Post subject: RAF Fixed and Free-mounted Reflector Gunsights
Hi

The Reflector Sight

In 1900, the noted scientist and optical instrument designer, Sir Howard Grubb (1844-1931), filed Patent No.12108 for 'Improvements for sighting devices for guns'. In the following year the Royal Dublin Society published a paper by Sir Howard entitled 'A New Collimating Telescopic Gunsight for Large or Small Ordnance'.

The basic principle of the reflector sight is as follows:

In the base of an upright tubular housing there is a light source. This is directed through an opaque glass plate on which is etched an aiming mark, or graticule. The image of the graticule is projected through the focal plane of a collimated lens, and reflected onto a glass screen mounted 45 degrees to the gunner's eye. This presents an aiming mark, usually a ring with a central dot on the reflector screen, giving the gunner a clear view of the target with the graticule pattern superimposed on it.

Sir Howard's first design used natural light reflected by mirrors, but after trials these were replaced by an electric bulb (such illumination was mentioned in the original patent). He approached various arms producers, including Vickers, but although they were impressed with the performance of the sight, no orders came. Ironically, this first sight was invented before the Wright brothers left the ground.

In 1915, Vickers decided to develop a reflector sight with Sir Howard as consultant. Although a patent was applied for stating that the sight would be useful against aircraft, no mention was made of possible aircraft use.

The Oigee sight

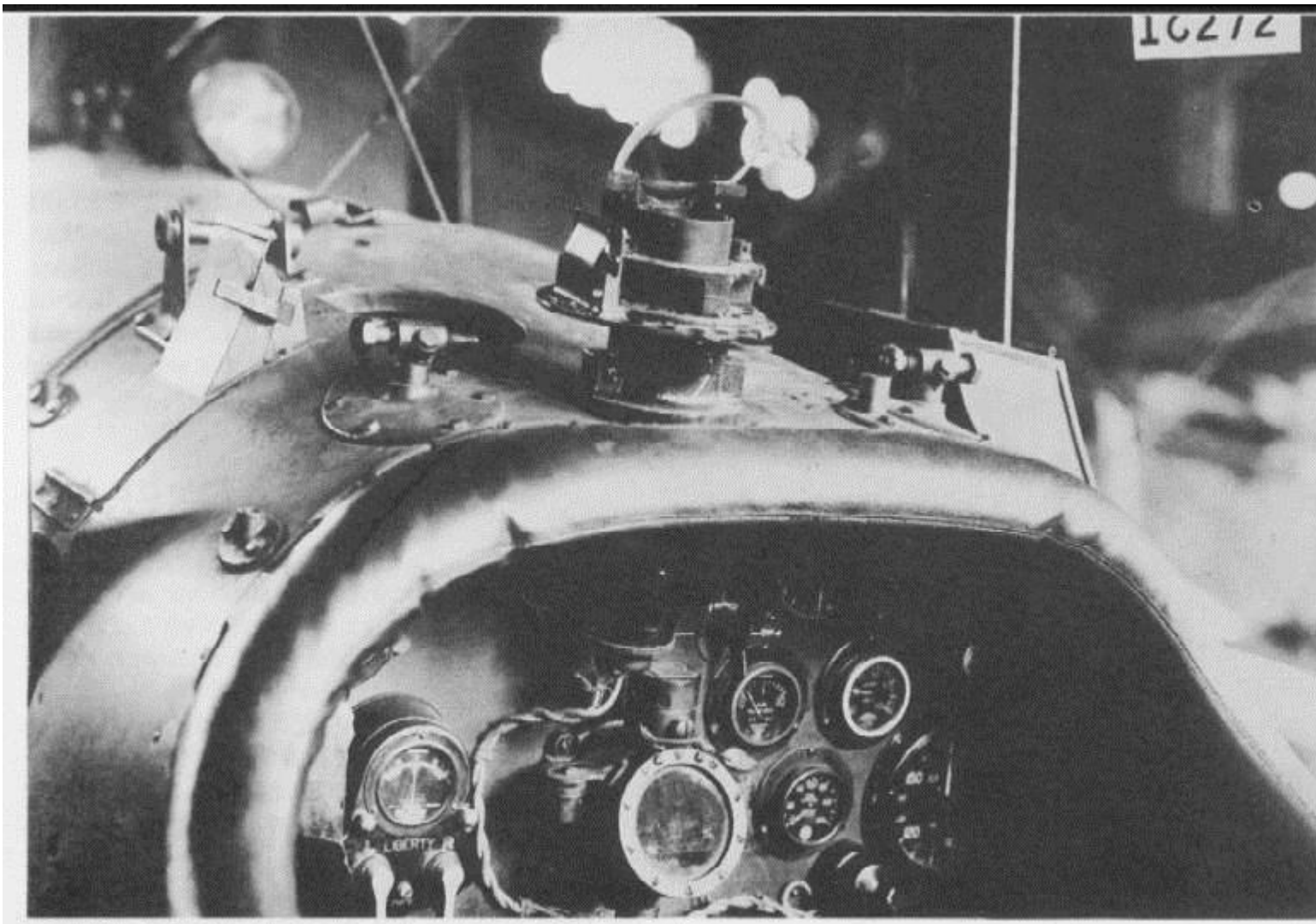
The first record of a reflector sight, being used on aircraft was in Germany, where in 1918 the optical firm of Optische Antal Oigee of Berlin, working from the Grubb patents, produced two reflector sights for aircraft. One of these was fitted with a sun screen, and could be used by day and night. A smaller version was meant for night use only. A small electric bulb was used as a light source, the reflector being an elliptical glass screen. The sight could be harmonised with the gun by means of a screw and clamp.

Several of the larger version were issued to Jasta 12 in 1918, when they were fitted to Fokker Dr.1 aircraft for operational trials. Others were tested on Albatros D.Va aircraft. In 1920 the US Military Attache in Germany was given a demonstration of the sight. He was so impressed that he sent an example to the US Army Engineering Division at McCook Field, but no official interest was shown.

The above text and photo was taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

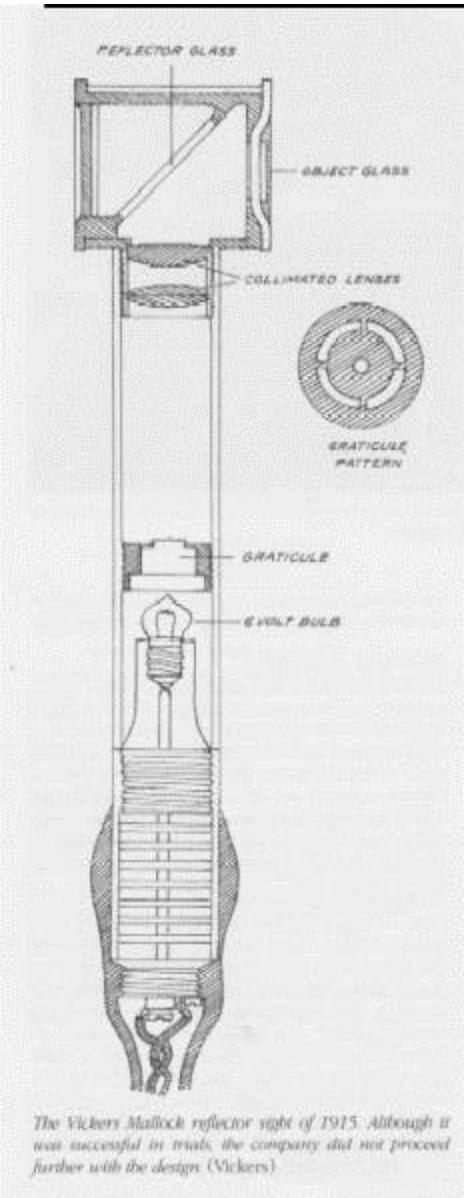
Regards

Bob



The German Oigee reflector sight of 1918 saw limited use on some Albatros and Fokker DR.1s. It is seen here mounte on a US DH.9 during trials at McCook Field in 1923. (Ross Whistler)

The Oigee sight.jpg



The Vickers Mallock sight.jpg

Last edited by Robert Hurst on 12 Mar 2003 14:57; edited 2 times in total

Post subject:
Hi

Barr & Stroud

After Grubb's work and the designs of other manufacturers had been studied, an experimental pilot's sight was produced. It consisted of a horizontal lens tube mounted under a rectangular Triplex reflector. Light from a bulb was directed through a circular pattern stamped out of a metal disc, and a collimated lens train to a prism, which turned the image 90 degrees up onto the reflector, which was fixed at 45 degrees to the pilot's eye line. A twin-filament bulb was used to vary the brightness.

The prototype sight, known as the Barr & Stroud GD1, was despatched to Martlesham Heath where it was tested on an Avro 504. The trials pilot reported that the graticule was not clear enough against white cloud, even with the smoked-glass sun screen in position, and the optics misted up after flying through cloud. The sight was completely redesigned in a new configuration, with the lamp at the base of an upright tube, the graticule being projected straight through the lenses onto the reflector screen, and heat from the lamp prevented misting. The lamp strength was increased, and a modifed dimming screen was raised in position by a knurled knob. This design, the GD2B, received favourable comments from the trials unit in 1927. Work then started on a sight for free-mounted guns.

The ENI sight

In 1931 the German Oigee company produced another reflector sight, the ENI (Electrische Nivellier Instrument, or Electrical Levelling Instrument). Germany was forbidden to produce armaments at this time, so the company used this acronym to promote sales. Again, Lt. Col. Jacob West, the US Air Attache, sent an example to McCook Field, where it was tested by the 17th Pursuit Group on Boeing P-12F aircraft. As a result, the Armament Laboratory at Wright Field designed an American version, an L-shaped housing in which a central cross graticule was surrounded by eight small arrows to assist sighting. This was the forerunner of the American 'N' series used by the US forces for the next 20 years.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

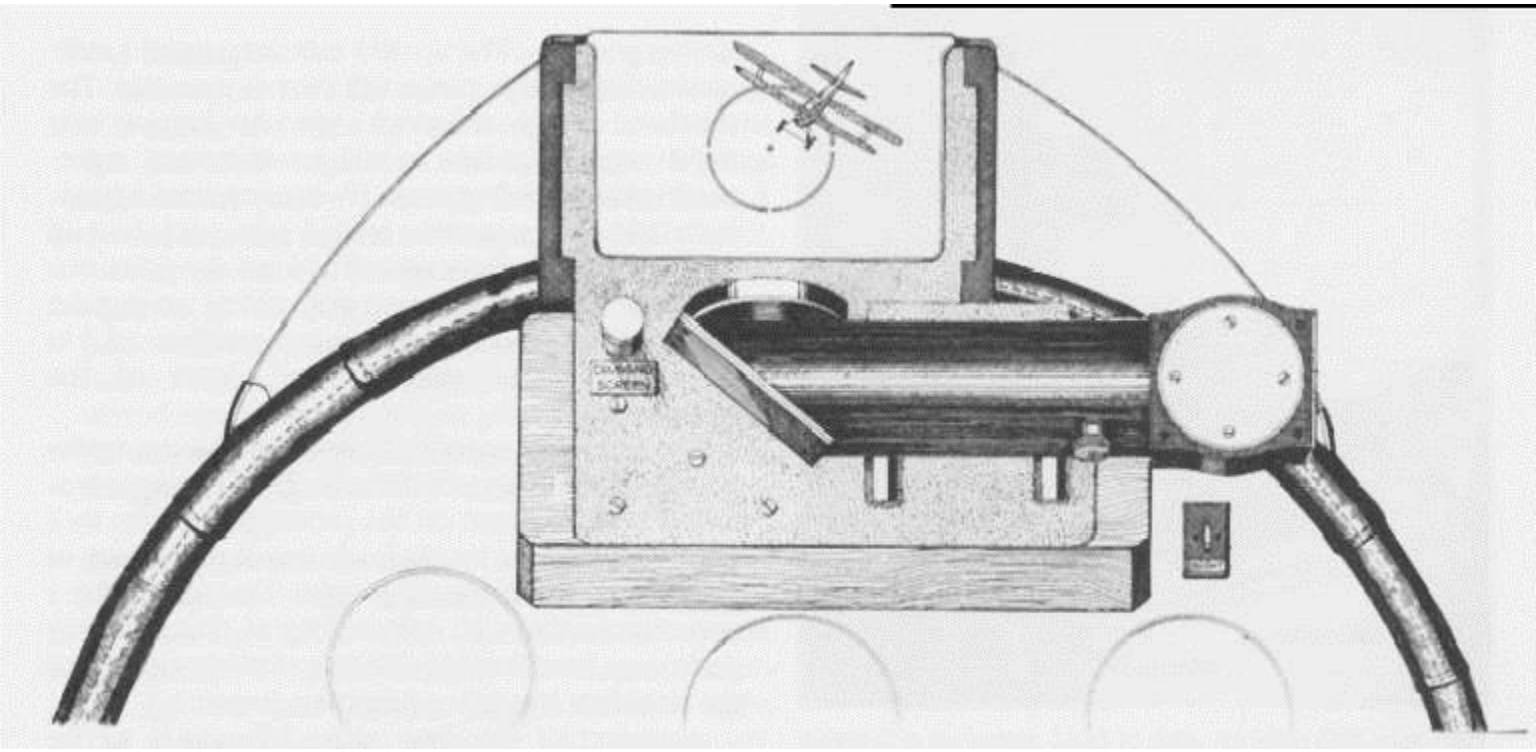
Regards

Bob

The Oigee ENI reflector sight of 1931, tested on a Douglas O-25A at Wright Field (Ross Whistler)

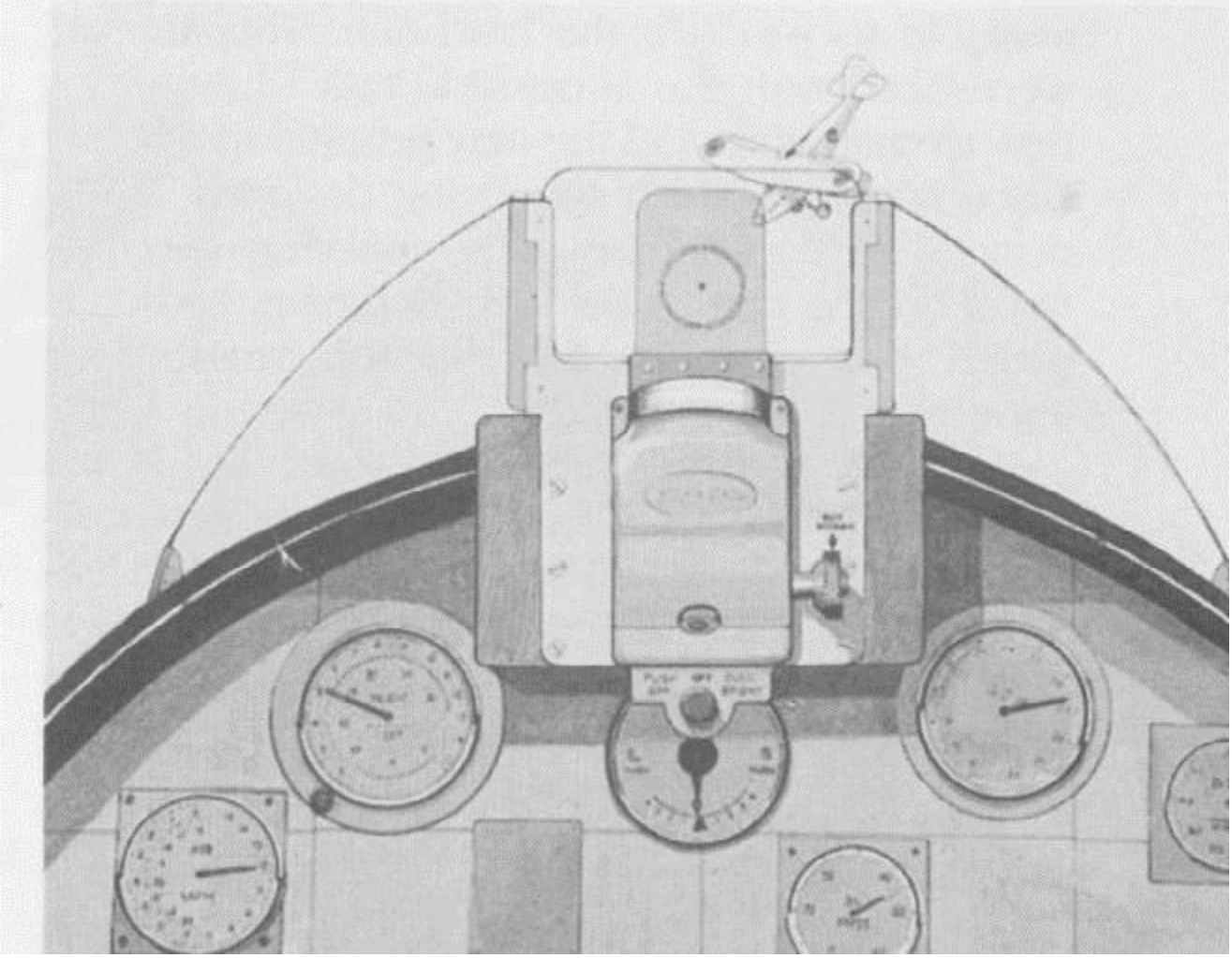
Oigee ENI.jpg

Barr & Stroud type GD1 reflector sight of 1925



GD1.jpg

The GD2B reflector sight of 1927. The optical system was upright, heat from the bulb tending to prevent misting



GD2B.jpg

Post subject:
Hi

The GD5

In 1934 a new Barr & Stroud sight was announced. The GD5 was a complete departure from previous designs. The sight consisted of a lens tube mounted in the centre of a 114 mm (4.5 in) bowl containing a parabolic mirror. The principle of the sight was to separate range-finding and the aiming graticule. The upright tube contained a collimating lens which projected a cross graticule. The parabolic mirror reflected a circular ranging ring which was adjustable to various diameters representing various wingspans. The system used a single bulb light source, and the images were projected up onto the pilot's windscreen. The ideal eye point was given as 419 mm (16.5 in) from the sight, giving an angular field of 7 degrees 40 and allowing eye movement of 25.4 mm (1 in) either side of the centre of the windscreen.

