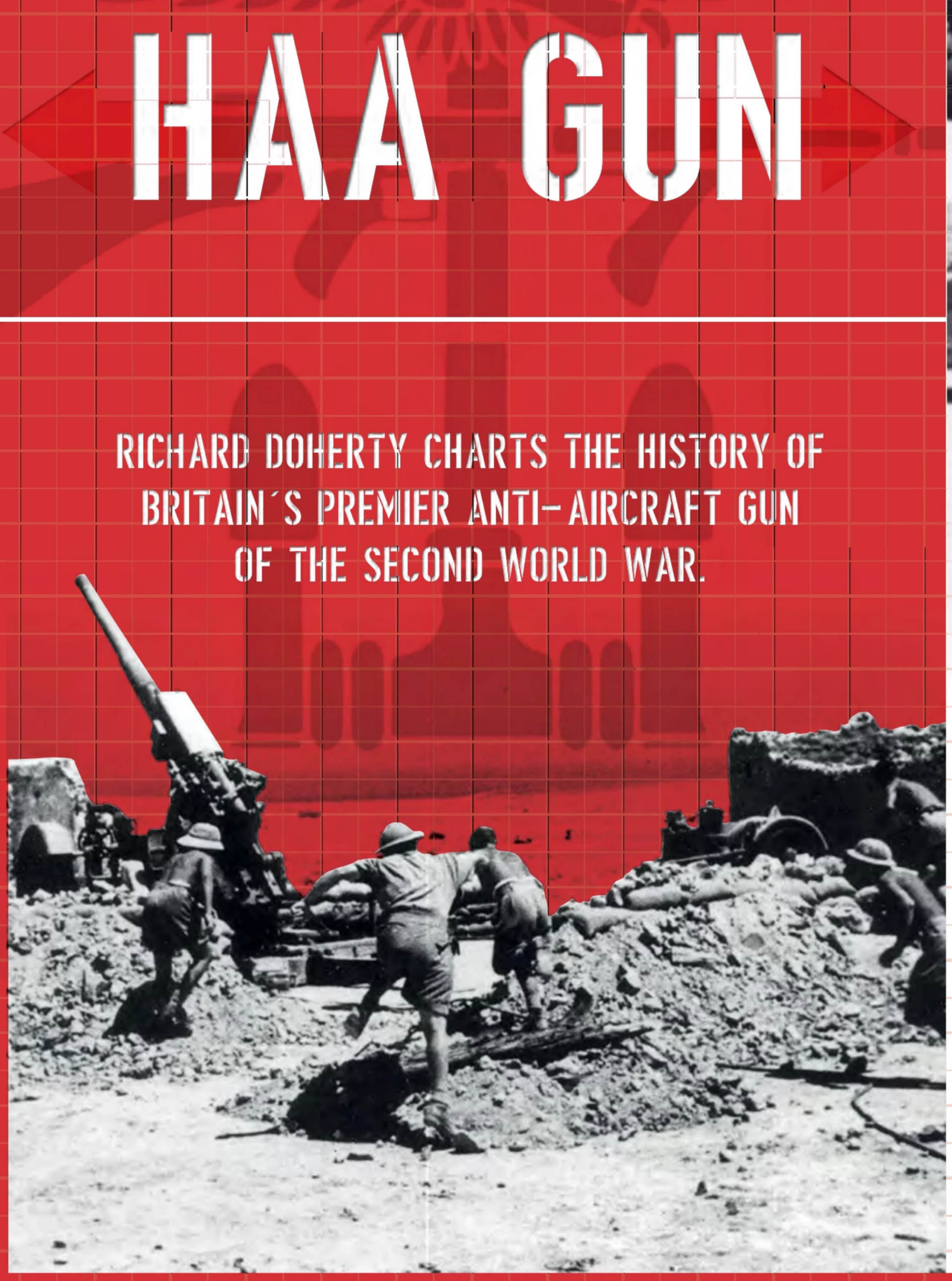
ORDNANCE QF 3.7-INCH HAA GUN

RICHARD DOHERTY CHARTS THE HISTORY OF BRITAIN'S PREMIER ANTI-AIRCRAFT GUN OF THE SECOND WORLD WAR.



