AP 1730A

Vol 1 Chapter 9

Bomb Sight Mk XIV

1944

CHAPTER 9

BOMB SIGHT, Mk. XIV

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF APPENDICES

Note.—A list of contents is given, where necessary, at the beginning of each appendix.

LEADING PARTICULARS

Weight of computor unit, sighting head, and flexible shafts ...	85 lb.
Overall height of computor unit ...	20 in.
Overall length of computor unit ...	21 in.
Overall depth of computor unit ...	11 in.
Overall height of sighting head (collimator stowed) ...	$11\frac{1}{4}$ in.
Overall height of sighting head (collimator vertical) ...	$15\frac{1}{4}$ in.
Overall length of sighting head (collimator stowed) ...	$17\frac{1}{2}$ in.
Overall width of sighting head and bracket ...	$11\frac{1}{4}$ in.
Size of transit case for computor unit ...	$24\frac{3}{8}$ in. × $11\frac{1}{4}$ in. × $22\frac{3}{8}$ in.
Weight of transit case complete with computor unit ...	101 lb.
Size of transit case for sighting head ...	$21\frac{1}{4}$ in. × $12\frac{1}{4}$ in. × $10\frac{1}{4}$ in.
Weight of transit case complete with sighting head ...	32 lb.
Range of indicated wind speed scale ...	0 to 76 m.p.h.
Range of indicated air speed scale ...	120 to 300 m.p.h.
Range of indicated height scale ...	1,000 to 20,000 ft.
Effective height range ...	1,080 to 20,000 ft.
Range of target height scale ...	1,000 ft. below to 5,000 ft. above sea level
Range of bomb T.V. scale ...	1,000 ft. per sec.
Supply air pressure at jets ...	5·4 lb. per sq. in.
Supply air pressure to reducing valve ...	60 ± 5 lb. sq. in.
Suction required at each gyro ...	4·5 in. of mercury
Voltage ...	12 or 24 volts as stated on name plate

	Stores Ref.
Sighting head (without lamps) ...	9/2219
Mounting bracket for sighting head ...	9/2221
Switchbox, 12 volt ...	9/2286
Switchbox, 24 volt ...	9/2225
Course setting indicator ...	9/2544
Course control handle ...	9/2228
Course indicator ...	9/2340
Gyro pipe connections ...	9/2303
Air drier ...	6H/493
Adapter for air drier ...	6H/509
Bomb sight cock ...	6H/1950
Radio interference suppressor, Type P ...	5C/1002
Fuse box, Type E ...	5C/882
Fuse, Type S, 2·5 amp. (sighting head) ...	5C/879
Fuse, Type S, 5 amp. (computor unit) ...	5C/880
Filter unit for exhaust pipe ...	6H/1975
Filter for back cover of computor ...	6P/81 or 6P/658
Lamp, filament, 10-watt, Type A (for collimator) 12 volt ...	5L/1332
Lamp, filament, 10-watt, Type A (for collimator) 24 volt ...	5L/439
Lamp, filament, jack type, P.O. No. 3 (for drift scale of sighting head, computor unit, course indicator, and course setting indicator) 12 volt ...	5L/1150
Lamp, filament, jack type, P.O. No. 3 (for drift scale of sighting head, computor unit, course indicator, and course setting indicator) 24 volt ...	5L/1898
Levelling spigot (adjusting screw) ...	9/3350
Filter (gauze, felt, and fabric) for gyros ...	6P/658
Socket, Type N 153 (for computor) ...	104/407
Socket, Type M, 2-pin (for switch box) ...	5X/755
Plug, Type S, 5-pin (for distributor box) ...	5C/1030
Bombing angle computor T.V.1800 ...	9/3304
Bombing angle computor T.V.1500 ...	9/3305
Bombing angle computor T.V.850–1160 ...	9/3306
Levelling screwdriver ...	9/3478

(The Stores Ref. Nos. of items of equipment such as computor units, flexible shafts, etc., which are for use in particular types of aircraft are included in the appropriate appendix to this chapter.)

CHAPTER 9

BOMB SIGHT, Mk. XIV

GENERAL INFORMATION

Guide to the chapter

1. This chapter has to provide information for a variety of readers, such as bomb aimers, tradesmen, etc. It is therefore divided into a number of different parts, and readers should refer to the parts which they require. The chapter is divided as follows:—

- (i) GENERAL INFORMATION, containing general information about the sight: what it consists of, what it does, etc.
- (ii) INSTRUCTIONS FOR USE.
- (iii) LEVELLING THE SIGHT.
- (iv) HOW THE SIGHT WORKS.
- (v) and (vi) DESCRIPTIONS OF THE SIGHTING HEAD AND COMPUTOR UNIT MECHANISMS, describing from a functional point of view the parts not dealt with in (iv).
- (vii) Appendix 1, giving the latest information concerning the sight.
- (viii) Appendix 2, BOMBING THEORY; showing in general terms, without mathematics, the variables which must be taken into account to drop a bomb so that it will hit a target.
- (ix) Appendix 3, and subsequent appendices; giving particulars of the sight as fitted in different types of aircraft.

2. Readers will find the information with which they are concerned as follows:—

- (i) *Pilots* should read the general information and instructions for use.
- (ii) *Bomb aimers* should read the general information, instructions for use, levelling the sight, and bombing theory.
- (iii) *Electrical* and *armament officers, tradesmen,* and *instructors* should read the whole of the chapter. Instructors should note, however, that bomb aimers do not need to know the detailed internal construction of the sight or how it works.

Introduction

3. Experience has shown that two features, in addition to accuracy, are desirable in a general purpose bomb sight. First, the sight should not make it necessary to fly straight and level for more than the least possible length of time when approaching the target. Secondly, the number of settings and computations which must be made by the bomb aimer during flight should be reduced to a minimum so that all his attention can be given to releasing the bombs at the correct moment.

4. The bomb sight, Mk. XIV, satisfies both these requirements. When using the sight the bomb aimer sees a graticule in the form of a sword-shaped cross moving over the ground and, at any time during a bombing attack, the point on the ground covered by the cross represents the point of impact of a bomb released at that instant. Avoiding action can be taken, therefore, almost up to the instant of release and bombs can be released, if required, while making a correctly banked turn or when gliding* or climbing.

5. The simplicity of using the Mk. XIV is shown by the fact that only five settings have to be made, and that all these settings can be made before flight although wind speed and direction must be re-set in the target area. The bomb aimer is free, therefore, to concentrate solely on identifying the target, directing the pilot, and releasing the bombs. Any alterations in height, air speed, or course are automatically accounted for by the sight, and all the bomb aimer has to do is to direct the pilot so that the graticule passes over the target.