The GD5 was specifically designed for use in the new Hawker fighter, the Demon. The prototype was tested at Martlesham on the prototype demon by a pilot who made a rough landing and was struck in the face by the protruding sight. This was to be a common hazard with reflector sights. Thick rubber pads were later fitted to the rear of the housing, but the problem was never fully overcome.

Accuracy of the new sight left much to be desired, and it needed continual realignment. The main problem, was double imaging of the graticules, caused by the Triplex glass of the windscreen. It proved difficult to produce surfaces sufficiently parallel to avoid this fault. As the sight had been designed from the outset to use the windscreen as the reflector, it would have needed a complete redesign to adapt it to an integral reflector. Meanwhile, squadron Demons were fitted with the usual Aldis and ring sights.

Later in the year the company was asked to provide a reflector sight for the PV3, which was to be the last of the famous line of Hawker biplane fighters designed by Sydney Camm. The Barr & Stroud drawing for the new sight, the GD12, specified its use in the Hawker Hawk. It was virtually identical to the GD5. It would appear that the company, realising that a firm order would be unlikely, had submitted a design as requested, but also mentioned that a completely new pilot's sight was being developed which would be more robust and less complicated than the GD5 series.

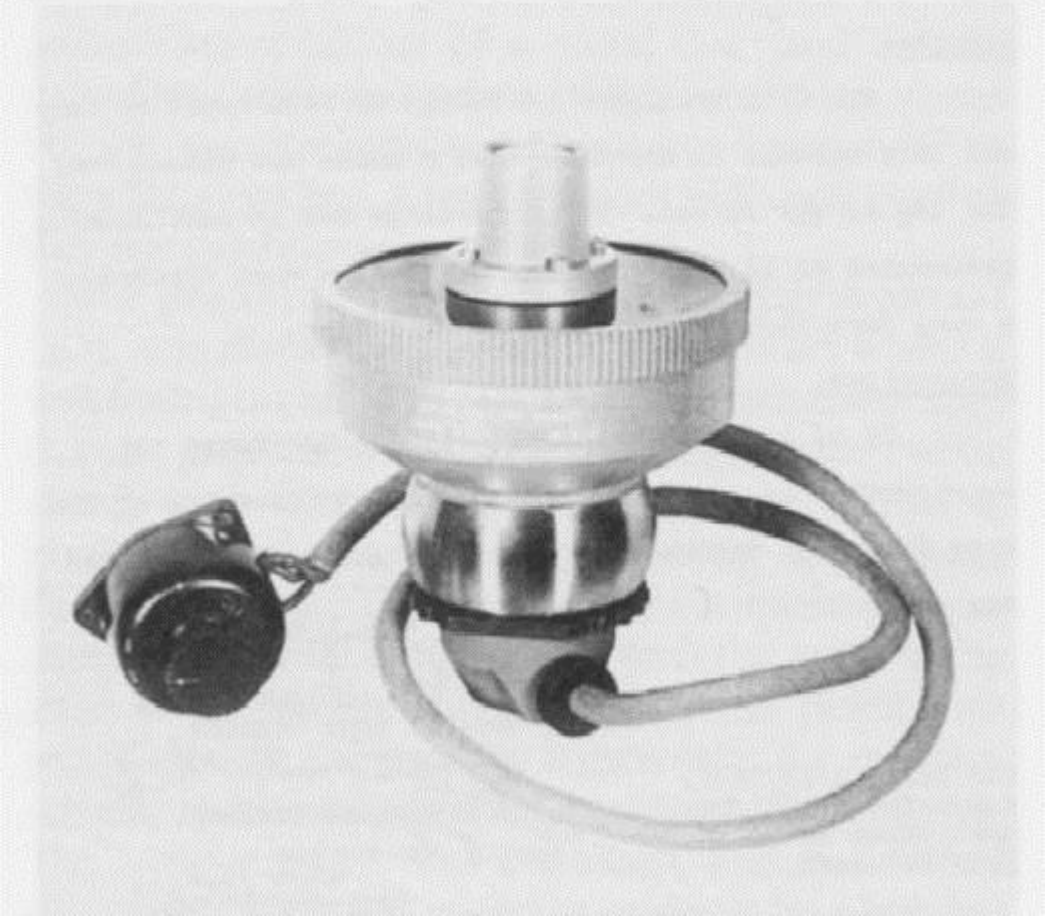
The caption for the bottom sketch is: A Barr & Stroud drawing of the GD5 in position behind the windscreen.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

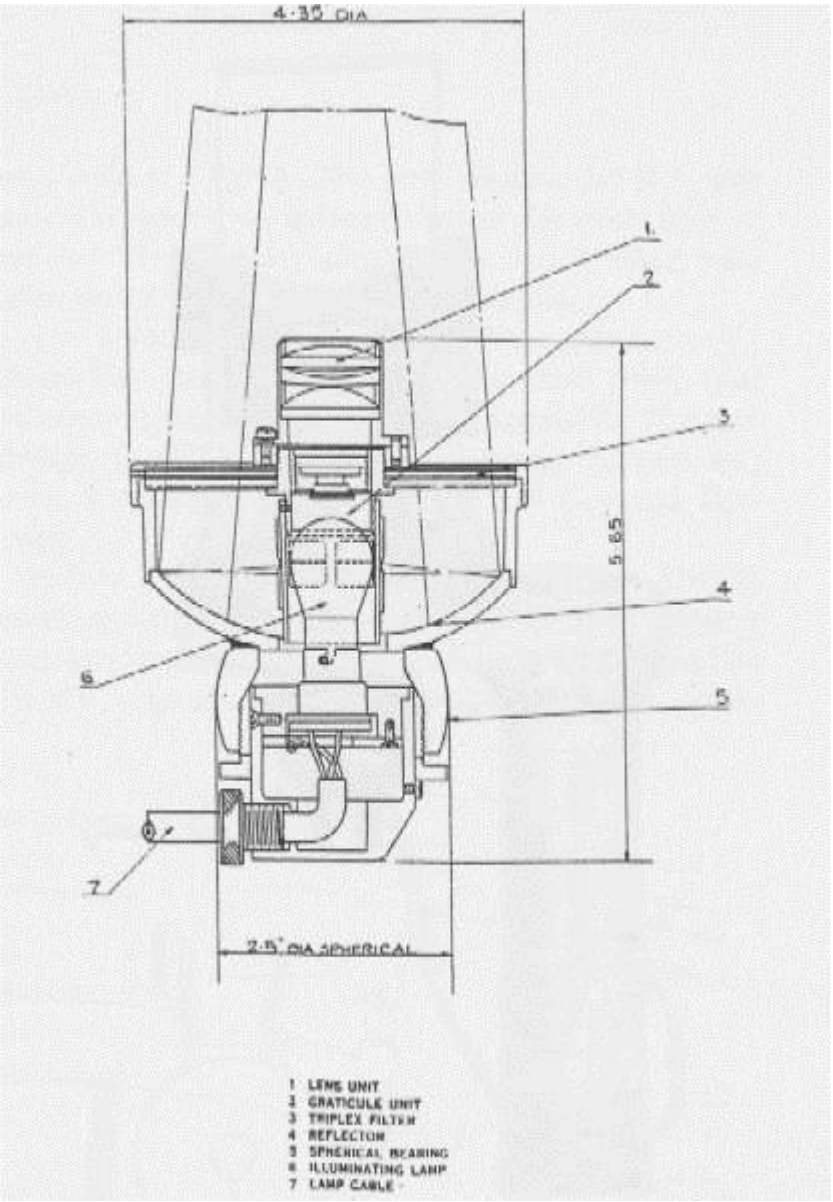
Bob

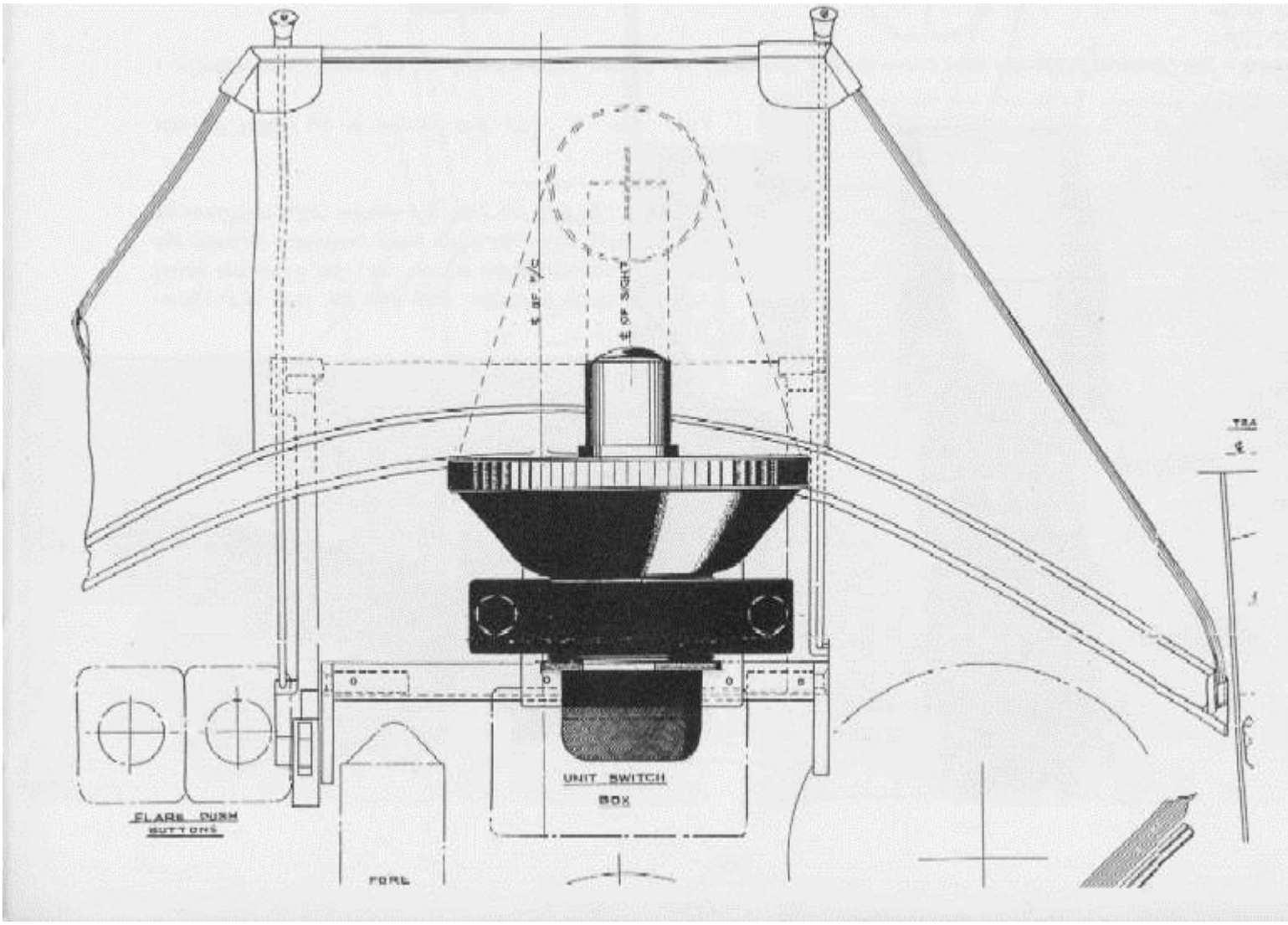
The Barr & Stroud GD5 of 1935. The centre tube projected a cross, a ranging ring being projected from a parabolic mirror onto the windscreen, operated by the knurled ring at the base of the housing. (Barr & Stroud)



GD 5 sight.jpg

Section through the GD5.


4·35 DIA
1
2
3
5·65
4
6
5
7
2·5 DIA SPHERICAL
1 LENS UNIT
2 GRATICULE UNIT
3 TRIPLEX FILTER
4 REFLECTOR
5 SPHERICAL BEARING
6 ILLUMINATING LAMP
7 LAMP CABLE
Sketch 1.jpg



Sketch 2.jpg

Last edited by Robert Hurst on 17 Mar 2003 11:44; edited 1 time in total

Post subject:
Hi

Free Gun Reflector Sights

The first sight designed by Barr & Stroud for free-mounted guns was the Type J1 of 1926. This was fixed on a bracket clamped half-way up the barrel of a Lewis gun. A circular reflector screen was mounted over a cone-shaped lens housing, with a sun screen which could be raised into position at the rear. Although the sight was well elevated above the barrel, the need to clear the ammunition drum put the gunner's eye position too distant for easy sighting. Its position hard on the barrel also ensured short bulb life. However, the new sight was found to be accurate when it was tested at Farnborough, where several improvements were suggested before it could be considered for Service use.

After the J1 was evaluated at Farnborough it was decided to change the format. The new design consisted of a rectangular lamp housing which was offset from the gun centre line. A bulb projected a ring graticule from the side of the housing onto a prism, which directed the image through a lens system onto a small circular reflector screen behind which was a swing-in smoked-glass sun screen. To be known as the GH6, the sight was fixed on the side of the gun clear of the drum, with the sight head protruding from the side to a position in line with the gunner's eye. The GH6 was found to be effective and was accepted for small-scale trials while an automatic 'own speed' and deflection system was devised on the lines of the Scarff compensating mount. This consisted of a pillar on which were speed settings, the sight being fixed to an arm fitted at right angles from the top of the pillar which varied the line of sight according to the setting. This required deft manipulation of the adjusting knobs, not easily accomplished with heavily gloved hands. The compensating mounting received the title Type GH2 No.14, but was never issued for Service use.

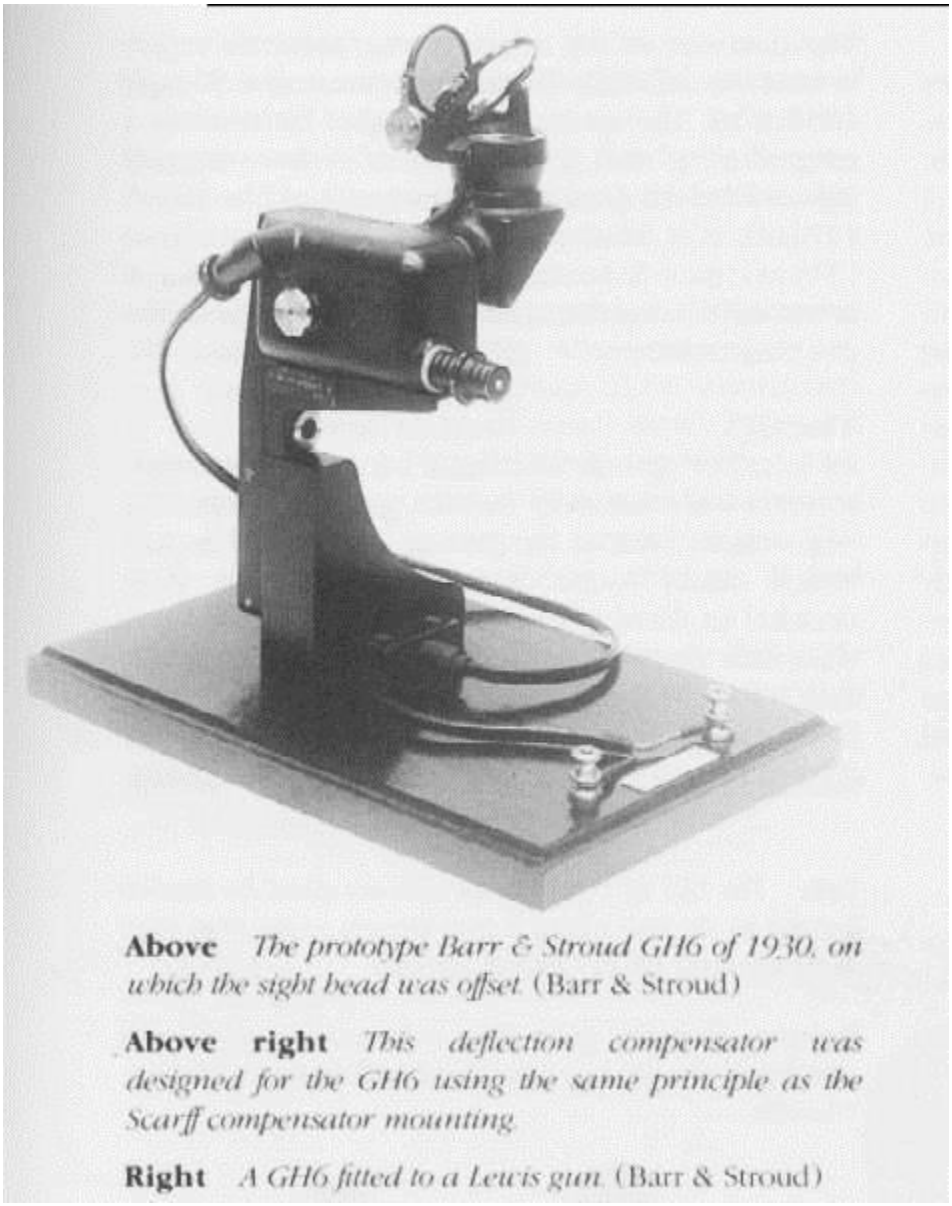
The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob

The Barr & Stroud type J1 of 1926. This was the first free gun sight produced by the company. The ring mounting was also a company product. (Barr & Stroud)

Barr & Stroud J1.jpg

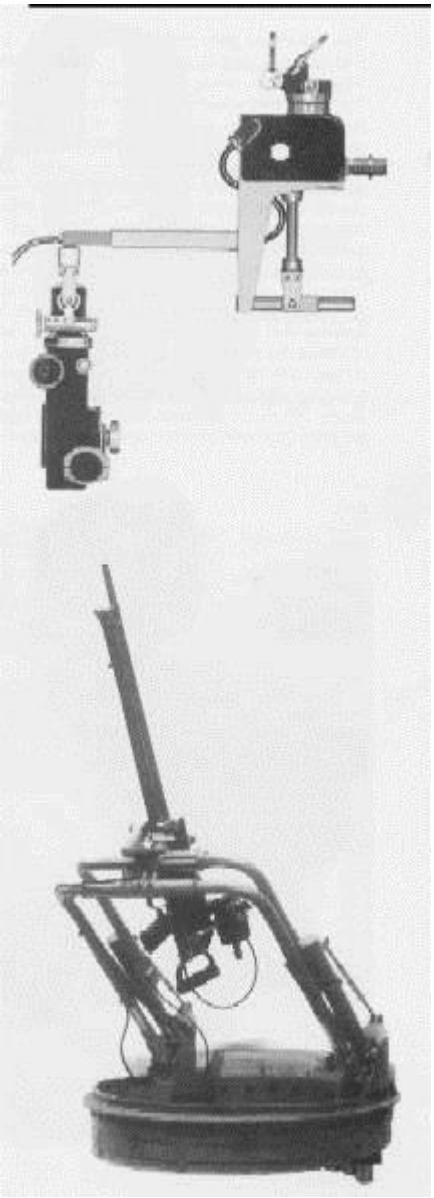


Above *The prototype Barr & Stroud GH6 of 1930, on which the sight bead was offset.* (Barr & Stroud)

Above right *This deflection compensator was designed for the GH6 using the same principle as the Scarff compensator mounting.*

Right *A GH6 fitted to a Lewis gun.* (Barr & Stroud)

Barr & Stroud GH6.jpg



GH6a.jpg

Post subject:
Hi

The Mk 1 Free Gun Reflector Sight

The GH6 was used by gunners of a flight of Handley Page Heyfords taking part in the 1934 exercises. During a night attack on a 'blue-land' city, searchlights picked out the 'raiders' and the gunners reported that the beams had caused dazzle on the reflector screens (there were also reports of sunlight having the same effect). After various experiments, it was found that a small hood over the reflector prevented most of the dazzle and also protected the screen from damage. This feature was incorporated in a new sight, the Mk 1 free gun sight, which had similar optics to those of the GH6 but was much more compact and practical. The lamp housing and rheostat was a separate unit, quickly detached for bulb changing. Like the GH6, a prism projected the graticule onto a hooded screen, offset from the sight body above the centre line of the gun barrel. The double-filament lamp could be dimmed from full brightness to extra low to suit conditions. The diameter of the bright orange graticule represented the deflection for a target crossing 80 km/h (50 mph). The graticule, the could also be used as a range-finding aid: if the span of a twin-engined fighter filled the graticule, the range would be 274 m (300 yds); if it filled the radius it would be 549 m (600 yds). Barr & Stroud then decided to develop a turret system using the same features, but without the prismatic sight.

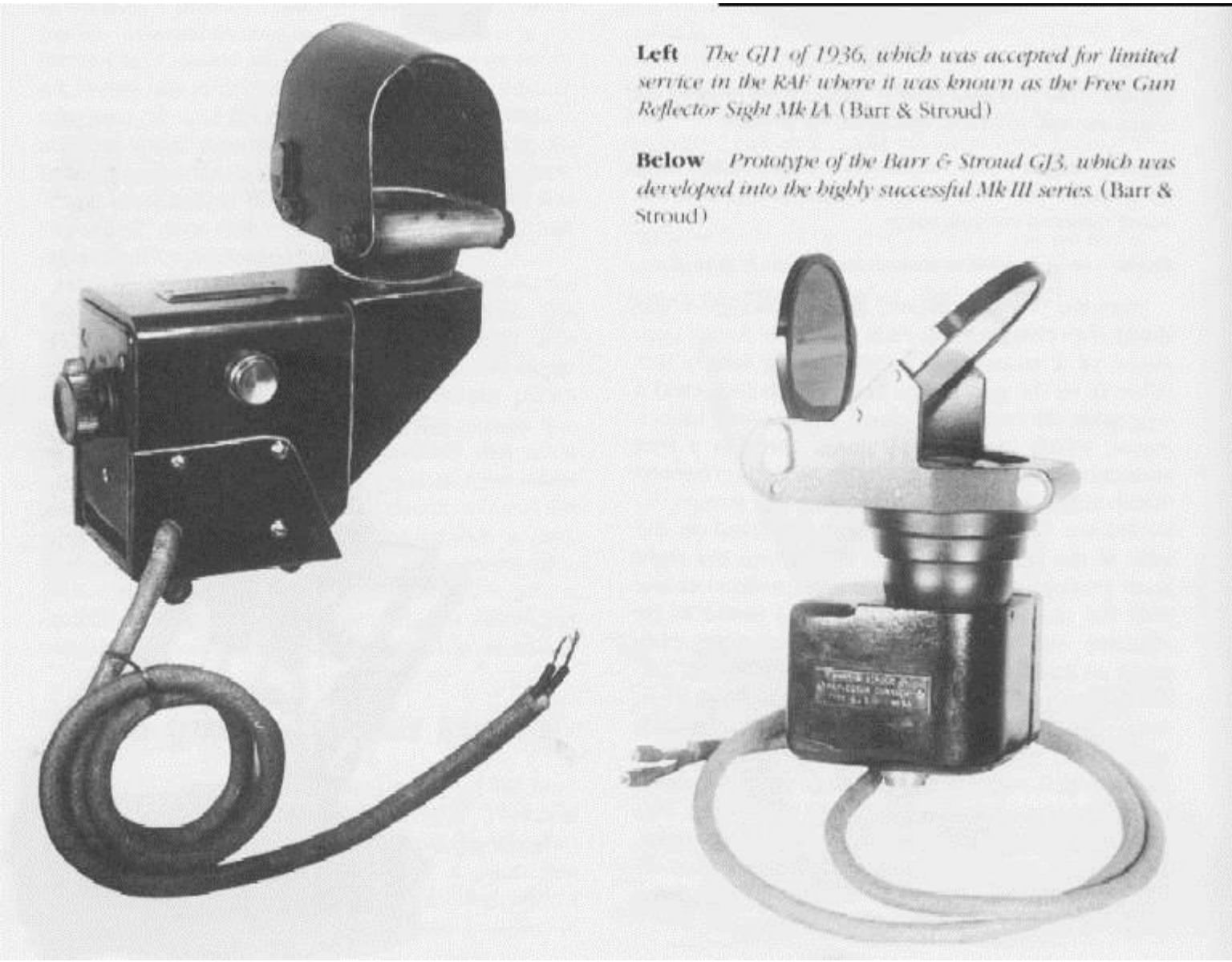
The GJ3 - Pt 1

As bomber speeds increased in the 1930s, windscreens were fitted to protect gunners. The next step was to enclose the gunner in a glazed cupola which could rotate. Some manufacturers then decided to develop enclosed, power-operated turrets, with the guns remote from the gunner's eye line. It followed that the sight also had to be remote from the guns, but linked to the gun movement. Barr & Stroud's answer was the GJ3, which, when fully developed, was to be produced in larger numbers than any other British sight. It consisted of a detachable lamp unit and an upright sight head, the glass reflector screen being fitted to a housing surmounting the lens tube. The reflector housing supported a swing-in-type sun screen operated by a small knob at the side.

The above text and photos were taken from "British Aircraft Aramament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob

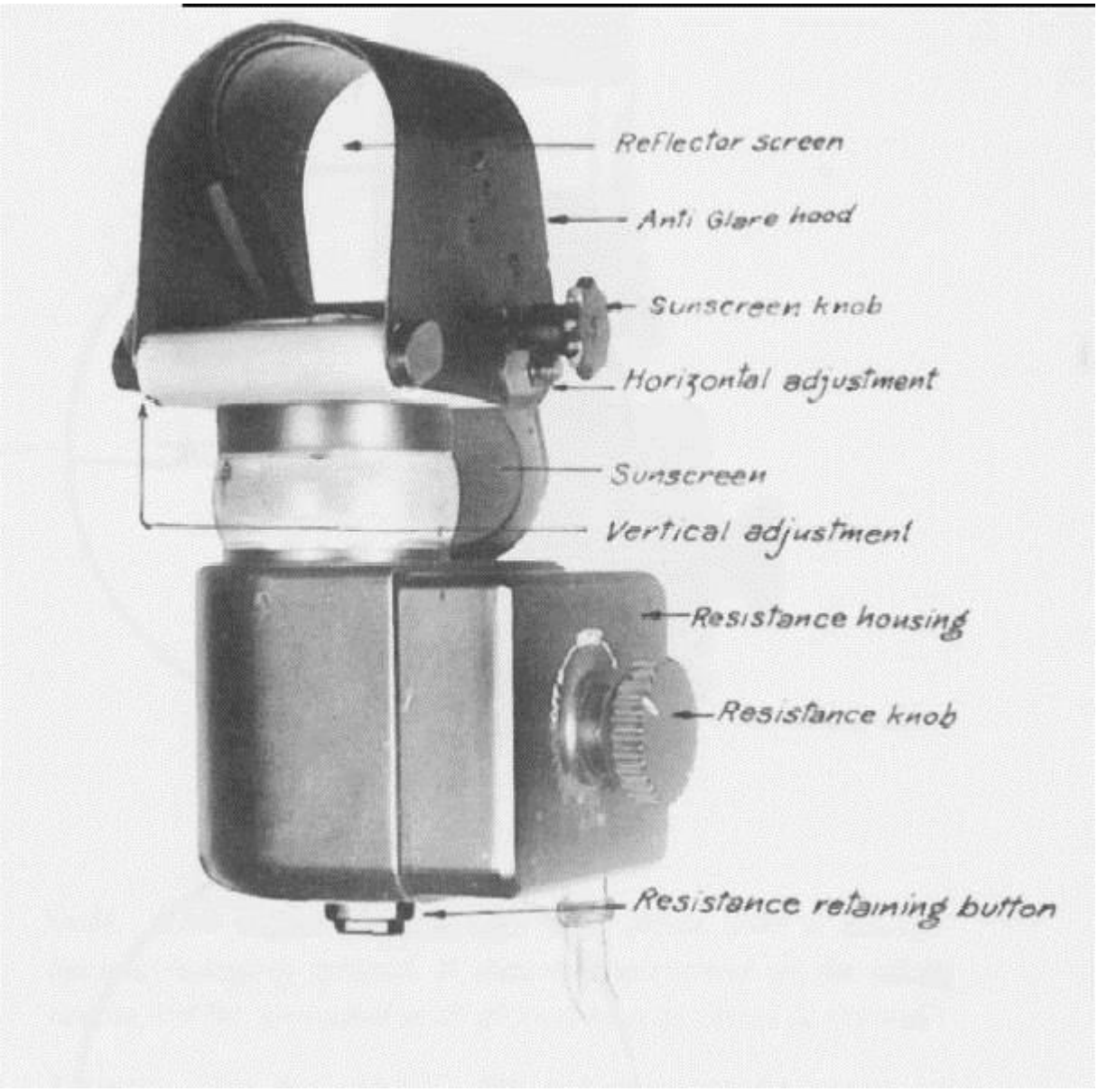


Left *The GJ1 of 1936, which was accepted for limited service in the RAF where it was known as the Free Gun Reflector Sight Mk IA.* (Barr & Stroud)

Below *Prototype of the Barr & Stroud GJ3, which was developed into the highly successful Mk III series.* (Barr & Stroud)

GJ1 & GJ3 sights.jpg

The production GJ3, adapted by the RAF as the standard turret and free gun sight, designated the Mk III and Mk IIIA.



Production GJ3 sight.jpg

Mk IIIA free gun sight.jpg

Post subject:
Hi

The GJ3 - Pt 2

The prototype sight was tested at the weapons department at Farnborough, where the optical system and electrics were proved to be satisfactory. It was then sent to Martlesham Heath, where it was installed in a Parnall Hendy Heck fitted with two Browning guns, and air firing trials were carried out at various heights and at ground targets. The trials reports were favourable, although it was recommended that a protective hood similar to the Mk 1's should be fitted. It was decided to fit the reflector screen into a slot fixed to the inside of the hood, and incorporate the sun screen at the rear operated by a knurled knob. The sight head could be adjusted for elevation, and it was clamped onto the lens tube, giving a means of lateral adjustment. The sight was reassessed and found, in the words of the official report, to be 'an accurate and compact sighting medium suitable for use in powered turrets, and situations where the Mk II* would not be ideal'. The company was given a production order for an initial batch, the sight being given the Service title Mark III Free Gun Reflector Sight.

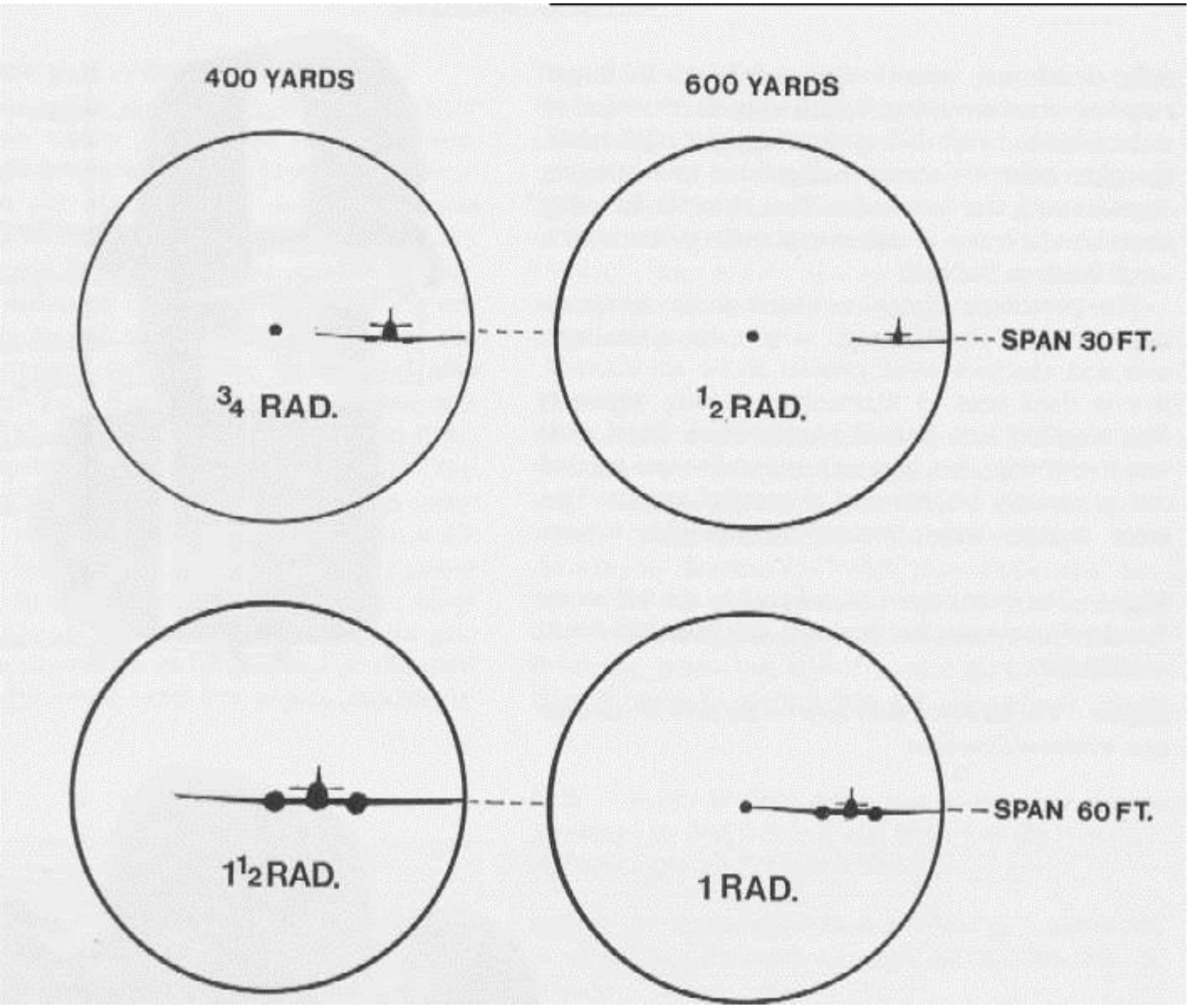
Caption to top sketch: Gunners were taught to compare an oncoming fighter's wingspan with the graticule of the sight. Known as stadiametric ranging, it gave a good indication of the target distance.