Anti-aircraft (AA) artillery developed rapidly during the First World War, with the UK's standard weapon becoming the 3in 20cwt, designed under Royal Navy auspices before the conflict. While a new quick-firing (QF) 3.6in gun was developed, and accepted for service, the end of the fighting meant it was not ordered into production. Only the 3in gun was retained in service.

Wartime experience was not forgotten, however, since aerial attacks on Britain had indicated a clear danger for the future. In 1922 the army re-established AA units in the UK; these were placed under RAF command in 1925 when the Air Defence of Great Britain was created. The War Office also published its *Textbook of Anti-Aircraft Gunnery*, outlining doctrine and including recommendations that would have far-reaching effects. High-explosive-filled

"SO WAS BORN THE 3.7 GUN, THE FINEST WEAPON OF ITS CLASS IN THE SECOND WORLD WAR"

shells were to have better ballistic shaping and be fitted with mechanical fuses. Automation would increase rates of fire, and optical rangefinders were specified to establish intruders' altitudes; gun-position fire control needed to be centralised, and directed by tachymetric instruments allowing quick corrections for local factors. Additionally, searchlights and barrage fire would be assisted by more accurate sound location. Only the final element did not happen, radio direction finding (RDF), or radar, superseding it.

GEARING UP

With the re-forming of AA units, it was planned to develop a 4.7in gun to defend rear areas and vital points (VPs), such as naval bases. Then, in 1928, a new calibre, intended to fill the gap between the medium 4.7in and the 3in weapons, was mooted: a 3.7in gun firing a 25lb (11.4kg) shell to approximately 28,000ft (8,534m). However, because of financial constraints the concept was not pursued until 1933 when a specification was issued for a 3.7in AA gun. Weighing 8 tons, it had to be capable of going into action in 15 minutes. It was also to be mobile, with a speed on tow along paved roads of 25mph (40km/h), firing a 28lb shell to 35,000ft with a muzzle velocity of 3,000ft per second (900m/s). So was born the 3.7 gun, the finest weapon of its class in the Second World War.

Vickers Armstrong submitted the successful design proposal, a prototype was built and, following successful trials, a production order was placed in April 1937. The Royal Artillery received the first examples in January 1938.

However, the design weight was exceeded, muzzle speed was 2,600fps, not 3,000, and lack of a mechanical time fuse meant the design ceiling was not reached. Nonetheless, solid 28lb rounds had been fired up to 41,000ft at a rate of 10 per minute, showing the gun's full potential. In action, good detachments could exceed 10 rounds every 60 seconds, while the introduction of automatic loading increased the rate to 25 per minute.