General description, fig. 1, 2, 3, 4, and 5

6. The bomb sight consists of two main components, a sighting head, see fig. 1, which is mounted in the nose of the aircraft in the position normally occupied by the bomb sight. and a rectangular box, called the computor unit, see fig. 4, which may be some distance away from the sighting head. The graticule seen moving over ground by the bomb aimer comes from the sighting head, as will be described later. The computor unit is the "brains" of the sight and controls the position of the graticule on the ground through two flexible shafts which connect the computor to the sighting head.

Sighting head, fig. 1, 2, and 3

7. The bomb aimer looks at the ground through a piece of plain glass called the reflector. The graticule is projected on to the reflector by a collimator and the bomb aimer must move his head

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* The term "glide" is used throughout this chapter for flight in which the fore-and-aft axis is inclined downwards, irrespective of whether the engines are used or not.

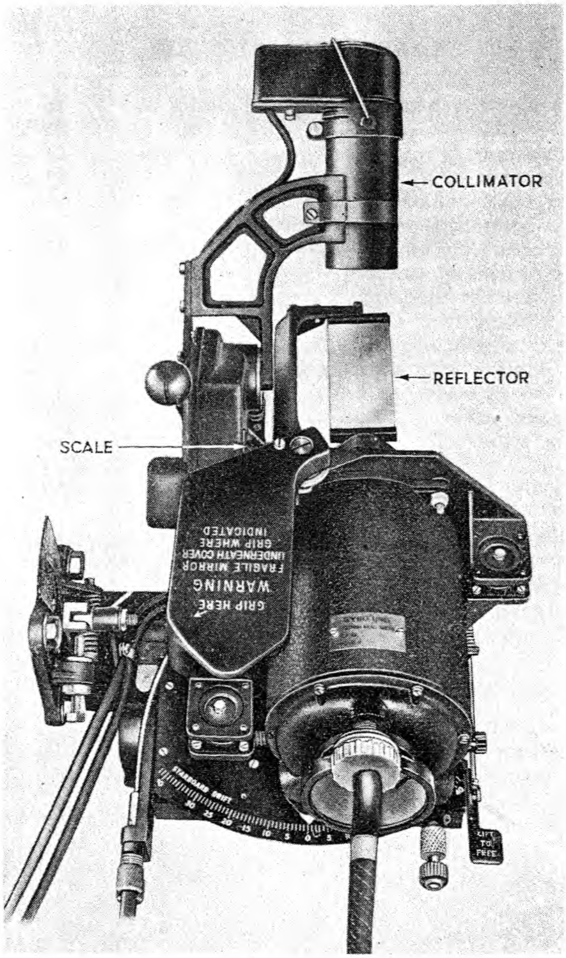


Fig. 1.—Bomb aimer's view of the sighting head

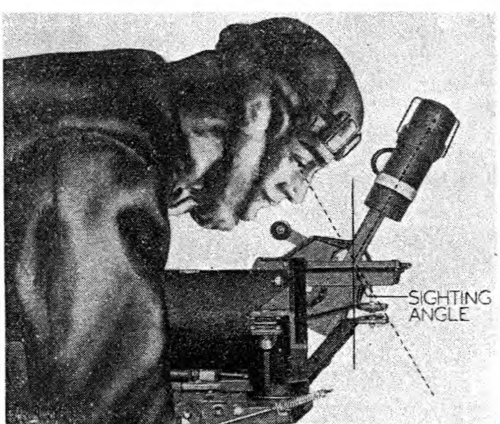


Fig. 2.—Sighting head in use

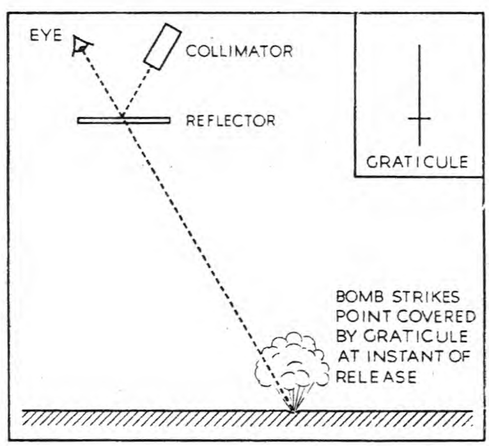


Fig. 3.—Line of sight

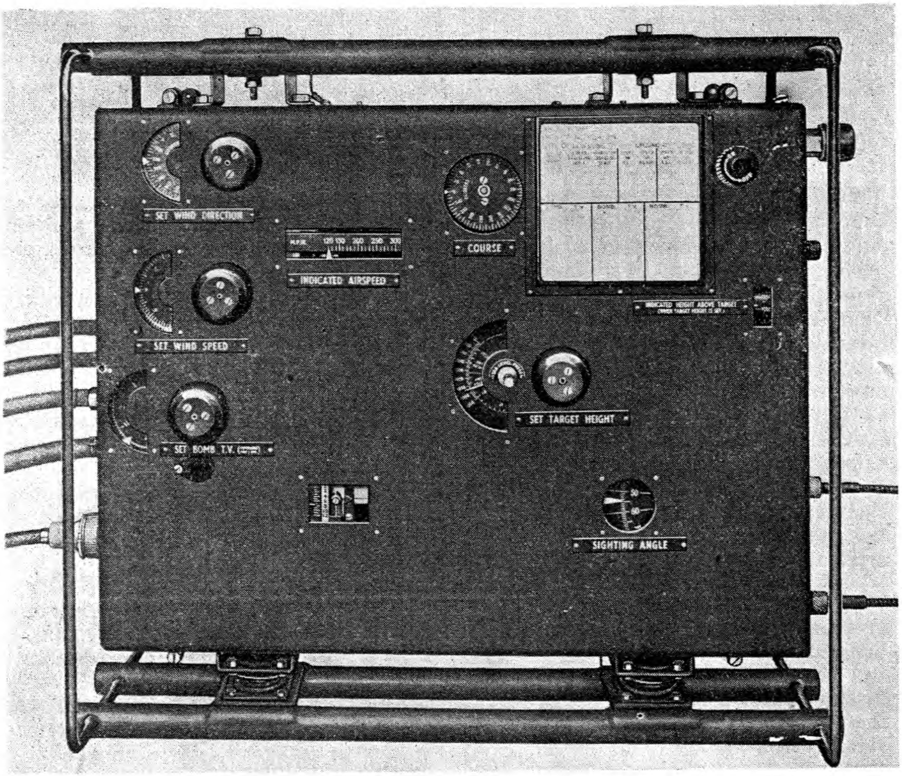


Fig. 4.—Computor unit

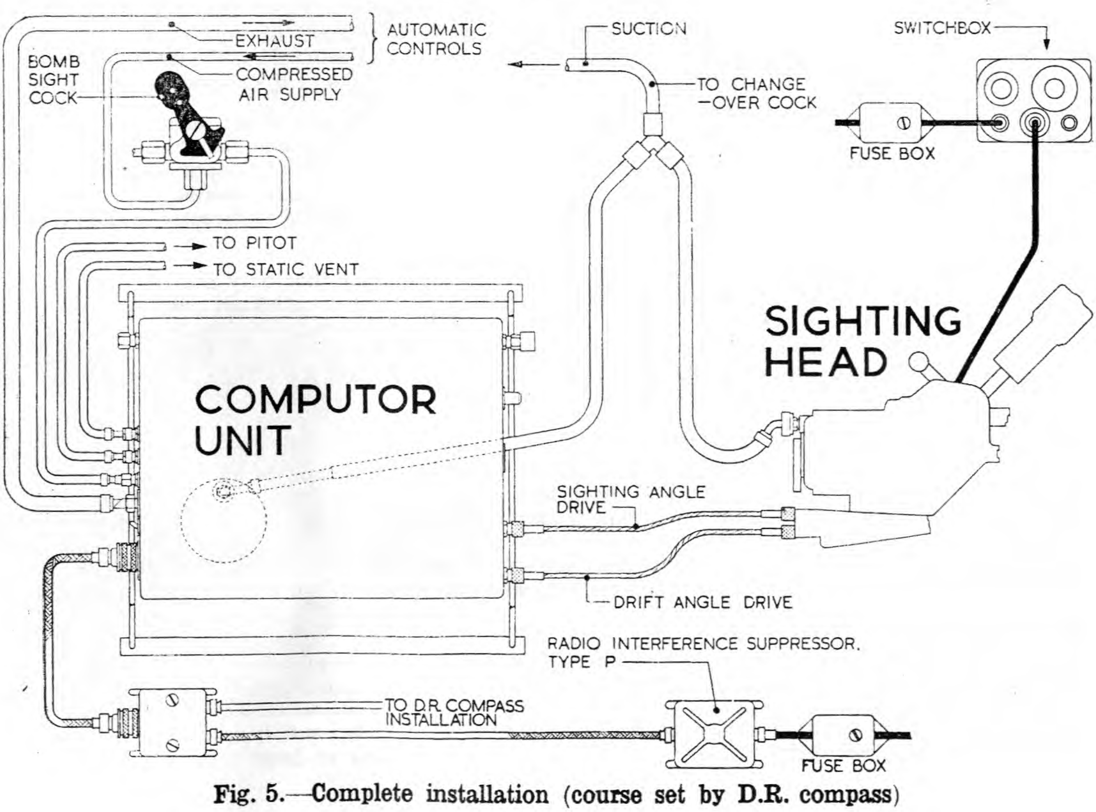


Fig. 5.—Complete installation (course set by D.R. compass)

Emergency use, fig. 6 and 16

22. If the computor unit becomes unserviceable but suction and electric current are available at the sighting head, bombs can be released using the sighting head and a hand-held emergency computor. Both flexible shafts are unscrewed from the sighting head, and a sighting angle hand-setting knob is screwed on in place of the upper flexible shaft. The sighting angle is found by using the emergency computor shown in fig. 16. A circular disc is secured on each side of the computor, one side being calibrated in knots and the other in miles per hour. Indicated ground speed marked on the appropriate disc is set against rectified I.C.A.N. height above the target. The sighting angle for the particular air speed at which the aircraft is flying can then be read in the opening in the circular disc. Using the hand-setting knob, this angle is set on the sighting angle scale. The drift angle for the course upon which the attack is made is found using the navigation computor, Mk. III, and is set by turning a drift hand-setting knob on the right-hand side of the sighting head.