Caption to centre photo: Following the success of the GJ3, Barr & Stroud produced a pilot's version. This model was made for inverted mounting, and had no built-in rheostat. Air tested in a De Havilland Don at Martlesham, it was not adopted for Service use.

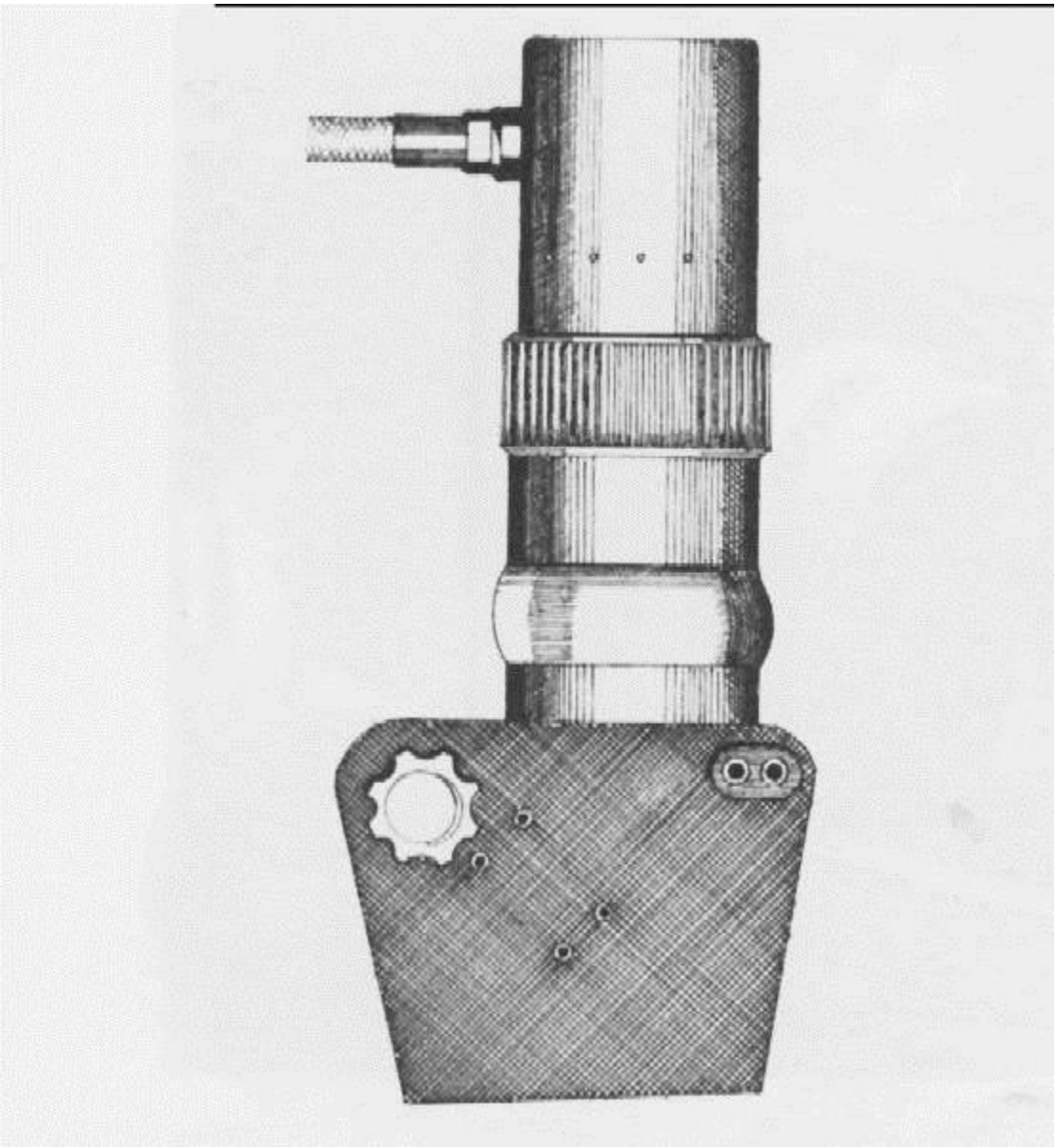
The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

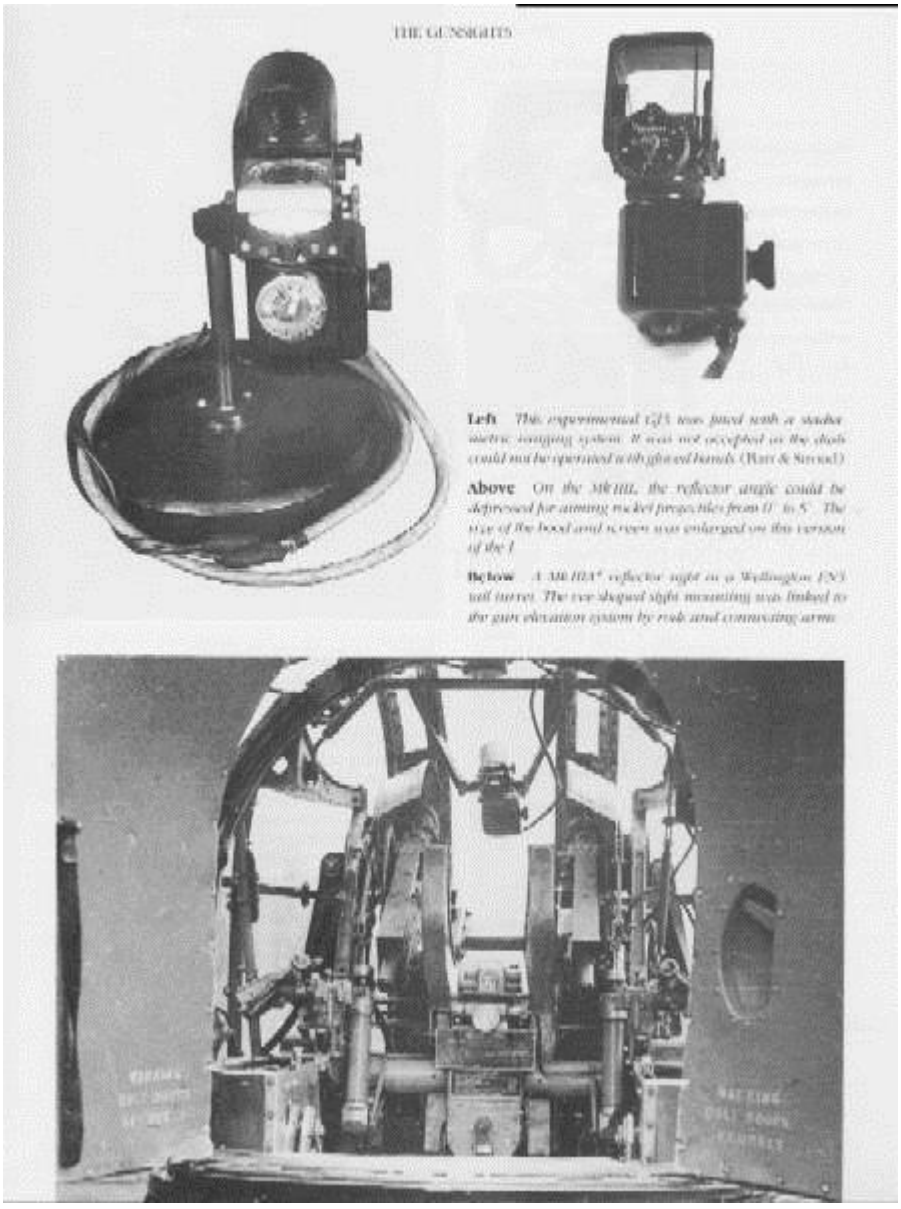
Bob



Stadiametric ranging marks.jpg



Pilot version of GJ3.jpg



Mk III & IIIA Reflector sight.jpg

Post subject:
Hi

The GJ3 - Pt 3

When production got under way, the company's lens-making department was fully extended, the Mk

III and Mk II pilot's sight (described later) requiring many high-quality lenses. As demand increased, sub-contractors were appointed for some of the work. The Glasgow team then decided to produce a version of the Mk III with stadiametric ranging, but it was found to be difficult to operate with heavy flying gloves.

The Mk III series proved to be one of the most successful reflector sights ever produced. Virtually every turret in RAF Bomber Command used it, and it was adopted by the USAAF and US Navy as the Mark 9, produced in America by the Woolensak Optical Co. of Rochester, NY, and in Australia, by the Kriesler (Australasia) Pty Ltd. (This model featured an anti-vibration lampholder). As well as turret use, it was fitted to free-mounted Vickers K guns, and, being less obtrusive than the Mk II*, was used as a pilot's sight on many multi-engined aircraft. The final redesign was the incorporation of a tilting head mechanism for rocket firing.

The production versions were:

Mk III: First version, no in-built adjustment, 24/12 v
Mk IIIA: Die-cast, modified adjustment 24 v, short hood
Mk IIIA*: Main production version, some bakelite housing, 24 v
Mk IIIG: Tilting head for rocket firing use
Mk IIIL: Tilting head with hood
Mk IIIN: Hood deleted
Australian Mk III: Spring-damped bulbholder
US Mk 9: With or without adjustable head

In most turrets the sight was mounted at the gunner's eye level and connected in elevation to the gun cradle by rods and cranks (in rotation the sight moved with the turret). Nash & Thompson FN4 tail turret gunners often used the sight as a convenient handhold when getting into their seats, which could put the sight out of alignment, so a prominent 'Hands Off' sign was attached.

The Mk IIIA* was used on many free gun mountings, and on heavy-calibre installations such as the Molins gun on the Mosquito F B Mk XVIII.

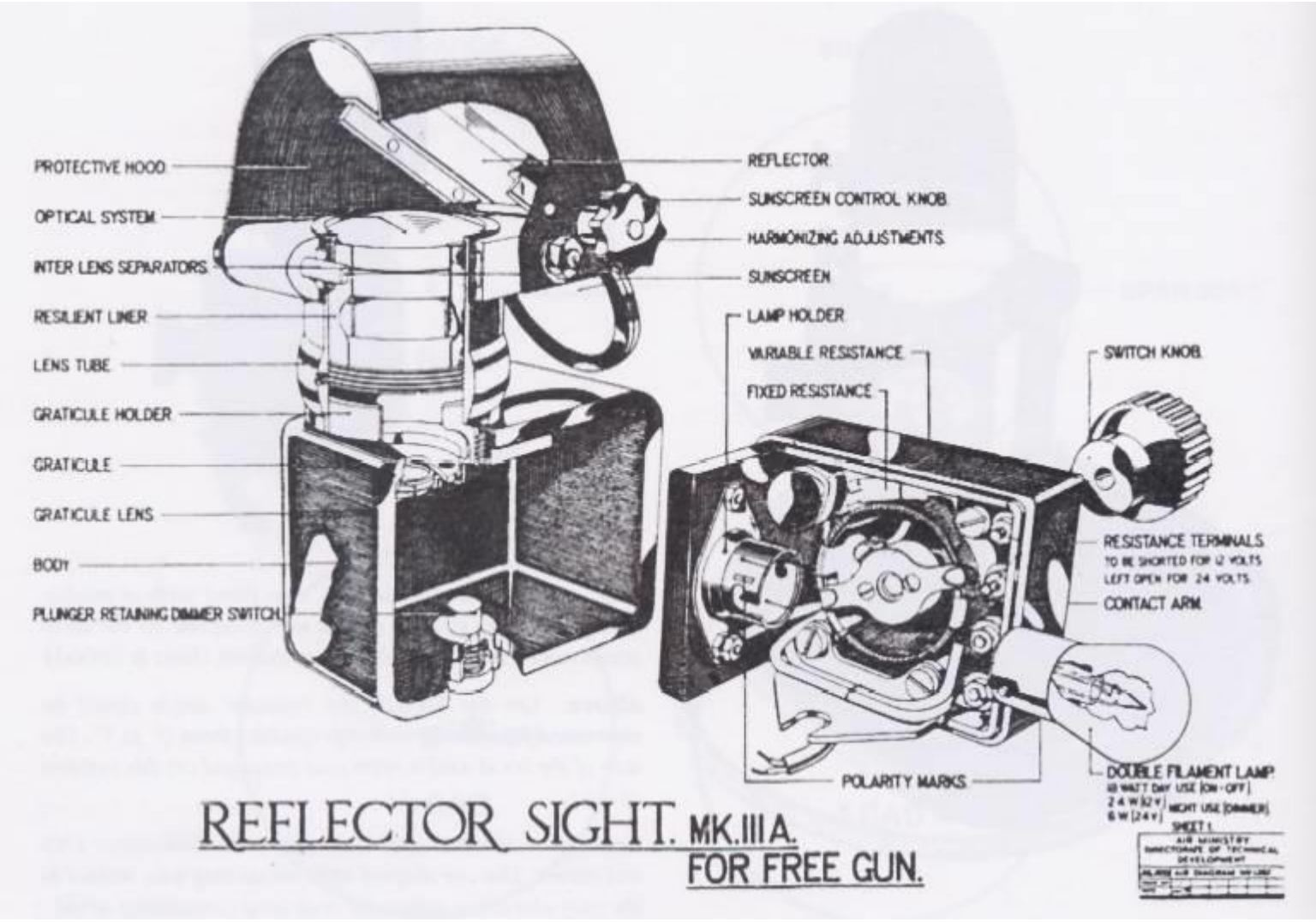
Caption to top sketch: Section through the Mk IIIA*.

Caption to centre photo: A Mk IIIN with neither hood nor dimming screen, used on daylight operations.

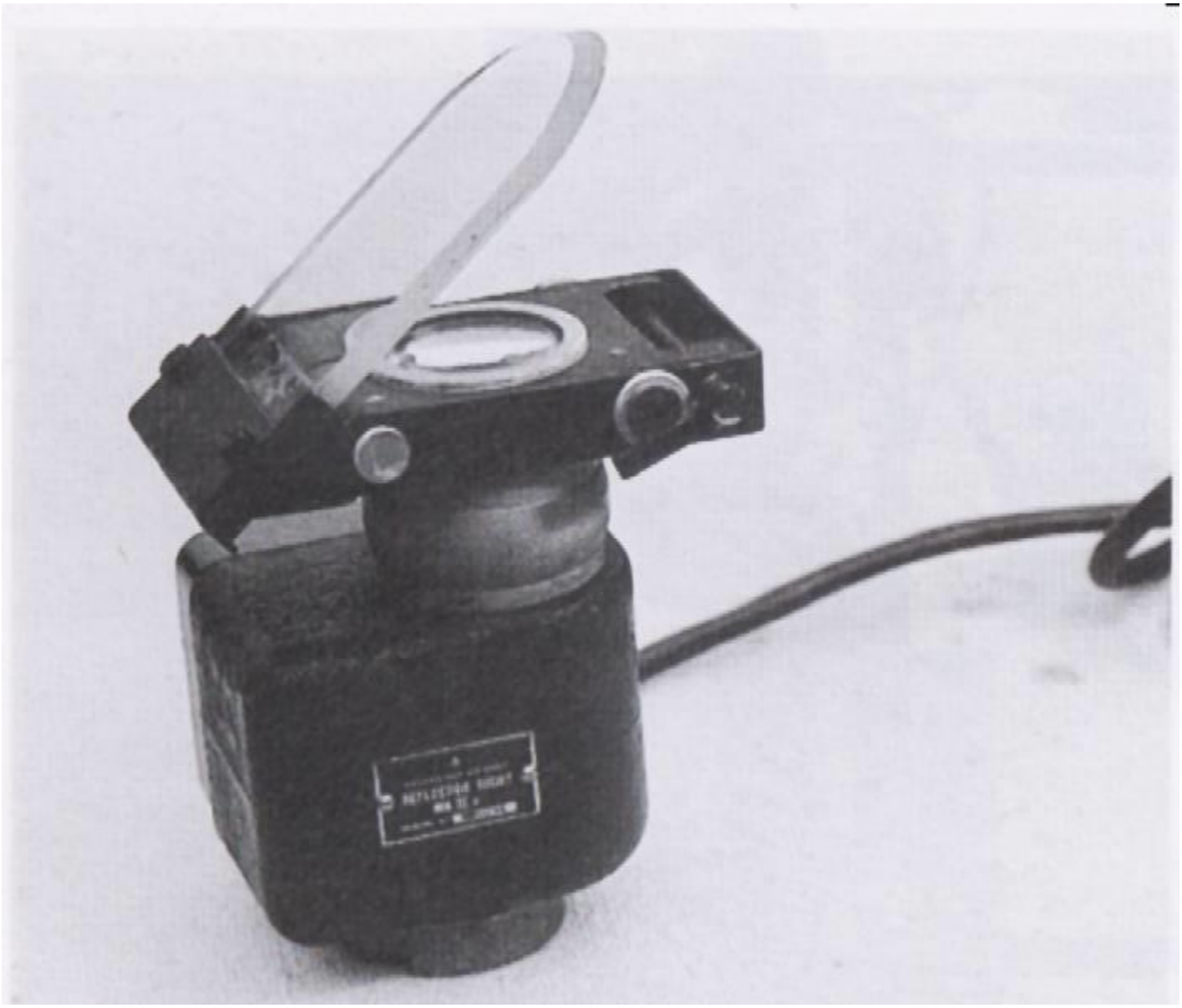
The above text and photos wre taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob



Sketch of Mk IIIA sight.jpg



Mk IIIN sight.jpg

The Mk IIIA was widely used by the USAAF as the US Mk 9. The gunner's 'No. 2' was brought back from Africa in a B17.*

US Mk 9 sight.jpg

Post subject:
Hi

Hawker's sight bar

Before the adoption of the new Barr & Stroud fixed gunsight, weapon aiming remained traditional.