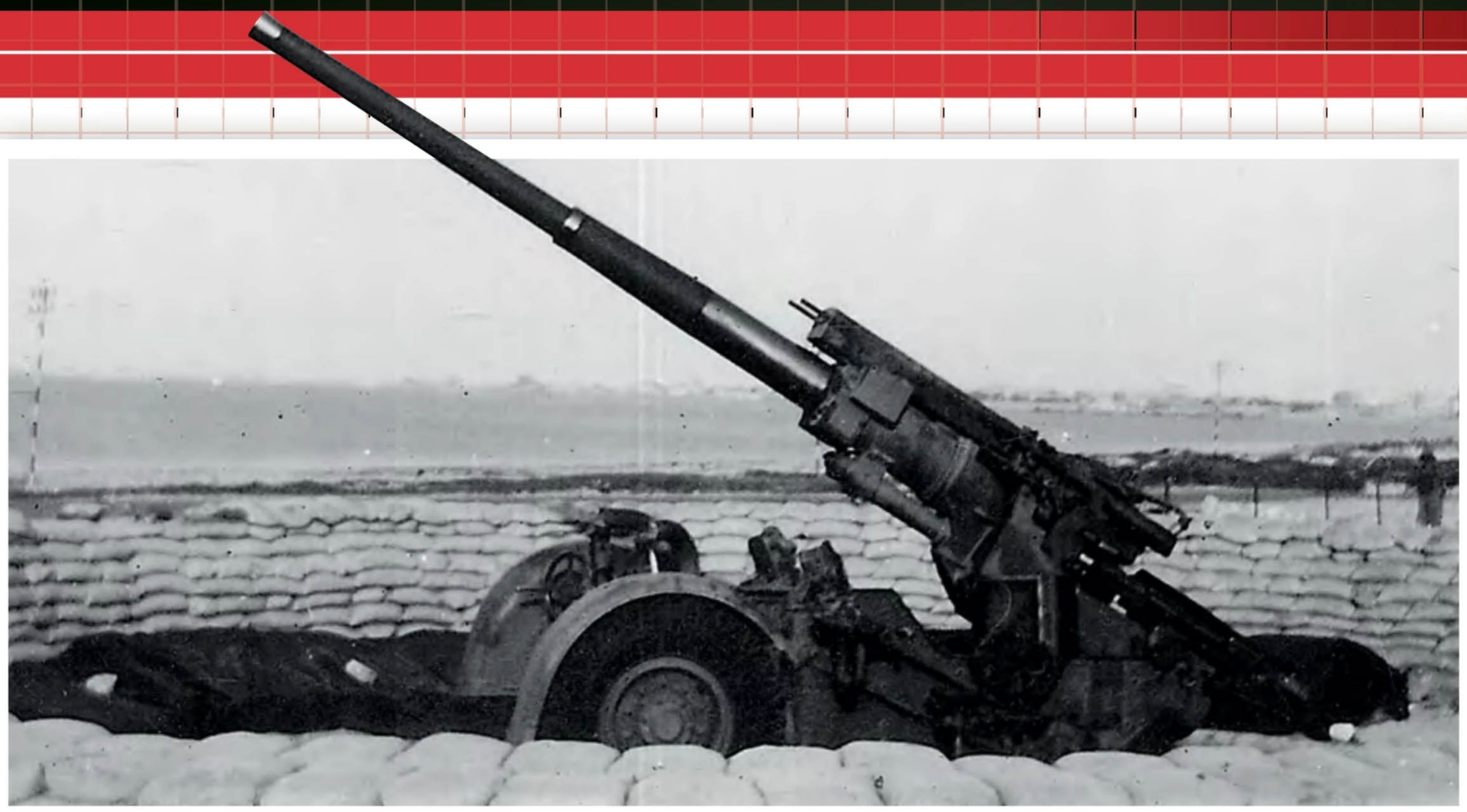
The Vickers gun was an outstanding weapon, well in advance of anything being produced by other nations. Moreover, the designers had 'future-proofed' it so that the introduction ▶

ABOVE

The 3.7in's breech and barrel weighed some two tons, so the strain on these gunners in the Egyptian summer may be imagined. *(IMAGES 9TH HAA REGIMENT ARCHIVE VIA AUTHOR UNLESS OTHERWISE NOTED)*

OVERLEAF

A detachment of either 'F' or 'H' Section, 25th HAA Battery races to its gun at Sidi Barrani, Egypt, in June 1941. The unit was defended RAF landing grounds.



RIGHT
A 25th HAA Battery position defending Agami Camp, Alexandria, Egypt, in early 1940.

of remote power control (RPC), automatic fuse-setting, and mechanical loading created no redesign delays; the gun was designed to accept all these, and other, refinements from the start.

Probably because it was so advanced, the 3.7 was not initially popular with those who manned it. They preferred the lighter, easier-to-handle 3in gun. Over time, however, detachments came to appreciate the 3.7's excellence. Production was increasing with almost 230 per month built during the war.

BELOW
A line drawing of the Vickers 3.7in gun.
(TIM WEBSTER)