Note.—(i) Rectified air speed is indicated air speed corrected for instrument and position errors but not for height or temperature.

(ii) Indicated ground speed is obtained from the navigation computor, Mk. III, using "indicated" wind and rectified air speed.

(iii) The emergency computor is calibrated for bombs having a T.V. of 1,440 ft. per sec.

(iv) Do not confuse the emergency computor with the bombing angle computor, which is for normal and not for emergency use. (See Appendix 7.)

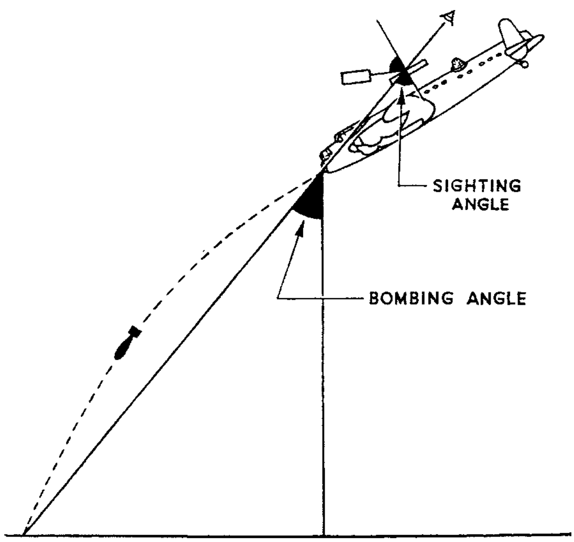


Fig. 17.—Sighting angle and bombing angle

Note on "sighting angle", fig. 17

23. The term sighting angle is used in a special way in connection with the Mk. XIV. The Mk. XIV sighting angle is not the same as the bombing angle and it is not the same as the sighting angle referred to in connection with tachometric sights. The bombing angle is the angle between the vertical and the line of sight set up by the bomb sight, see fig. 17. The Mk. XIV sighting angle is the angle between the line of sight and a line perpendicular to the reflector, see fig. 2. This is the same as the angle between the line which joins the graticule with its image on the reflector surface, and a line perpendicular to the reflector. The difference between the sighting angle and the bombing angle is seen most clearly when the aircraft is gliding, as shown in fig. 17. The sighting angle referred to in connection with tachometric sights such as the automatic bombsight, Mk. II, and the Sperry 0-series sights, is the angle between the vertical and a line joining the bomb aimer's eye to the target.

Before flight

24. Switch on the graticule lamp. Check that the graticule can be seen and that it is clearly defined.

25. Check that the reflector is clean. *The reflector must not be touched while the gyro is running.*

26. If course is fed into the computor by the D.R. compass, check that the course dial indicates the master unit reading plus the "A" error, if necessary press in the synchronising knob and turn until it does. If course is set by hand, check that the course dial agrees with the course indicator; if necessary turn the course indicator dial until it does.

Test flight

27. The sight cannot be satisfactorily tested on the ground without special equipment. The sight should therefore be tested in the air before each operational flight, as in the following para. 28 to 34.

28. Check that the reflector settles to an apparently horizontal position in straight flight.

29. Turn on the bomb sight cock; where air is obtained from the automatic controls, the pilot must first turn the main control cock to OUT.