Hawkers fitted a long sight bar for the ring and bead on which the pilot could choose the position of the two elements, some preferring the the ring in the centre with a bead at either end. Although the Aldis was more accurate, some pilots preferred the ring and bead, especially during fast manoeuvres when 'g' forces made it difficult to align the small eyepiece. Another reason was that, when engaged in low-level air-to-ground firing, the pilot needed full peripheral vision to avoid flying into the ground. The Aldis also restricted the field of view at a time when targets of opportunity could appear. Another advantage of the 'iron sight' was that when engaging ground targets, the point of aim was in front of the impact point, and it was not easy to do this with the Aldis.

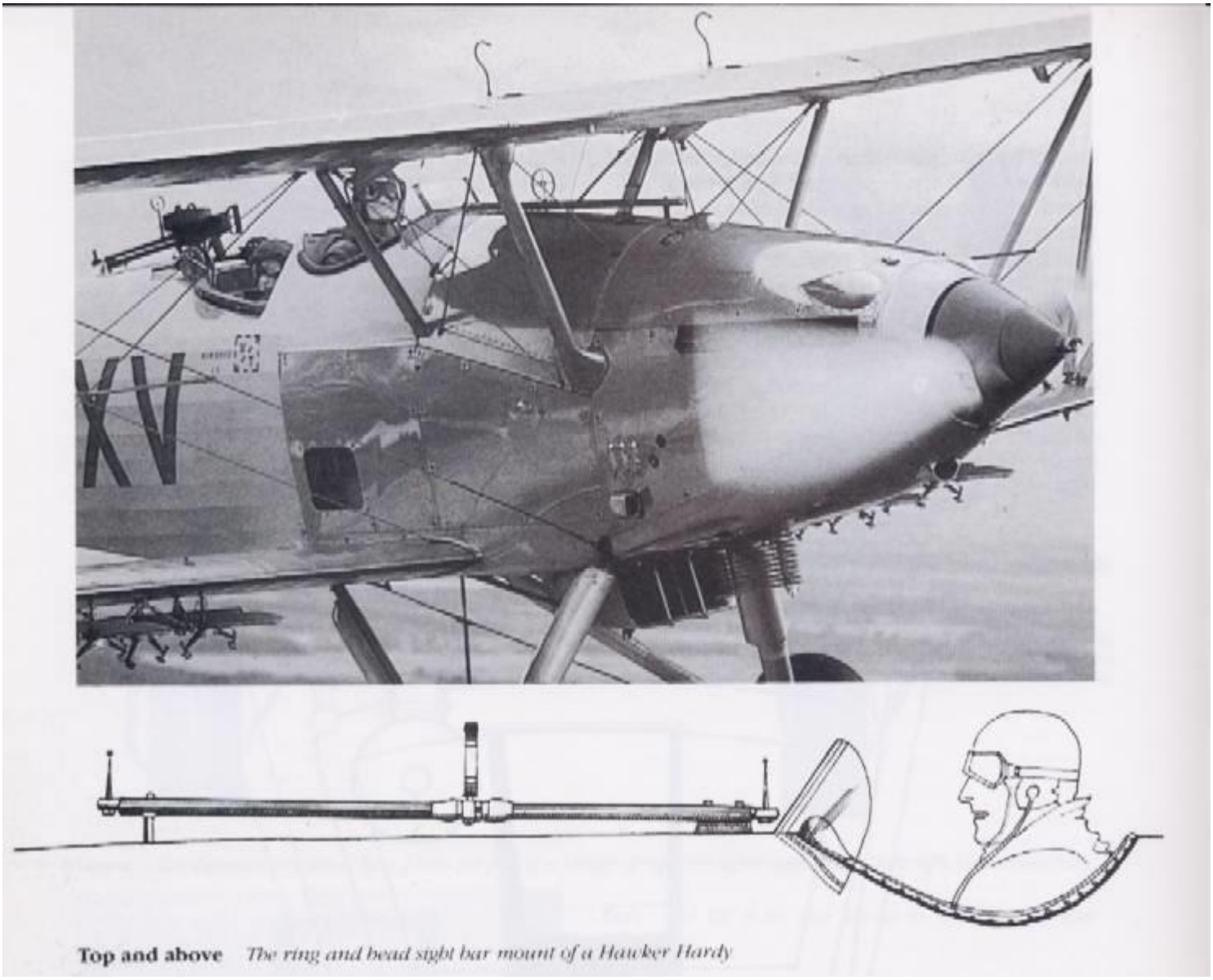
Prismatic Sights - Pt 1

The reflector sight was not universally accepted as ideal: during trials at Northolt and Farnborough, pilots complained that the graticule was hard to see against bright cloud, and could not be held in view in a tight turn. These complaints were usually made by older pilots used to the black outline of the ring and bead, and as they were of a higher rank, a conference was held at Farnborough on 12 October 1938 to discss alternative systems. The Armament Department of the Royal Aircraft Establishment suggested a sight similar to the Aldis, but using prisms to reduce the size for use behind the windscreen. The RAE were given an order for two such sights, the GI type 'A' pilot's sight, and the type 'B' for free guns and turrets. These were to have a black-line graticule and a facility for night illumination.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

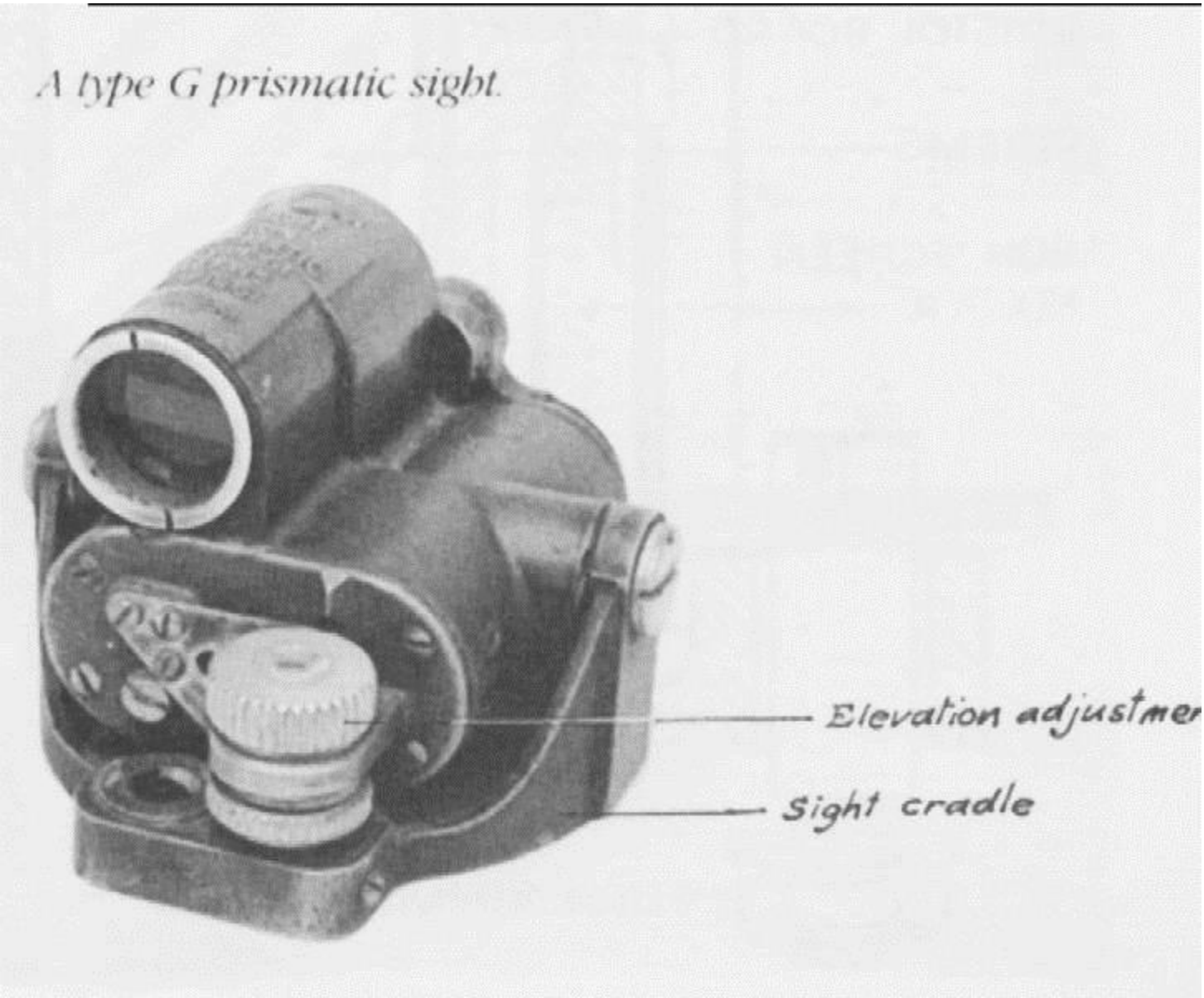
Regards

Bob

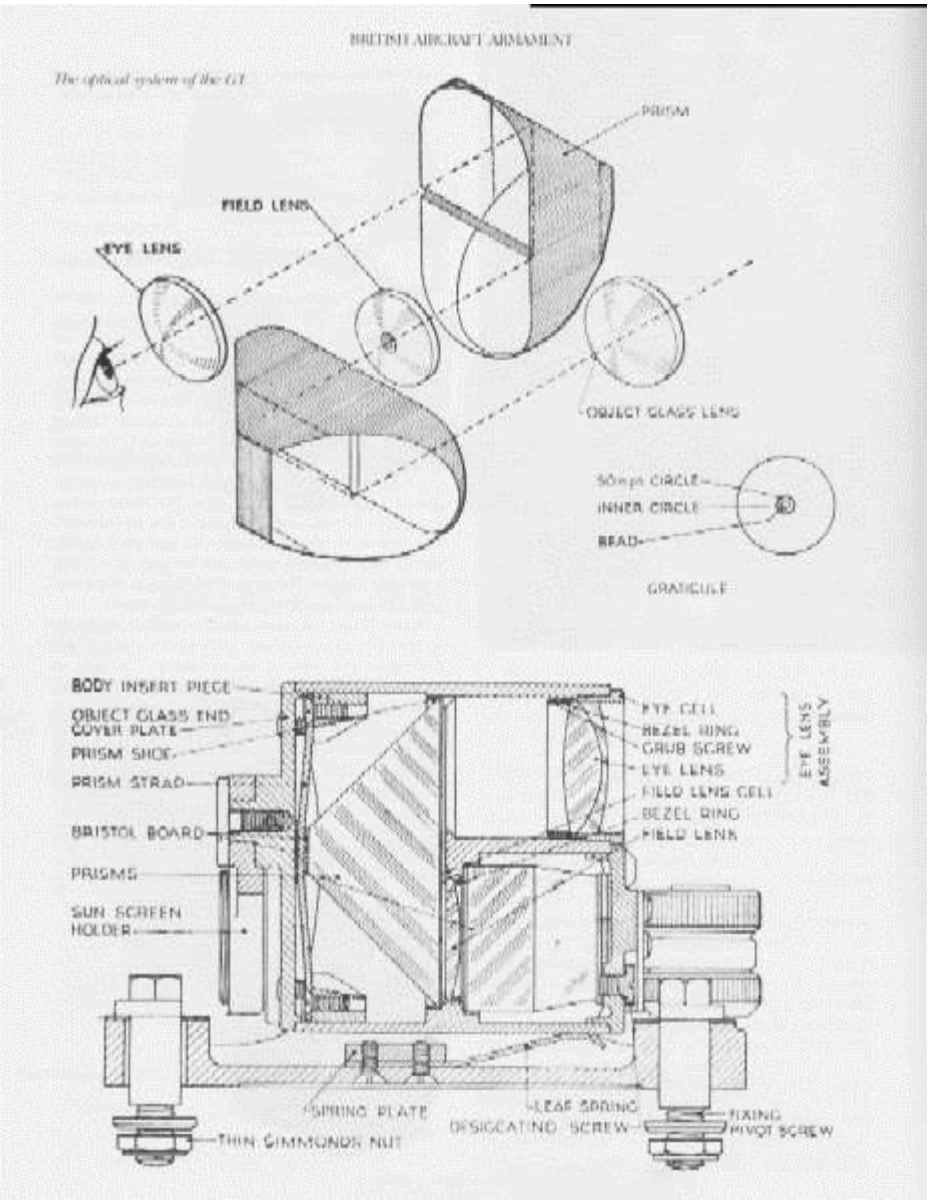


Top and above *The ring and bead sight bar mount of a Hawker Hardy*

Hawker's sight bar.jpg



Type 'G' Prismatic sight.jpg



G1 sight.jpg

Post subject:
Hi

Prismatic Sights - Pt 2

Messrs Ross Ltd produced four type 'A' sights, to be given comparative tests with reflector sights in a

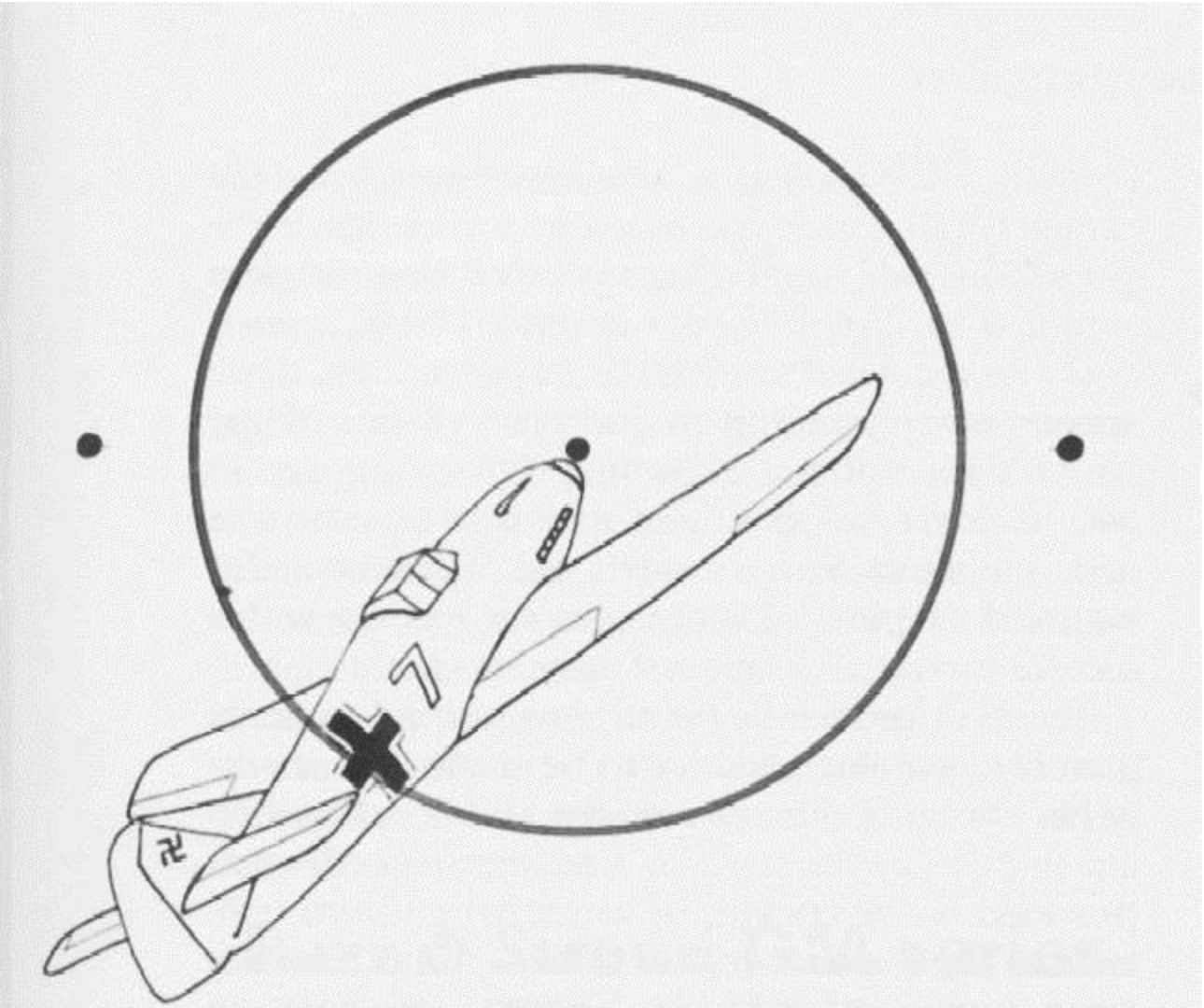
Gloster Gladiator. The type 'B' was produced for use in turrets, but the small 20 mm (0.78 in) eyepiece proved a drawback, and it was soon replaced by the Mk III reflector sight. All work on prismatic sights was finally abandoned in 1940. The G1 was used as the optical head of the Mk 1 Gyro, and some Bristol B.1 turrets used it, but from 1940 onwards the reflector sight became standard apart from the ring and bead sights used on some free-mounted guns, as mentioned elsewere.