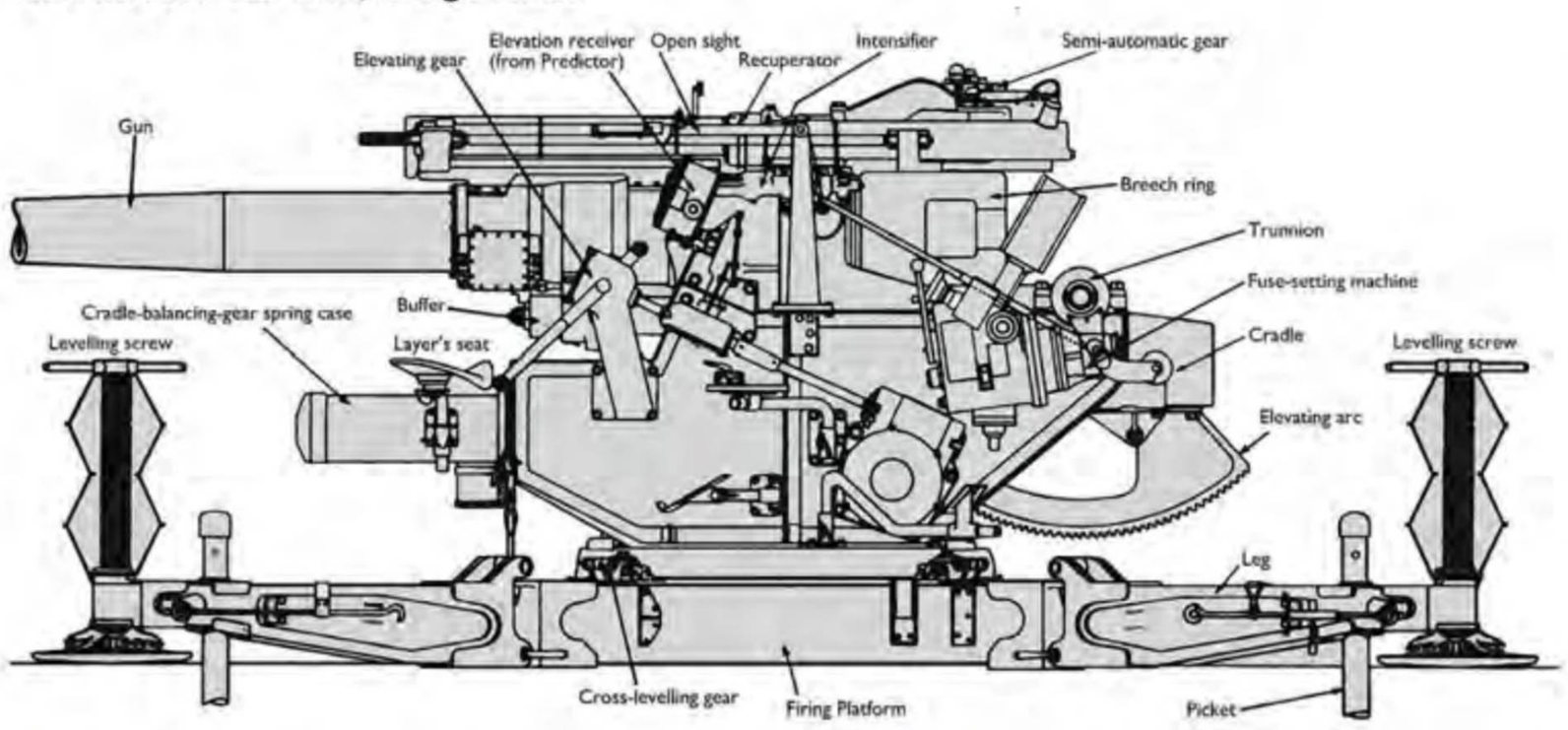
INTO ACTION

Although the British Expeditionary Force's (BEF's) initial equipment was the 3in gun during the opening months of World War Two, 3.7s were soon deployed in France, and in overseas bases, including HMS *Nile*, the naval base in Alexandria, Egypt. But there were only 540 heavy AA guns when war was declared in September 1939, rising to more than 1,100 by the Battle of Britain in 1940.

Eventually, no fewer than 212 heavy AA (HAA) regiments were equipped with the 3.7; each usually including three 8-gun batteries. Two regiments of Royal Marine Artillery used 3.7s, as did a pair of Royal Malta Artillery regiments. Another 35 regiments from India, Australia, Africa and Canada also used it.