30. Switch on the computor switch.

31. Check that the height mechanism is functioning, as follows:—

(i) Set zero TARGET HEIGHT to the barometric pressure, as set on the pilot's altimeter (The computor now measures height above sea level.)

(ii) Check that the INDICATED HEIGHT ABOVE TARGET shown on the computor agrees approximately with the reading of the pilot's altimeter.

32. Check that the INDICATED AIR SPEED shown on the computor agrees approximately with the pilot's air speed indicator at cruising speed.

Note.—At very high and very low speeds these may differ by as much as 10 m.p.h. The indicated air speed which should be shown on the computor for certain A.S.I. readings is shown on the levelling card on the front of the computor, see fig. 4 and 19.

33. With the aircraft flying straight and level at the levelling speed for the particular type of aircraft, check that the glide datum line is opposite the arrow and that the bubble on the sighting head is central. If they are not, the sight must be re-levelled.

Note.—The glide datum line and bubble may not be exactly central if the computor has been levelled for the all-up weight of the aircraft at bomb release and the all-up weight on the test flight is different from this.

34. Check, as follows, that the correct sighting angle is being transmitted by the computor to the sighting head:—

(i) Find rectified air speed, that is, indicated air speed corrected for instrument and position errors.

(ii) On the emergency computor, set rectified I.C.A.N. height above the ground against rectified air speed.

(iii) From the opening on the emergency computor, read the sighting angle for the particular rectified air speed.

(iv) Set zero wind speed on the computor unit.

(v) Set T.V. to 1,440 ft. per sec. on the computor unit. (This is the T.V. for which the emergency computor is calibrated.)

(vi) Check that the sighting angle set on the sighting head and computor unit is within 2 deg. of that obtained from the emergency computor. If the sighting angle is not within 2 deg. the computor unit is unserviceable

Bombing

Before flight

35. Before flight set:—

(i) Met. WIND SPEED } (see para. 55 and 56).
(ii) Met. WIND DIRECTION }
(iii) BOMB T.V.
(iv) TARGET HEIGHT to sea level pressure (at target).
(v) LEVELLING SCALES for all-up weight (see para. 68).

When approaching target area

36. Turn on the bomb sight cock; where necessary the pilot must first turn the main control cock of the automatic controls to OUT.

37. Switch on the computor.

38. Switch on the graticule.

39. Re-set WIND SPEED and WIND DIRECTION in accordance with the latest available data (see para. 55 and 56), and check the reading of the course dial.

Bombing run

40. If the bomb sight is not connected to a D.R. compass, a second member of the crew must keep the course setting indicator matched with the pilot's directional gyro.

41. Give the pilot the necessary instructions to bring the target down the drift line of the graticule. Release the bombs when the target reaches the cross-line of the graticule.

Note.—The collimator handle is used to extend the drift line to pick up a distant target. The handle *must* be released to take up its own position before deciding the moment of release.

After bombing

42. Switch off the computor and turn off the bomb sight cock.

Wind finding

43. Two methods can be used for finding drift, as follows:—

(i) Set any high wind speed and rotate the wind direction knob until objects on the ground appear to move parallel to the drift line of the graticule. Note the reading on the drift scale. Wind speed and direction must be re-set after wind is found.

(ii) Free the upper part of the sighting head by raising the release lever on the right-hand side of the sighting head. Rotate the upper part by hand to pick up drift. Note the reading on the drift scale. When wind is found, lower the release lever and rotate the upper part until it engages with the mechanism which sets drift automatically.

44. With two or three drifts found as described above, preferably on courses at 120 deg., wind speed and direction can be found in the usual way using the navigation computor, Mk. III. Course and indicated air speed can be read from the computor unit.

Emergency use

45. If the computor unit becomes unserviceable, bombs can be released using the sighting head and the hand-held emergency computor. The sighting angle is found from the emergency computor as follows:—

(i) Find rectified air speed, that is, indicated air speed corrected for instrument and position errors.

(ii) Find wind speed and direction.

(iii) Find indicated wind by subtracting 1½ per cent. per 1,000 ft. of height from true wind.

(iv) Find indicated ground speed, using rectified air speed and indicated wind speed.

(v) On the emergency computor, set rectified I.C.A.N. height above the ground against indicated ground speed.

(vi) From the opening on the emergency computor, read the sighting angle for the particular rectified air speed.

46. The settings are made on the sighting head as follows:—

(i) Unscrew the flexible shafts from the sighting head and screw the hand setting knob on in place of the upper shaft.

(ii) Set drift, obtained from the navigation computor, by turning the drift hand setting knob on the right-hand side of the sighting head.

(iii) Set the sighting angle obtained from the emergency sighting angle computor as described above by turning the hand setting knob.

(iv) Release the bombs in the usual way.

Use of the sight above 20,000 ft.

46A When the sight is used above 20,000 ft., release of the bombs should be delayed after the release line has reached the target, as follows (see para. 112B to 112E):—

Height	*Delay*
20,000–21,000 ft.	zero
21,000–25,000 ft.	1·0 sec.
25,000 ft. upward	1·5 sec.

Summary

Before flight

47. Set:—

(i) WIND SPEED (met.).

(ii) WIND DIRECTION (met.).

(iii) BOMB T.V.

(iv) TARGET HEIGHT against sea level pressure.

(v) THE LEVELLING SCALES.

When approaching target area

48. (i) Where necessary, pilot turns main control cock to OUT.

(ii) Turn on the bomb sight cock.

(iii) Switch on the graticule.

(iv) Switch on the computor.

(v) Re-set WIND SPEED and DIRECTION

(vi) Check COURSE.

Bombing run

49. (i) Second member of crew matches course indicator, unless D.R. compass is fitted.

(ii) Give necessary instructions to pilot.

(iii) Release bombs.

After bombing

50. (i) Switch off computor.

(ii) Turn off the bomb sight cock.

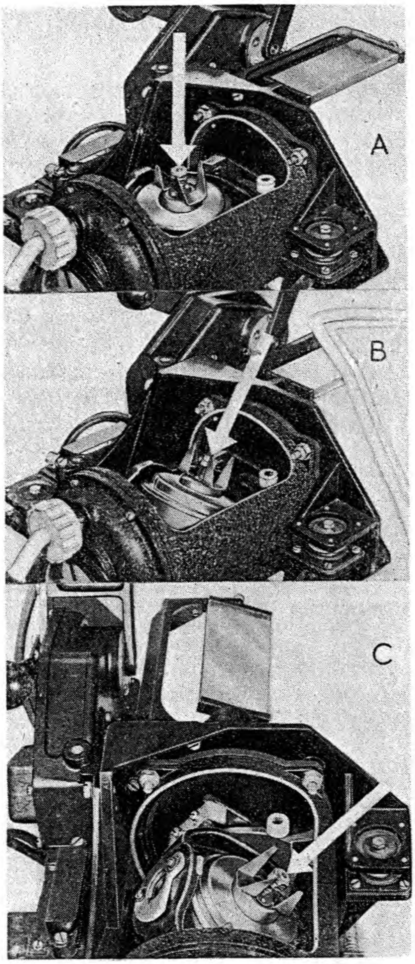


Fig. 18.—Effect of touching reflector

A.—Axis of gyro normally vertical

B.—Axis tilts if reflector is touched but reflector remains horizontal

C.—Reflector tilts if course is changed

General notes

Setting target height

51. A sea level pressure setting knob is provided on some computors on the left of the target height setting knob, see fig. 4. It was intended that this sea level pressure setting knob should be first turned until the pointer indicated sea level pressure, and that target height should then be set to the pointer. It is easier, however, to turn the pointer out of sight and set the target height directly to sea level pressure.