The caption for the bottom photo is: A G1 sight mounted on a Bristol B.1 turret. The gunner placed his chin on the pad to steady his aim.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

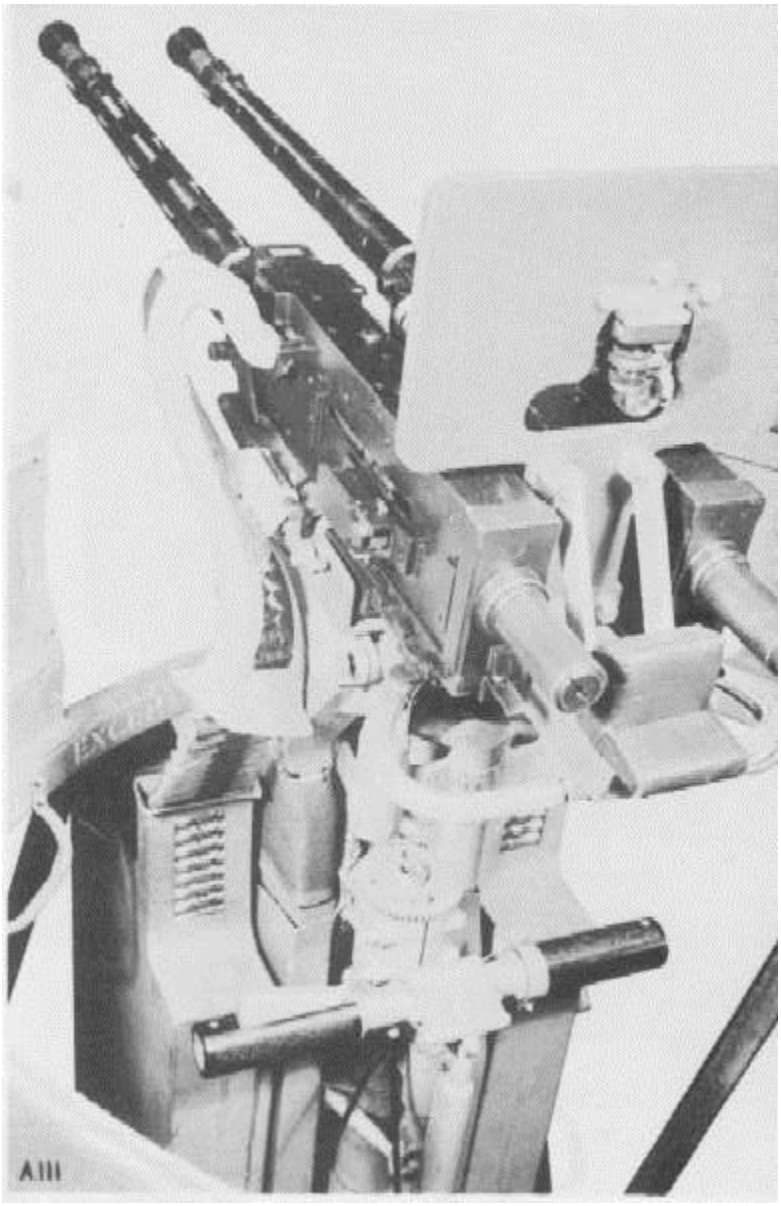
Regards

Bob



Above *The graticule pattern of the G1 sight. The spots were used for ranging.*

View of graticule pattern.jpg



G1 sight mounted on a Bristol B.1 turret..jpg

Post subject:
Hi

Barr & Stroud GM Series Fixed Gun Sights

Although the GD5 pilot's sight had proved to be quite effective, the windscreen projection system had

caused problems with double imaging, and it had proved difficult to manufacture. With this in mind, the company was asked to design a sight with an intregal reflector which would be more suitable for series production. In late 1935 the prototype of the new sight was submitted for evaluation. The optical department produced a lens with a numerical aperture of F/O=.68, through which a large circular graticule was projected onto a circular glass reflector screen 76 mm (3 in) in diameter. The graticule was bisected by a cross, the horizontal bar of which was broken in the centre, the gap being set by (1) a knurled ring which turned a perspex pointer to various range settings, and (2) an adjustable ring which turned an indicator to wingspan in feet. The internal mechanism then set the gap according to the required range. A central dot was added for a further aiming point. The pilot first set the span dial to the known wingspan of his prospective target, then the range dial to the maximum for accurate fire. When the target coincided with the gap it was within range. The radius of the graticule ring gave the deflection allowance for hitting a target crossing at 161 km/h (100 mph). The sight, designated the GM1, was illuminated by a half-silvered 12v lamp in a quick release holder at the base of the sight body.

The prototype was tested at Farnborough, and then at Martlesham in a Bristol Bulldog for air firing tests. The trials reports led to various modifications. A substantial rubber pad was fitted to protect the pilot from injury in the event of a rough landing, the range/base setting was modified to two similar knurled rings with their own scale and indicator, and the lamp changing was also made easier. The blue-tinted swing-in sun screen was found to be effective in high brightness situations although the orange graticule was not perfect in some conditions. The modified sight was designated the Barr & Stroud Type GM2, and was accepted as the standard fixed gunsight of the RAF, being known as the Reflector Sight Mark II. it was patented in 1937, and the first sights of an initial order of 1,600 reached aome Gloster Gladiator squadrons in 1938.

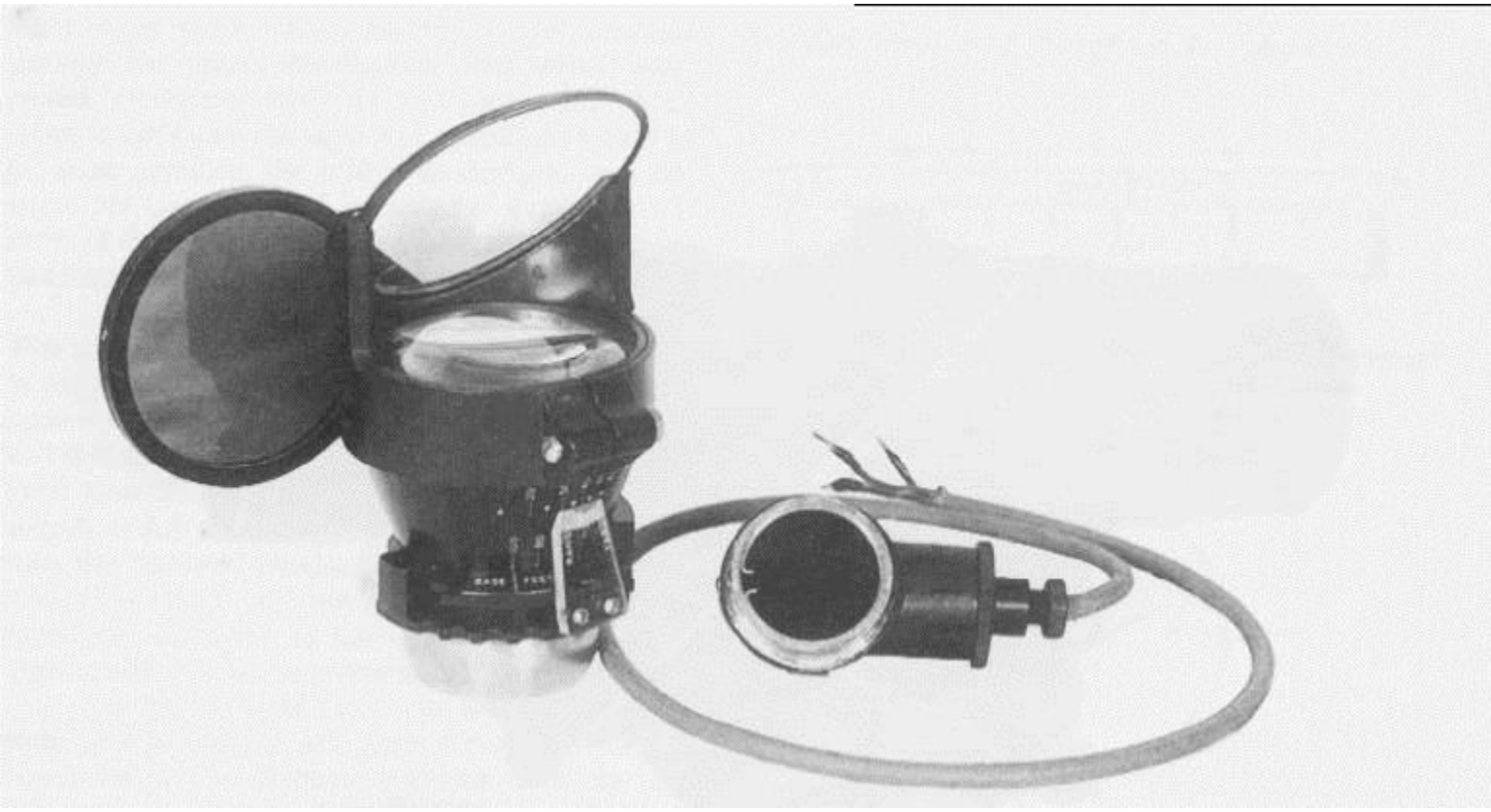
The caption for the top photos is: The Barr & Stroud GM1 fixed gun sight. This was the prototype with a perspex range/base indicator.

The caption for the centre photo is: The GM2, adapted for use in 1938 as the standard RAF fixed gun sight and designated the Fixed Gun Reflector Sight Mk. II.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

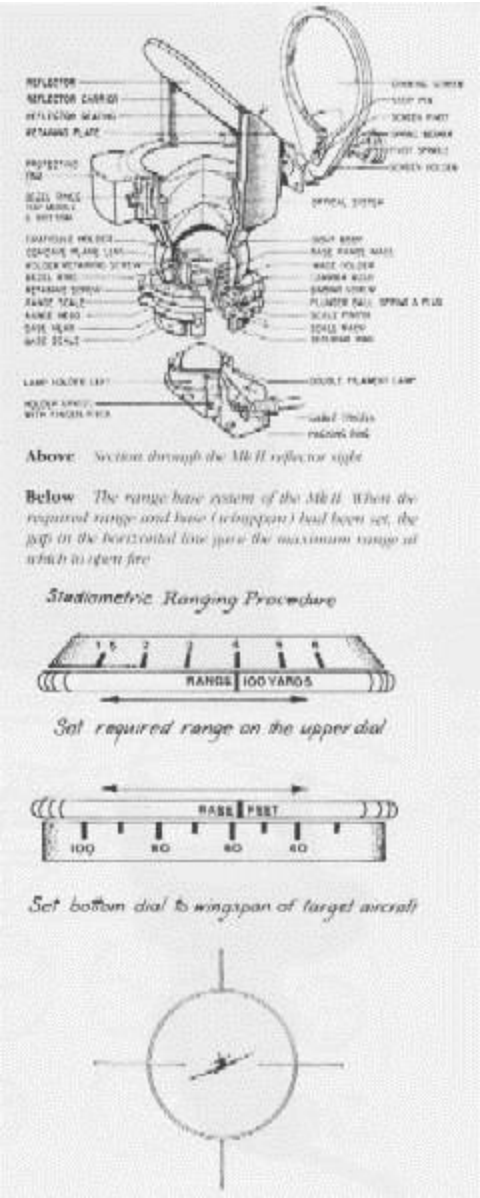
Regards

Bob



The GM 1 sight.jpg

The GM2.jpg



Sketch Drawings of Mk.II sight.jpg

Post subject:
Hi

At the time of the Munich crisis in 1938, increased orders were placed for the Mk II for the new Sptifire and Hurricane fighters just coming into production. Even with 24-hour working, Barr & Stroud were already at full strech, and as all British companies with the required production facilities were

committed to other defence contracts, the Air Staff asked the company to find an overseas licensee. This resulted in an agreement being signed with C.P. Goerz of Vienna. Drawings and a Mk II sight were sent to Vienna, and Herr Neumann of Goerz concluded a produciton contract with an Air Ministry representative. In early 1939, with 55 sights delivered, the Anchluss was signed between Germany and Austria. However, Air Ministry fears of cancellation were groundless and Goerz were only too pleased to honour the contract, 700 sights known as the GM2 Mk III being delivered before the outbreak of war in September. These gunsights made by the 'enemy' were invaluable, as production at Glasgow could not satisfy the needs of Fighter Command. In early 1940 the situation was eased when the Salford Electrical Co. began production under licence. The sight was used in most British fighters of 1938-43, although as mentioned earlier, some Beaufighters and Mosquitos used the Mk III* turret sight for fixed guns.

The first change in the design was made in 1941. when the circular reflector glass was replaced by one 114 mm (4.5 in) square, the circular design having been found to have slight optical aberrations. This modification was designated Mk IIs, later Mk II*, fixed gun reflector sight. Existing sights were retrofitted with new sights heads, and the circular sight heads are now highly prized by collectors. The dimming screen was discontinued, as it was said to be rarely used.

When rockets came into widespread use, a special version of the GN2 was designed in co-operation with Farnborough, to allow for the increased gravity drop of these projectiles. The reflector screen was made to tilt forward by the pilot from 0 to 5 degrees depression, according to airspeed and the known drop of the missile being used. This modification, which involved the replacement of the sight head, became known as the type 1 Mk II conversion, and the sight then became the Mk IIL.

Caption to top photo: The Mk II* replaced the Mk II in 1941, the circular reflector screen being replaced by a rectangular one. The sun screen was also deleted.

Caption to centre drawing: A Mk II* reflector sight mounted in a Spitfire.

The above text. photos and drawing were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob

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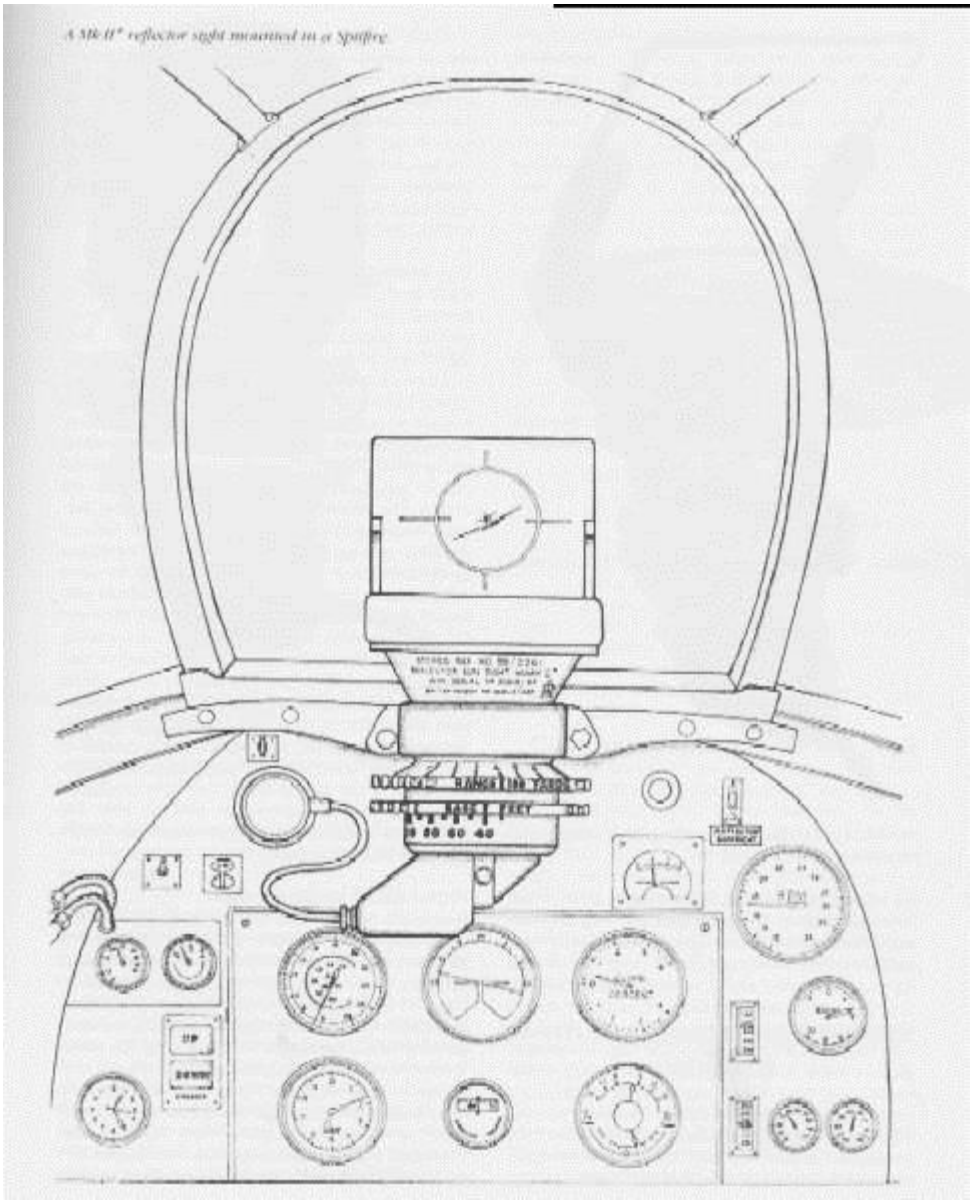
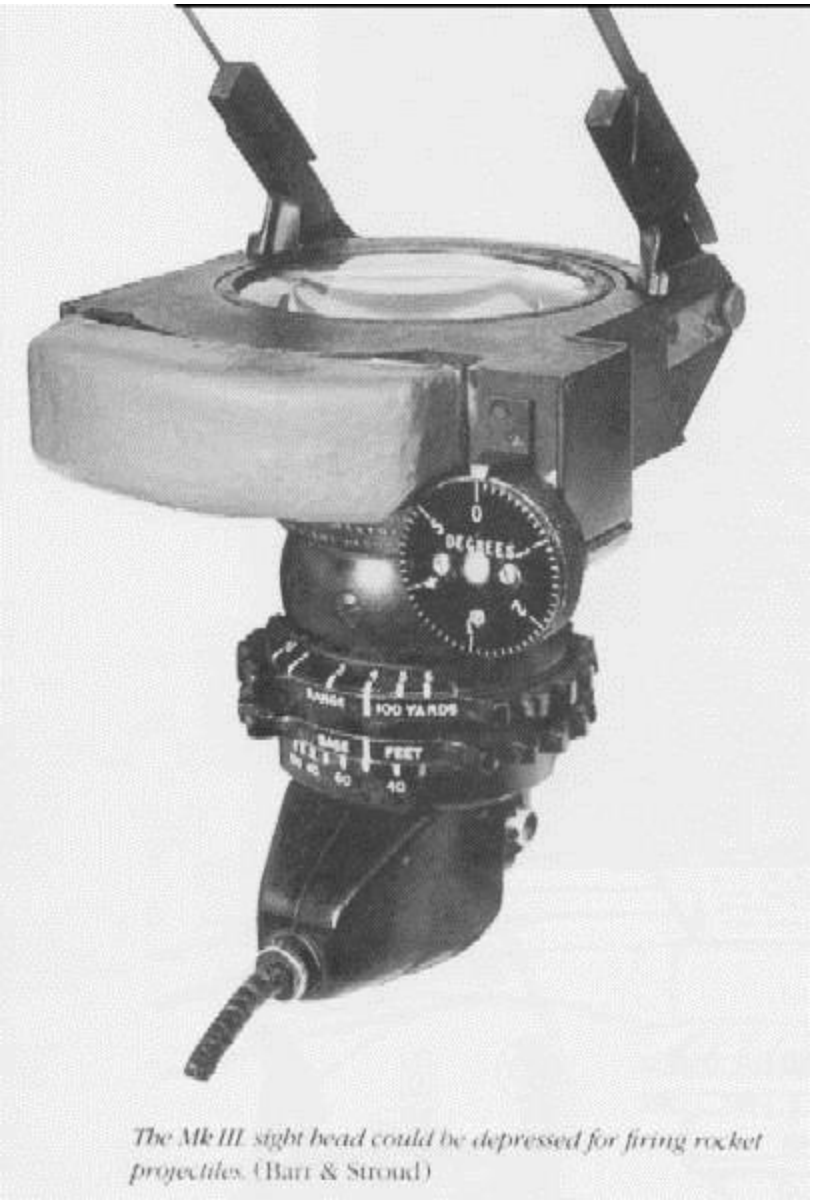


