. Moreover, whereas five shots were fired in a given distance in the halting-to-fire runs, eight aimed shots, the number allotted, were fired in motion on one nonstop run without undue exertion or haste.

3. It is, incidentally, of no advantage to use stabilized control in the Centurion when halting to fire. In fact, gun-camera testing disclosed that it took longer to fire after halting, stabilized, than to halt and fire, nonstabilized.

(3) Miscellaneous.

(a) Firing on the Move. The average speed on nonstop runs, starting from standstill, varied from a low of 8 miles per hour to a high of about 13. The over-all average was 10.5 miles per hour. There was no discernible connection between the average speed on each run and the number of hits obtained. Under the conditions of the test, no evasive action was taken during a run.

(b) Halting to Fire.

1. When halting to fire five times per run on the same course, the average speed of the tank varied from 9 to 10 miles per hour, the over-all average being 9.5. When including the elapsed time for halts, the over-all average speed was only 7.5 miles per hour. Standstill time, as previously discussed, varied, averaging between 11 and 14 seconds. As a result, the halting-to-fire tank was immobilized for about 1 minute on each run. Moreover, it was never able to get a shot on the way in less than 8 seconds after halting. The mean time on the course was 4 minutes 30 seconds.

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2. In contrast, the Centurion II, in comparative non-stop runs, (series 4) averaged 11 miles per hour and was exposed on the 1,000-yard run for 3 minutes 5 seconds.