Switching on and off

52. An automatic safety switch is incorporated in the computor to switch off the electric current if the air supply fails. This switch must not be made to operate unnecessarily. When switching on, therefore, the bomb sight cock must be turned on before the computor is switched on, and, when switching off, the computor must be switched off before the bomb sight cock is turned off.

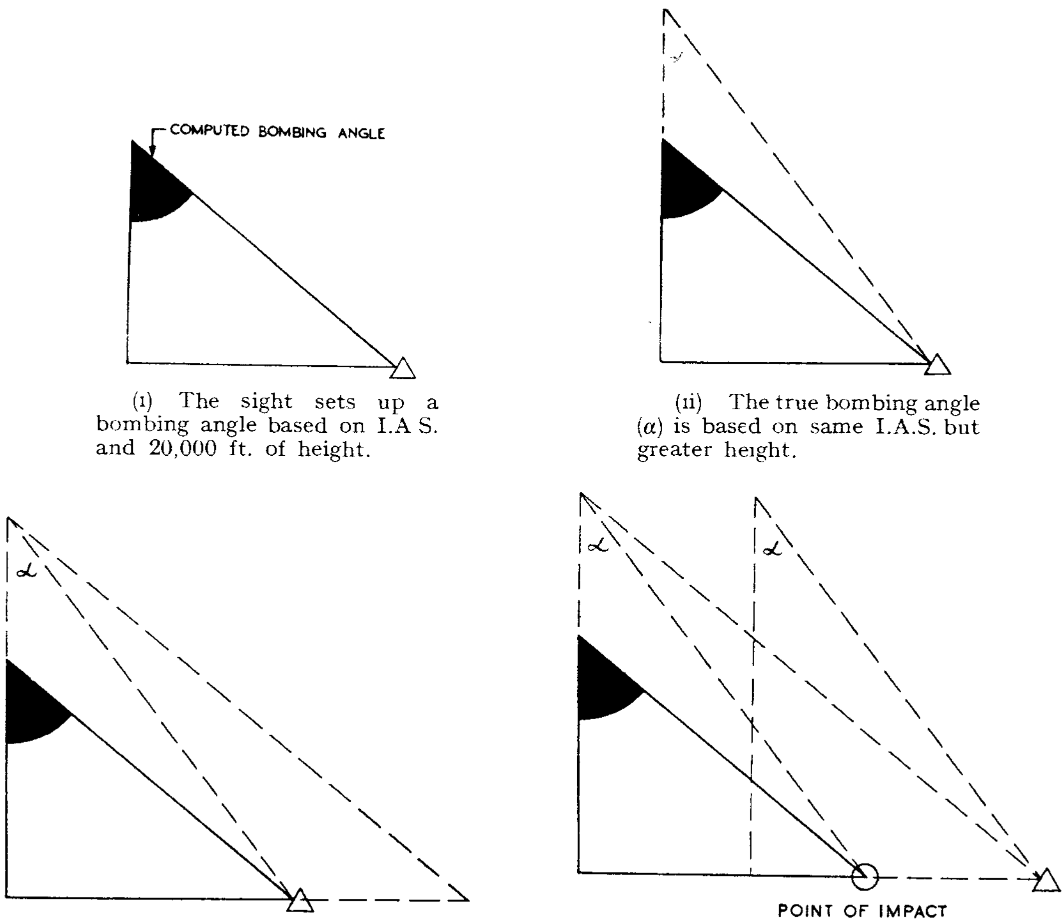
Reflector, fig. 18

53. The slightest pressure on the reflector is sufficient to render the sighting head inaccurate for some time, and great care must be taken that it is not touched accidentally, for example, by the edge of a map. The axis of the gyro in the sighting head is normally vertical, as shown at A in fig. 18. If a map touches the reflector, as shown at B, the axis of the gyro becomes tilted, but the reflector remains horizontal *so long as the aircraft keeps on the same course.* If a turn is made, the reflector rotates as shown at C, and the sighting plane is no longer vertical. It takes the gyro some time to re-erect after it has been disturbed; if the pressure on the reflector is such that the gyro topples, that is, if it tilts so much that the top of the gyro touches the ring within which it is mounted, it will take 15 min. to re-erect.

112A. There is a second error due to temperature. Extremes of cold, for instance, may so affect the metal of an instrument that calibrations which are accurate at sea level are no longer accurate at the given height. While this variation is negligible in the air speed unit, it is a source of considerable error in the height unit. For this reason the so called exhausted bellows are not completely evacuated but have in them a small quantity of air The presence of this air compensates for the average error.

Use of the sight above 20,000 ft.

112B. When the Mk. XIV is used above 20,000 ft , the upper limit of its height range, the sighting angle it computes is obviously incorrect. For any given air speed the bombing angle set up by the sight will be too large by an amount depending upon the extra height at which the aircraft is flying, therefore the bomb will be released too soon and will fall short of the target. The only



(i) The sight sets up a bombing angle based on I.A S. and 20,000 ft. of height.

(ii) The true bombing angle (α) is based on same I.A.S. but greater height.

(iii) The sighting line projects beyond the target at correct instant of release.

(iv) Bomb, released at moment graticule reaches target, falls short.

Fig. 28A.—Premature release of bomb due to excessive size of bombing angle

practicable way of increasing accuracy in bombing at such a height is to delay the release of the bomb by a specified time after the release line of the graticule has crossed the target. Using an ideal bomb, this time delay increases up to a height of 28,000 ft , but above that height begins to decrease again until it reaches zero at 36,000 ft. The reason for this apparently paradoxical fact is the rapid fall of density at heights above 25,000 ft.

112C. At heights up to 20,000 ft., at which the height unit functions normally, the height registered is modified by the cut of the height blade. This modification compensates for the mis-reading of air speed by the air speed unit, due to changes in density at different heights. That is to say, air speed is unavoidably underestimated by the computor, and in order that the correct bombing angle should not be destroyed, height is deliberately underestimated by a proportional amount. In fig. 28B, AB is made shorter than it should be, because AC is an under-reading. BC is then parallel to the true line of sight.