Sketch drawing.jpg



The Mk III sight head could be depressed for firing rocket projectiles. (Barr & Stroud)

Mk IIL sight.jpg

Last edited by Robert Hurst on 29 Mar 2003 11:52; edited 1 time in total

Post subject:
Hi

The Beamont Modification

S/Ldr. R.P. Beamont commanded a squadron of Hawker Typhoons engaged in low-level attacks on German installations in occupied France. Low clouds and poor visibility were often encountered, and it was found that, even if the gunsight lamp was turned right down, the large ring and range bar tended to obscure tracking and target aquisition. Beamont decided to cut down the graticule pattern on his Mk II* sight, so squadron armourers blanked off the ring and bars, leaving only the centre dot visible. The smaller aiming ring proved a big success: Beamont could discern much more without the large orange glow.

On subsequent operations he realised that it would be even better if the glass reflector screen was removed and the graticule projected onto the windscreen, the rake of which was 45 degrees. The following day he used the sight in an attack on an installation in the Lille area, and found he had a better field of view than ever before, so he had all No.609 squadron's sights altered to the same configuration. When news of this modification reached the authorities, terse instructions were issued to remove the unauthorised alterations forthwith. Eventually it was agreed that in low light conditions the system had its advantages, and the spot was easily seen in full daylight conditions if the brightness was fully turned up.

Type I Mk III Projector Sight

Beamont's modification was taken up by Farnborough and a new version of the Mk II* sight was designed with the reflector screen removed and the graticule modified to a plain 161 km/h (100 mph) ring and dot. The two control rings were replaced by a single ring which moved the graticule forwards or backwards, raising or lowering it on the windscreen. A dual-purpose graticule was devised consisting of an adjustable ring for rocket-firing and a dot for the guns. An angle of depression scale was fitted, but it was found that a white celluloid strip, on which a pilot marked settings for various dive angles with a marker, was more practical. A detachable shroud was fitted over the sight head to prevent images of the sun being reflected into the pilot's eyes.

Trials revealed several shortcomings in this model, which was known as the Type 1 Mk III projector sight: the graticule was dim and allowed very little eye movement. However, a simpler modification was agreed in which the graticule reverted to a single dot only, without a reflector glass. A production order was issued for this version, which was first officially used when the Hawker Tempest Mk V entered service in February 1944. Similarly altered Mk IIs were also used by night-fighter and Typhoon squadrons. Beaumont's modification was further improved when Grade A armoured windscreens became available. These were optically correct, and prevented the double image which sometimes occurred if the lamp was turned up to high (shades of the GM5). In a special night-fighter version tested by the Fighter Interception Unit in November 1942, a green filter diffuser cell was inserted between the lamp and the graticule to enable tracer to be seen to a maximum range at night. Another idea tested by the Air Fighting Development Unit consisted of an optically correct reflector glass screen the same size as the windscreen fitted 38 mm (1.5 in) behind it, which gave the pilot much more eye movement.

More than 84,000 GM2 sights were manufactured, mostly by Barr & Stroud, the production of lenses alone amounting to over 1 million units. The production versions were as follows:

Mark II: Oval reflector with sun screen

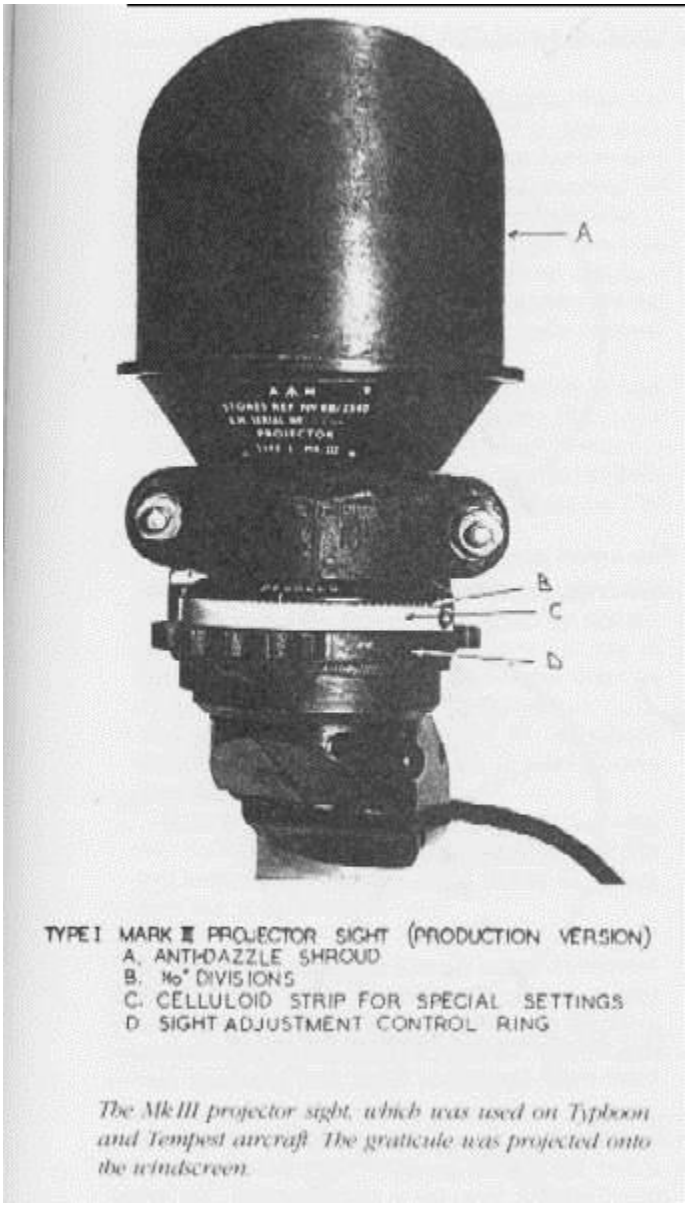
Mark IIs: Rectangular reflector with no sun screen
Mark II*: Similar to the IIs, slightly different dimensions
Mark IIL: Adjustable sight head (0-5 degrees) for rocket firing and 40 mm guns
Mark III: Produced by Goerz
Type 1: Mark 1 (Projector) open/shut graticule one ring only
Type 1: Mark 111 (Projector) dot graticule
Type 1: Mark 8 (Projector) standard range/base graticule

The last reflector gunsight produced by Barr & Stroud was based on the GM2, but incorporated automatic adjustment for elevation and azimuth (horizontal movement). It was designed for the large anti-shipping missile of 1945 code-named 'Uncle Tom'. Radar signals were fed into a computer which energised flexible shafts driving actuators which tilted or slewed the reflector glass to the left or right, giving a correct point of aim. Approximately 150 of these intricate instruments were produced, but the 'Uncle Tom' system was cancelled when the war ended.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob



Type 1 Mark III Projector Sight.jpg

Last edited by Robert Hurst on 27 Mar 2003 12:39; edited 2 times in total

Post subject:
Hi

The Srb-a-Stys Sight

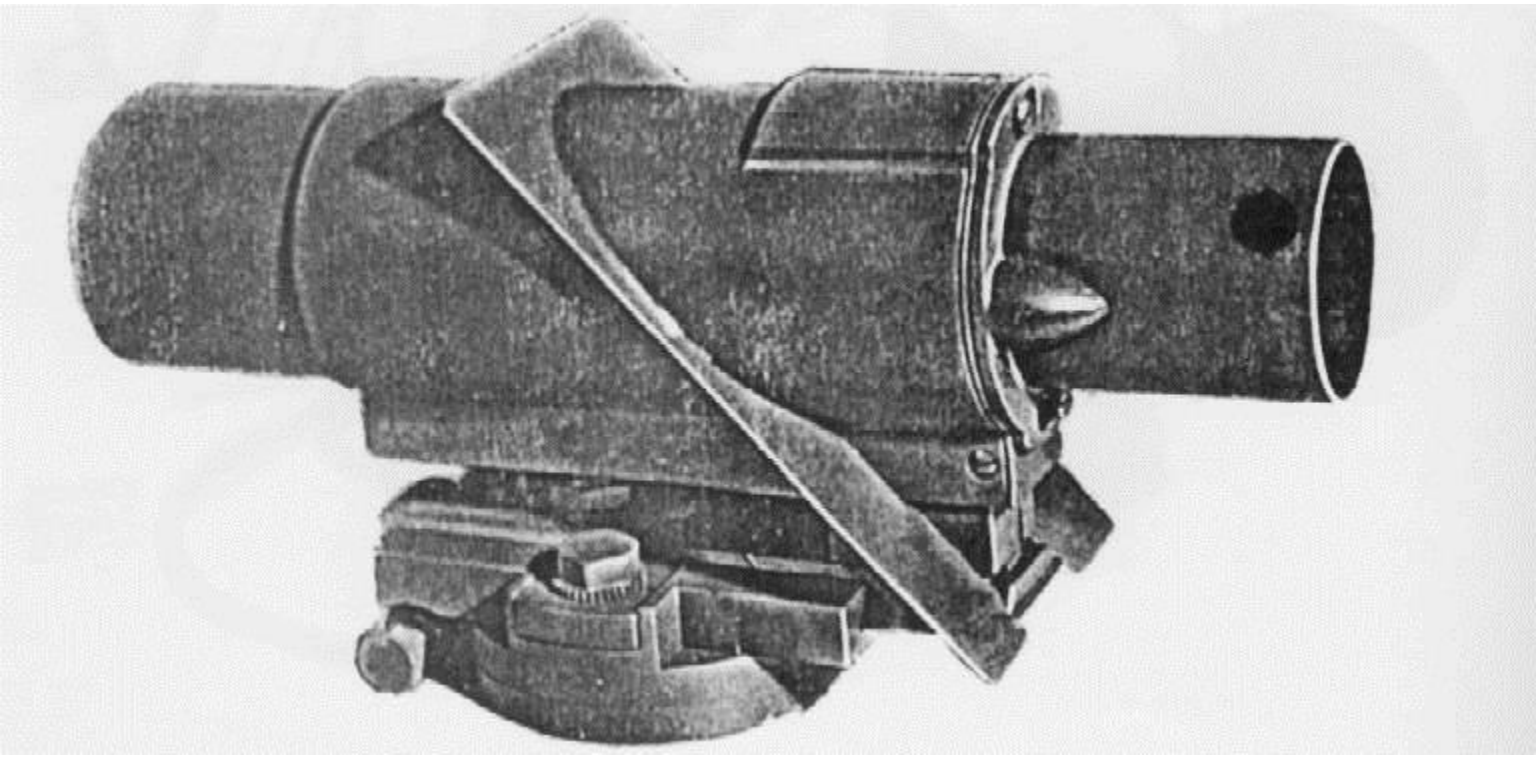
When Germany occupied the Sudetenland, a Swedish optician working for the Czech Srb-a-Stys Company was sent to London on a secret mission to offer a new aircraft gunsight design to the British. The instrument resembled a large-diameter shortened Aldis sight which needed to be inserted through the pilot's windscreen. This would have been posed problems with thick bullet-proof windscreens. Although the sight was tested and found to be quite accurate, the offer was declined and the agent, Mr George Vogel, returned to Prague with a letter of thanks to the Czech Company.

The caption to the photo is: The Srb-a-Stys optical sight offered to the Air Ministry in 1938. It was brought to London by a representative of the Czech company after Germant had marched into the Sudetenland. The offer was declined with thanks. It would appear that it would have been even more hazardous than the Mk II in a rough landing. This is the only known picture of the sight.

The above text and photo were taken from "British Aircraft Armament Vol.2: Guns and Gunsight", by R Wallace Clarke.

Regards

Bob



Srb-a-Stys optical sight.jpg

Post subject:
Hi

Wartime Ring and Bead Sights

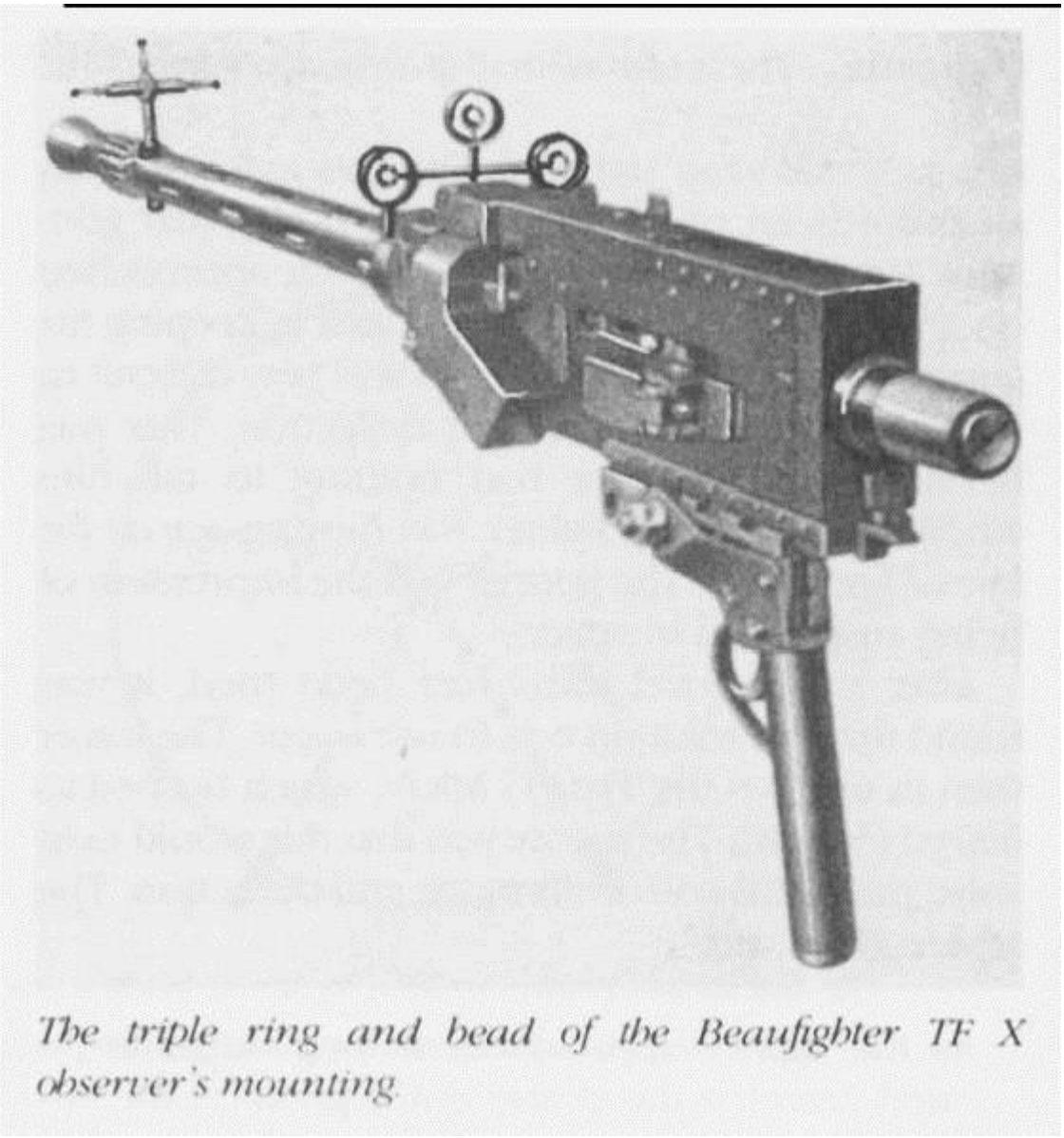
Even in the Second World War the ring and bead sight was used operationally by RAF gunners, because it was not practical to use reflector sights in some positions. Gunners manning side hatch positions in flying-boats, observers in naval aircraft, and extra hand-operated guns in bomber aircraft all used such sights. They were usually the 51 mm (2 in) type, which were far less prone to damage than the pre-war 114 mm (4.5 in). Observers in the Beaufighter T.F.Mk.X had three ring and bead sights on the single Browning in the cramped rear cockpit. They used whichever gave a lead on the target.