VARIANTS

The 3.7 came in two basic variants. For the field army, the mobile version



BRITISH 3.7IN HAA GUN vs GERMAN 8.8CM FLAK GUN

GUN	QF 3.7IN MK.I–MK.III	8.8CM FLAK 36
Crew	7	10
Total weight	20,500lbs (9,300kg)	16,325lbs (7,400kg)
Shell Weight	28lb (13kg)	17lb (7.7kg)
Rate of Fire	10-20rpm	15-20rpm
Muzzle Velocity	2,600ft per sec (792m/s)	2,690ft per sec (840m/s)
Effective Ceiling	32,000ft (9,800m) (Mk.III shell)	32,500ft (9,900m) (88x571R cartridge)

used a four-wheeled carriage (either Mk.I or III), usually towed by an AEC Matador. The carriage had four folding outrigger trails, with levelling jacks, fitted to the gun platform. For action the wheels were removed, or lifted off the ground, the front ones usually being used to assist balance.

In contrast, the other version, although transportable on a special limber, was designed to be fixed to a holdfast. The mounting pedestal was secured to a solid platform – usually concrete – but in 1944 during the V-1 campaign, temporary platforms, of railway sleepers and rails, provided firm foundations. These were dubbed 'Pile platforms' after the GOC-in-C Anti-Aircraft Command, General Sir Frederick ('Tim') Pile GCB DSO MC.

Both versions could traverse 360°, with elevation up to 80°. In all, six marks of ordnance barrel and breech assembly were produced, plus a few marks of carriage for both variants. Recoil and gun-laying systems, fuse-setting and loading machinery formed part of the carriage. Other than loading shells into the feed of the machine fuse-setter, the Mk.IIC static mounting enabled fully automatic engagements, and, with the American SCR584 gun-laying radar and RPC, much hard labour was removed from the AA gunners' role.

MORE THAN AN AA WEAPON

Although trials had proved the 3.7in to be a highly effective anti-tank (AT) gun, it was rarely used as such. *In extremis*, the guns of 68th HAA Regiment in Tobruk engaged German and Italian tanks in June 1942; one position fought an armoured battalion for four hours, destroying four tanks. In clashes along the El Alamein line days later, four 3.7s engaged a German column, demolishing vehicles, 8.8cm guns and tanks, thereafter, continuing to harass enemy infantry and armour.

There has been much speculation in historiography about why the 3.7in was not used more as an anti-tank gun at a time when the need such an arm was pressing, giving rise to erroneous claims that the use of these guns in the AT role was explicitly forbidden. The 3.7in, on paper, was a competitive tank-killer and, as highlighted above, could and did prove decisive in (always permitted) emergency situations.

The 3.7in gun was capable of defeating any Axis tank c.1942, and the DeMarre equation offers an estimate of 103mm penetration with AP shells, compared with an estimate of 95mm with early 8.8cm Flak guns. However, several factors precluded the widespread deployment of 3.7in guns in the AT role.

Intensive use meant frequent barrel changes were necessary; with one gun taken out of action for a barrel change at a time and changes being recommended after every 700 rounds. Stocks of AP shells were also limited, but HE shells set to fuse zero were effective.

The 3.7in lacked effective sights for direct fire and when engaging armour was normally fired over open sights until modifications were made. The gun was much heavier than the 8.8cm and, like the Flak, was mounted on a durable carriage designed for towing and stability when firing at high angles. Unlike some 8.8cm variants, the 3.7in was never paired with a split trail carriage.

Being a corps or army level asset, 3.7in guns were primarily employed to protect key rear areas. Too few 3.7in guns were available to support frontline positions and protect rear areas; redeploying 3.7in guns would weaken vital strategic protection.

When the need for AT guns was at its height, 25Pdr howitzers were redeployed to positions where, if needed, they could engage with direct fire. The upside was a somewhat effective – interim – solution was available. However, while opposing German tankers developed a healthy respect for the 25Pdr, there were increased losses of guns and crews and the reduction of concentrated firepower. By mid-1942 the 6Pdr was beginning to arrive in numbers and subsequently the excellent 17Pdr filled the requirement.

A dedicated AT variant of the 3.7in gun, the QF 32Pdr, was designed and prototyped. Post-war testing showed it could penetrate 200mm of sloped armour and the DeMarre equation estimates 205mm of penetration. Tests against Panther tanks resulted in reliable penetration at 950 yards, with four of five rounds causing damage at 1,350 yards. Development ceased post-war as the 20Pdr offered similar capabilities.

LEFT
ATS girls record the accuracy of anti-aircraft shells at the anti-aircraft training school at Manobier, South Wales, in October 1940.