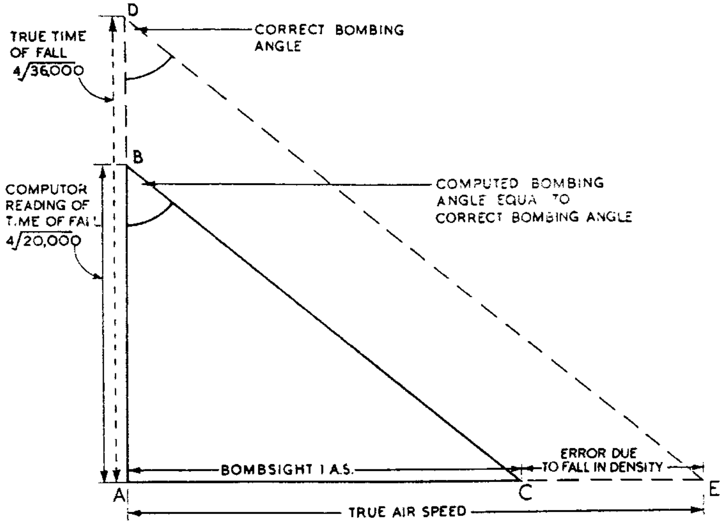


Fig. 28B.—Compensation for density error makes indicated height 20,000 ft.

112D. At 36,000 ft. the density of the air has decreased so much that the sight would have to register as little as 20,000 ft. in height in order to compensate for the excessive under-reading of air speed; therefore the bombing angle set up by the computor is correct for that height.

112E. The amount of time delay required varies with the speed of the aircraft, and the T.V. of the bomb. The figures already specified for the heights at which time delay is at its peak, and returns to zero, apply only to ideal bombs, that is, to bombs with infinite T.V., not subject to air resistance. The lower the T.V. of a real bomb, the greater the height at which the density of the air is so little that delayed release is unnecessary. The exact figures are given in the following table but for practical use these simplified rules should be followed —

	Height	*Delay*
Time delay:	20,000–21,000 ft.	zero
	21,000–25,000 ft.	1·0 sec.
	25,000 ft. upwards	1·5 sec.

Theoretical Time Delay in Seconds

Height in ft.	Rectified A.S. m.p.h.	AU	150	250	150	200
	T.V. m.p.h.	∞	1000	1000	1400	1400
20,000		0	0·4	0·3	0·2	0·2
25,000		1·0	1·6	1·5	1·3	1·3
30,000		1·15	2·0	2·1	1·7	1·8
35,000		0·45	1·6	2·1	1·4	1·3

Note.—Even when these allowances are made, the approximations embodied in the bomb sight are so exaggerated above 25,000 ft. and increase so rapidly at about that height, that serious errors are caused on the ground. It should also be noted that a second pump is needed to keep the suction at the right pressure when the sight is used above approximately 25,000 ft.

Gyro unit, fig. 28, 31, and 32

121. This unit is similar in principle to the gyro unit of the artificial horizon. The gyro is suction driven, air being withdrawn from the case through the pipe leading from the back of the unit; air enters through a circular filter on the back of the case, see fig. 6. From the filter it passes through

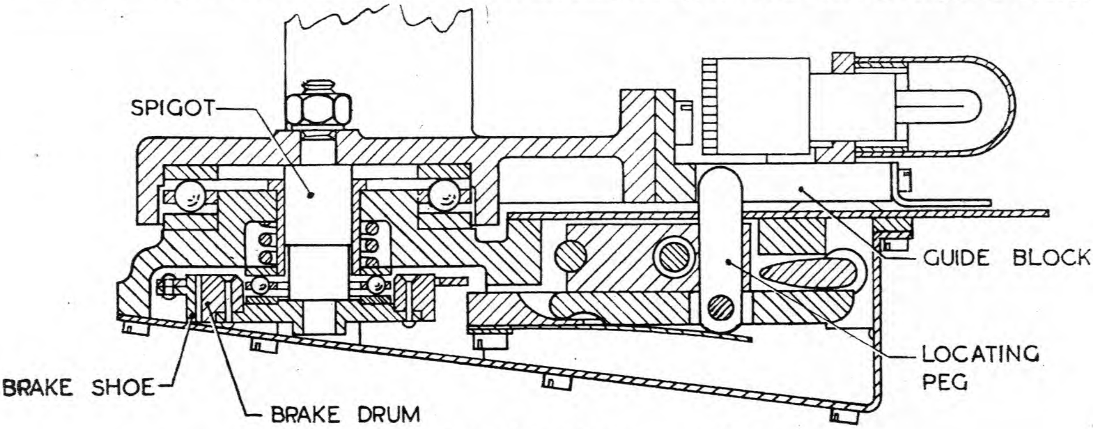


Fig. 30.—Section through brake drum and locating peg

the bearing of the outer gimbal ring along a channel cut in the ring and then through the bearing of the rotor case. It next passes along two channels cut in the rotor case, and impinges on buckets in the gyro rotor, which is thus made to rotate. The air leaves the gyro through four ports in the lower part of the rotor case and is withdrawn along the suction pipe.

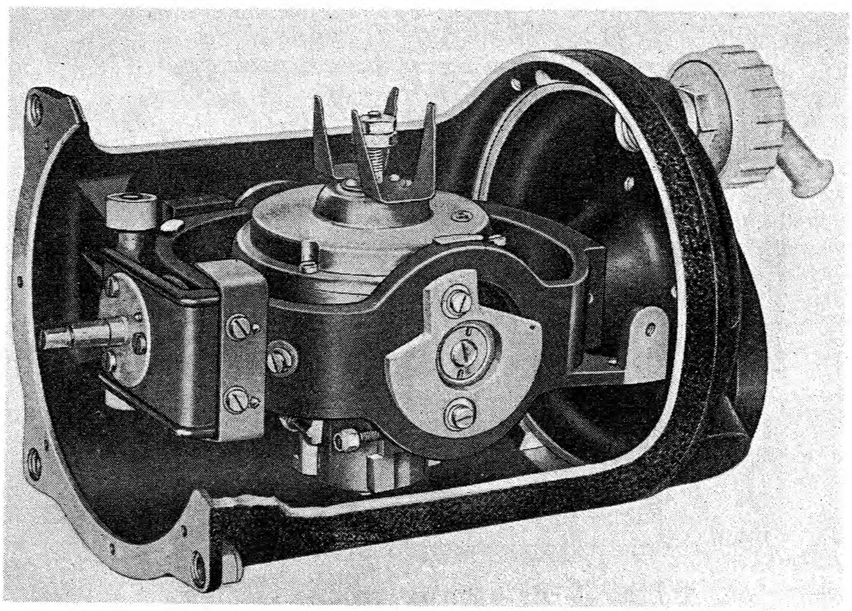


Fig. 31.—Sighting head gyro

122. The gyro is erected by the movement of four pendulous vanes which partly obstruct the ports. If the gyro is not fully erected the vane on one side will obstruct its port more than the opposite vane obstructs its port. Less air issues through the first port and the reaction on the gyro from this stream of air is less than the reaction on the opposite side. The gyro is therefore precessed until the reactions at opposite ports are equal, and when the reactions are equal the gyro is fully

erected. When fully erected, the axis of the gyro is not vertical but is inclined so that the top of the gyro is forward of the vertical and towards port. The gyro axis is about $2\frac{1}{2}$ deg. forward from the vertical and about $1\frac{3}{4}$ deg. off the vertical towards port. The reason for this inclination is that the effect of centrifugal acceleration in turns is less on a gyro having an inclined axis than on a gyro which has a vertical axis.