Fairey Battle light bombers took a leading part in trying to stop the German advance into France in May 1940. Their armament, against high-performance Luftwaffe fighters, was identical to that of the 1917 two-seaters. The observers had a single Vickers K gun, and rarely had a chance to align their sights onto their opponents, who decimated them.

The above text and photos were taken from "British Aircraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob



The triple ring and bead of the Beaufighter TF X observer's mounting.

Triple ring and bead.jpg

Fairey Battle observer using a 2 in ring and bead sight on a Vickers K gun

Fairey Battle observer with ring and bead sight.jpg

Twin Vickers K guns in a Catalina, each with its ring and bead.

Twin Vickers K with ring and bead.jpg

Post subject:
Hi

The Gyro Gunsight Mk I - Pt I

The gyro gunsight at last solved the most difficult problem faced by pilots and air gunners, that of

finding the correct angle of deflection or 'lead' needed to hit the target when it was moving across the line of fire. Even experienced fighter pilots had great difficulty in overcoming the problem. Indeed, the world's top-scoring fighter ace, Eric Hartmann, revealed that his secret was 'Get in close - down to 25 m - then you don't need to worry about deflection shooting!'

When the gyro sight was perfected, no quesswork was needed. The sight presented an aiming mark which automatically allowed for range, deflection and gravity drop of the projectiles. As early as 1917 the basic theory of using a gyroscope as an aid to deflection shooting was propounded by W/Cdr L.J. Wackett, RFC. With him on the same station was Capt. (later Prof. Sir) Melville Jones, who was to be a leading member of the Farnborough gyro team 25 years later. The idea was later suggested by Dr L.B.C Cunningham of the RAF Education Branch. In 1936 he pointed out that mathematics could be used to solve any problem of dynamics; as an example he put forward the theory that even the complicated problem of air-to-air deflection shooting could be solved mathematically 'by using a gyroscope to offset the sight line from the gun line through an angle determined by the rate of turn of the sight line'. Although his pupils could not understand the implications of his theory (most of them had no idea what the angle of deflection was anyway), his observations did not go unnoticed.

In 1938, with the international situation worsening, the Air Staff arranged an exercise at Northolt in which all aspects of fighter combat were to be assessed. The Committee for the Scientific Survey of Air Defence, headed by Henry Tizard, appointed observers from Farnborough to advise on points of scientific importance which might be otherwise be overlooked.
Camera guns were fitted to many of the aircraft, and a squadron of Gladiators had just been fitted with some of the first batch of Mk II reflector sights. When exposed films from the camera guns were examined, it was found that although the pilots often got into positions to despatch their victims, very few had any idea of the amount of deflection needed.

A report on the findings was duly presented to Tizard, stating:

Although the new Spitfire and Hurricane fighters performed well, their effectiveness would be vastly improved if some means could be found to predict the amount of lead required to hit the target accurately. Many of the gun camera films proved that if the combats had been in earnest the enemy would have escaped unscathed.

The Air Staff were deeply concerned, and the Director of Farnborough was instructed to investigate the possibility of a predictor gunsight suitable for use in fighters and the gun turrets of bombers. The problem was to be given priority over all other work, no expense was to be spared and the utmost secrecy was to observed.

Dr Cunningham's theory depended on the fact that a gyroscope will resist any rotation of its axis. If a gyro is clamped onto a rod on which is fixed a ring and bead sight, any attempt to follow a crossing target will depend on the target's crossing speed. A gyro sight would have to present the marksman with a sight line held back by the gyro, whilst the line of flight and guns would be in front of this sight line. In other words, if the pilot kept to the sight line indicated by the gyro, his guns would automatically point correctly, in direct relation to the rate of turn.

By October 1939 two experimental sights of slightly different design had been fitted to a Hurricane and in the Frazer-Nash FN 25 under turret of the Wellington. The results of the trials were promising,

although the sights were rather primitive. By the summer of 1940 the RAE Dircetor was able to report to the Air Staff that a potentially operational sight, the Mk I GGS (gyro gunsight) was ready for testing. It was given the code name Type 6 mechanism.

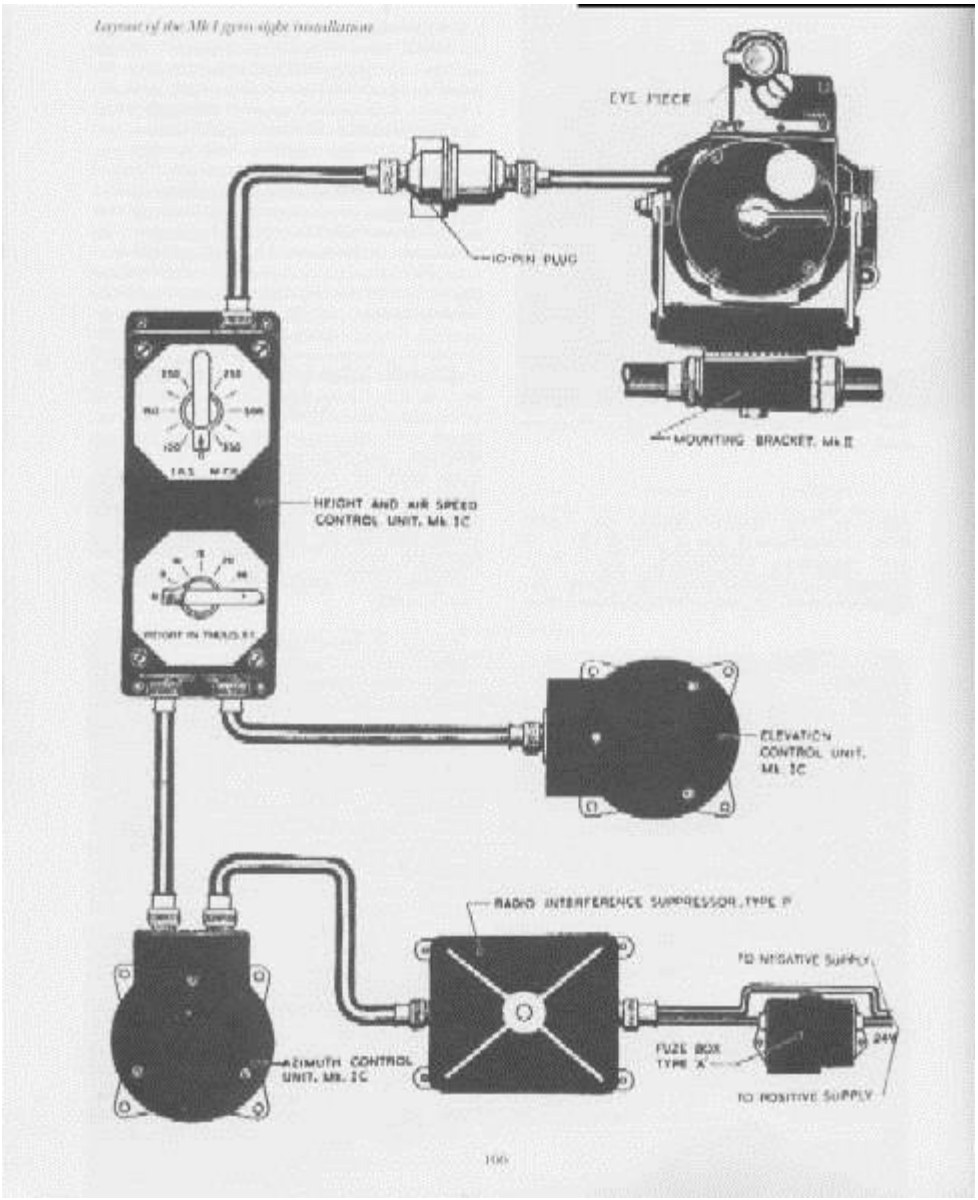
The Type 6 contained an electric motor driving a rotor mounted on a stem, the end of which actuated a linkage. Also fitted to the stem was a saucer-shaped aluminium dome surrounded by four electro magnets. The motor ran at a speed of 4,000 rpm, so the gyro resisted any angular movement of the housing. Such a movement tilted the axis of the stem and the linkage moved a celluloid strip in the optics of a GI primatic sight. A black ring was engraved on the end of the strip, so that the gunner saw two graticule rings, one fixed, the other on the celluloid.

In principle, the Mk I GGS was very similar to a rate-of-turn indicator which also used a gyro. In this, as the aircraft turned, the gyro held back the needle of the instrument, this deflection indicating, the force of the turn with a needle on a dial. In the GGS the gyro resistance was used to deflect the ring on the celluloid. The electro magnets allowed for host aircraft speed and height: the thinner the atmosphere, the less the bullets drop.

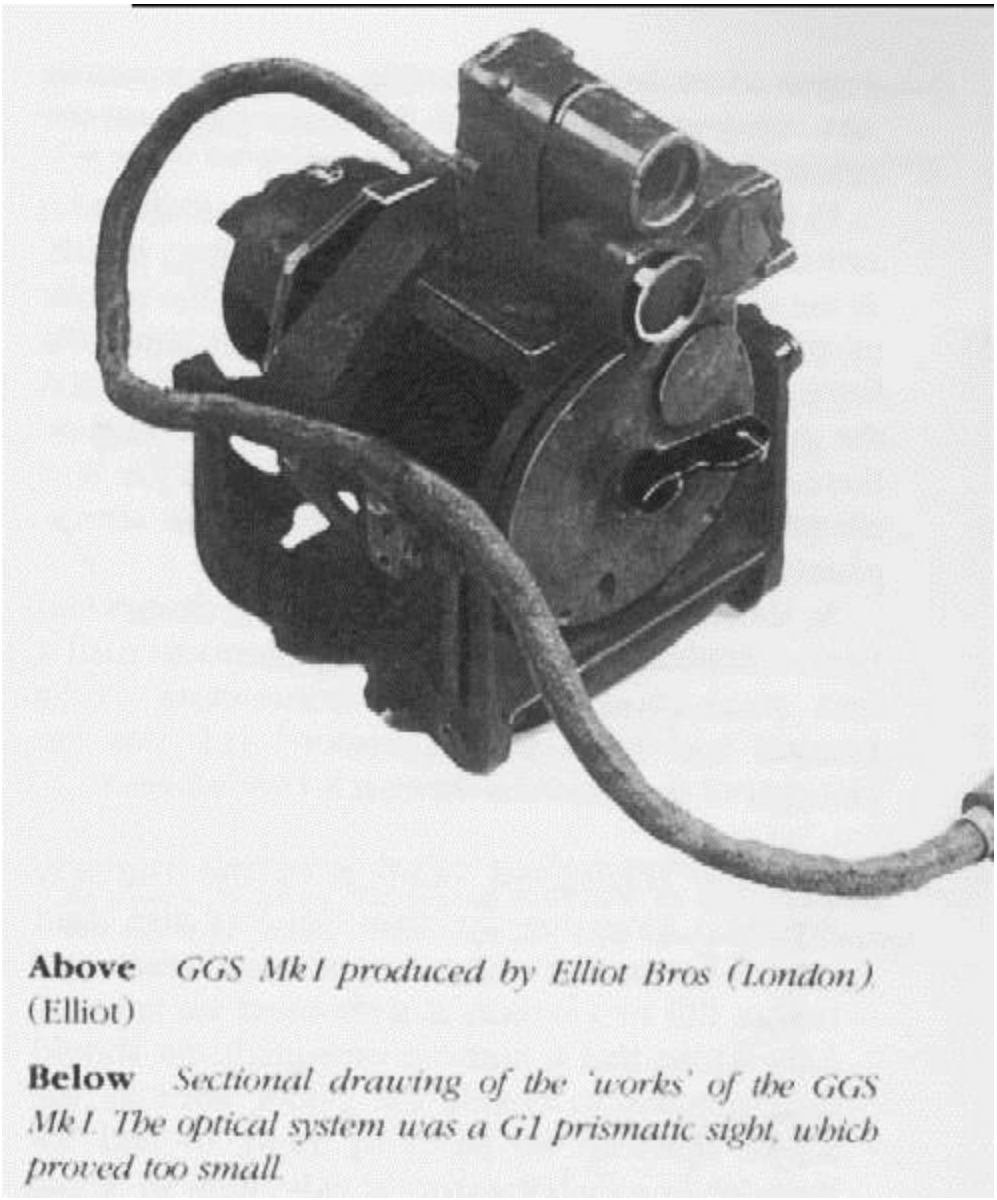
The above text and photos were taken from "British Aiorcraft Armament Vol.2: Guns and Gunsights", by R Wallace Clarke.

Regards

Bob



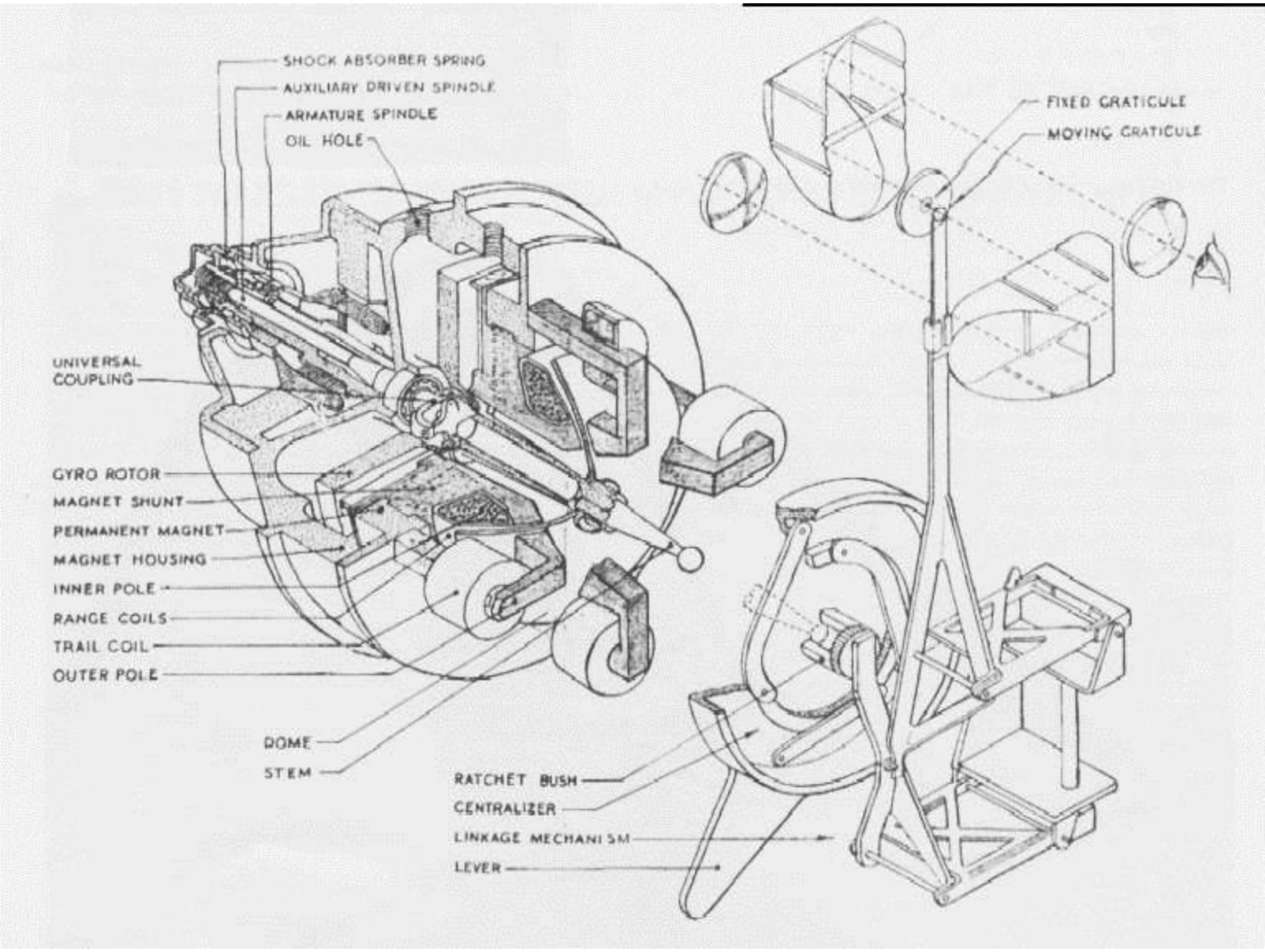
layout of Mk I gyro sight.jpg



Above *GGS Mk I produced by Elliot Bros (London)* (Elliot)

Below *Sectional drawing of the 'works' of the GGS Mk I. The optical system was a G1 prismatic sight, which proved too small.*

GGS Mk I.jpg



Sectional drawing of GGS Mk.I.jpg

Last edited by Robert Hurst on 22 Mar 2003 12:09; edited 1 time in total