Pre-war 3.7-equipped units had a sophisticated gun-control system designed for effectively aimed AA fire, the basic form of engagement. To achieve this, predictors were employed. Electro-mechanical computers, produced by Vickers in the UK, and Sperry in the USA, such pre-digital 'computers' could weigh up to 1.5 tons and comprised about 3,500 parts. The predictor team received information from other command post members, including the height and rangefinder team, whose equipment resembled a large horizontal metal tube on a swivel stand, with sights at either end. Through two eyepieces the operator observed the images and, by adjusting the instrument, could bring both images together; target data could be read off a scale and passed to the predictor team. Ideally, three readings were taken, the average being fed into the predictor.

The predictor team applied corrections for wind speed, direction and the guns' locations to produce the data needed to tell the gun detachments where in the sky a target would be at the end of a shell's flight. This all pre-supposed an aircraft was maintaining constant speed, course and height.

Firing data was transmitted to each gun (usually four in a position) via a 'mag-slip' electrical induction system. Three detachment members, the fuse-setter and two gun-layers, received relevant information, data appearing on dials for each. No.4 in the detachment, the fuse-setter, set or 'cut', the fuse manually, while the gun-layers laid 'for line' (No.2), pointing the gun to face the threat or 'for elevation' (No.3).

Both gun-layers faced a dial with two pointers, the first being set by the predictor. The layers swung and elevated the gun until the second pointers 'blacked out' the first. At that point the gun was on target and the No.1, usually a sergeant, gave the order to fire.

TIMING THE DETONATION

Fuse-setting was time-consuming with powder-burning fuses doubly ▶

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RIGHT *Gun crews of 127th HAA Regiment rush to their 3.7in guns at Southwold, Suffolk, to defend London from V-1s, 9 October 1944.* (NARA)

BELOW *Onlookers watch the skies as 3.7in guns in Hyde Park, London, go into action during a large air defense exercise, August 1939.*

inefficient; the speed of burning varied with altitude. Subsequently, the introduction of automatic fuse-cutting made the task more efficient and shells could be fired to greater heights. Instrumental in this was the Molins Machinery Company, cigarette-making machinery manufacturers, who produced the Machine Fuze-Setter No.11 (MFS 11). This not only set the fuse but also operated the loading mechanism. Introduced in 1942, MFS 11 allowed rates of fire of 20 rounds per minute.

Mechanical, or clockwork, fuses were in short supply when war began, the principal source being Switzerland. British industry took some time to produce reliable versions and in the meantime many gunners were killed or maimed by premature explosions.

By the time V-1s started to hit Britain towards the end of the war, the AA defences had reached peak effectiveness and, despite the publicity given to RAF interceptions of ‘Doodlebugs’, the guns shot down more, achieving an 82% success rate. However, their role was not emphasised in case the Germans change the V-1s’ operational altitudes. Most guns involved were 3.7s using SCR 584 gun-laying radar, the No.10 Predictor, RPC and MFS 11, all adding up to the most sophisticated defence system of the war. V-1s were downed by an average of about 150 rounds, compared with the 18,500 rounds per ‘kill’ during the Blitz.

The 3.7 was also employed as field artillery in Italy, North West Europe, Burma and the Pacific, often using airburst rounds. This allowed difficult targets to be engaged. So effective were the guns of 24 and 25 HAA Batteries, supporting 34th US Division in the advance to the Arno river in Italy, that US field artillery units brought the work of those gunners to the attention of Fifth Army HQ. In one instance a machine gun position, which had defied US field artillery bombardment, was knocked out by a single 3.7 airburst.

The 3.7 served Britain well throughout the war. Its final variant, the Mk.VI, could project its shell to almost 60,000ft, although the effective ceiling was 45,000ft; muzzle velocity was 3,425fps. This static weapon was basically a 4.5in gun fitted with a 3.7in liner and a new rifling system. Firing 19 rounds per minute, it remained in service until 1959 when the Thunderbird guided missile succeeded it. A post-war 60-round-per-minute automatic development, Longhand – also made redundant by missile technology – never entered service.

NEXT MONTH

It’s the Westland Wessex helicopter’s turn in the spotlight next month as we examine its development and extensive use with the British and Commonwealth forces.

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