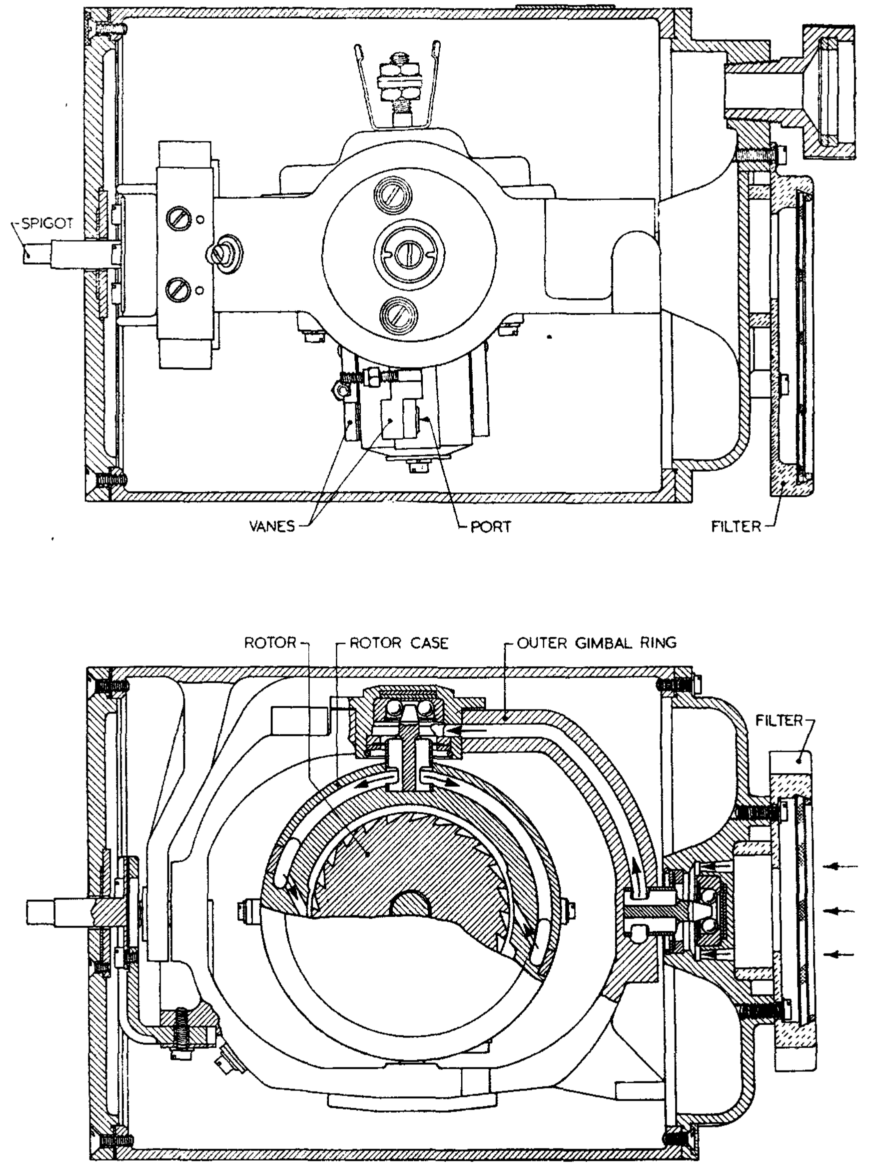


Fig. 32.—Sections through sighting head gyro

123. The outer gimbal ring, which remains horizontal when the aircraft banks, is connected to the reflector unit by a projecting spigot which is in line with the fore-and-aft axis of the ring. The spigot is mounted on a lug on the ring and projects through the case into the reflector unit. The spigot does not serve as a bearing for the ring, but merely enables the reflector to be linked to the ring. If the aircraft banked more than 80°, one end of a stop at the forward end of the outer gimbal ring would come into contact with a rubber-covered lug on a projection from the gyro case. The aircraft should not bank more than 60°, however, as the freedom allowed the gyro in the computor unit is only 60°.

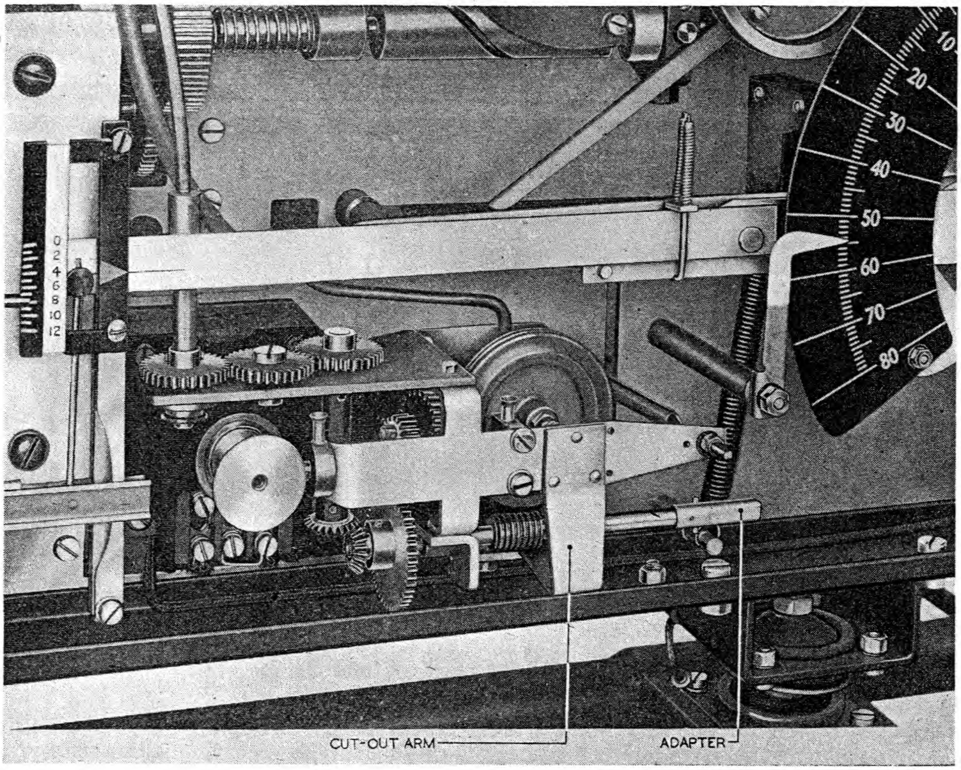


Fig. 49.—Drift angle servo motor assembly

40 deg. When this amount of drift is set, a pin on the gear driven by the worm is brought into contact with a lip on the end of a cut-out arm; the pin comes into contact with the outside or inside of the lip depending on whether 40 deg. port or starboard drift is set. As the lip is moved by the pin, the cut-out arm moves the pivot arm so that the tyre is moved out of contact with the flange of the bobbin and the servo is brought to rest.

Ground speed mechanism, fig. 36 and 61

152. The construction of the ground speed mechanism can be seen from fig. 61 (dark blue) and from fig. 36. The steel tape is kept in tension by a long spring which passes along inside the ground speed slider tube, part number 32 in fig. 61, and is secured at the left-hand end of the tube. A compensating spring, not shown in fig. 61, is secured to the wind pin, passes over a pulley and then passes along the front flange. The pulley and part of the spring can be seen in fig. 36. A mark scribed on the ground

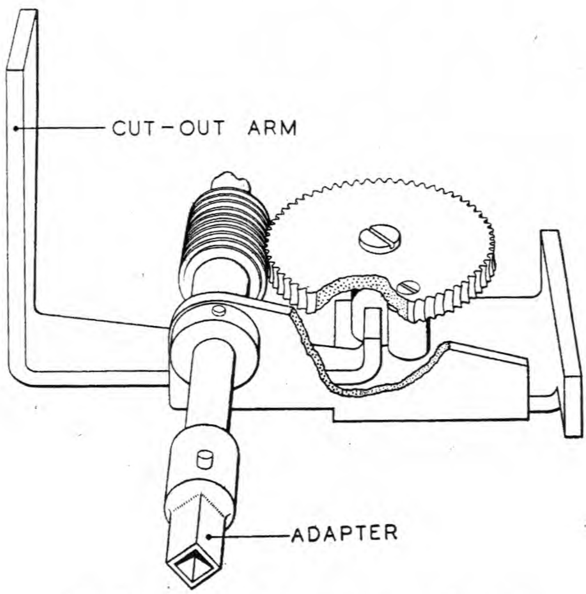


Fig. 50.—Drift angle cut-out mechanism

speed shaft and a pointer on the base plate are used when tuning the computor. The mark is opposite the pointer when ground speed is 200 m.p.h., that is, for example, when air speed is 200 m.p.h. and zero wind is set.

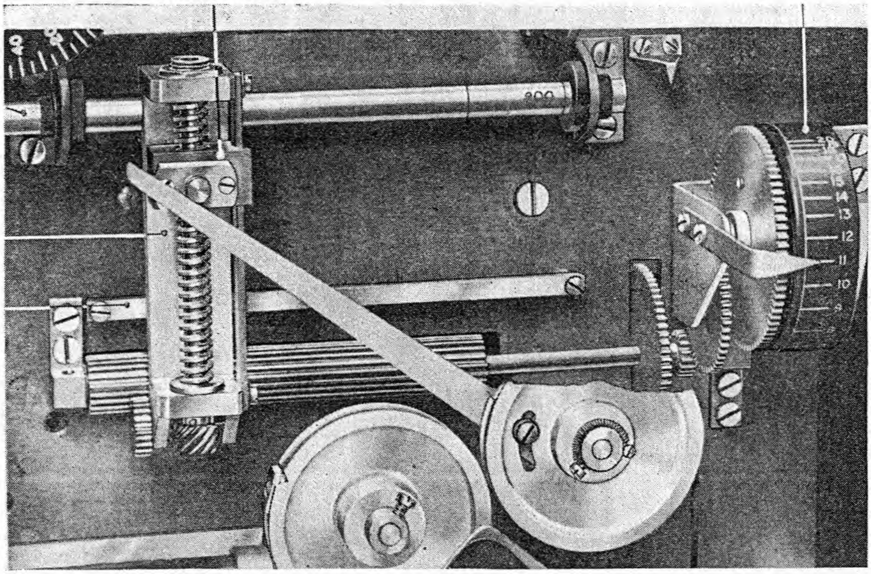


Fig. 51.—Height carriage and drum

Height carriage, fig. 51

153. The drive from the altas unit is taken to the height carriage by a gear which projects through an opening in the base plate. A guide strip on the base plate engages with a fork on the back of the carriage and prevents the carriage from swinging away from the base plate. A similar vertical guide strip on the right-hand side of the carriage prevents the height nut from rotating.

Height drum safety switch, fig. 52

154. The height interrupter blade is shaped so that the height servo does not function when a height below 1,080 ft. is registered. At this height the height nut is nearly touching the bottom of the height carriage. If either of the jets becomes stopped with dirt, the effect is the same as if the blade is between the jets, and the height nut would be jammed against the bottom of the carriage. To avoid this, a safety switch is mounted within the height drum and this switch breaks the circuit through both servo motors if a height of less than 1,080 ft. is recorded. Normally, therefore, the switch does not come into operation, as the servo does not record heights of less than 1,080 ft., but if the jets become clogged, the switch functions and prevents the mechanism from being damaged. The switch is very simple in construction, consisting of two contacts which are separated by a pin pressing against one of them. The pin is secured to the drum and is adjusted so that the contacts are separated when the drum registers a little less than 1,080 ft. This tolerance prevents the contacts breaking whenever the computor hunts about the lower "at rest" position.

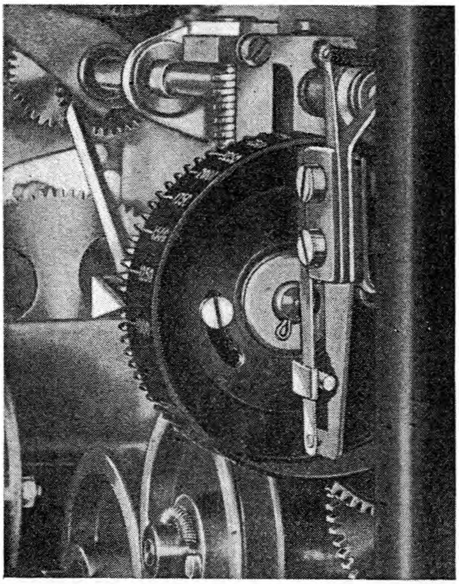


Fig. 52.—Height drum safety switch

Sighting angle mechanism

Ideal bombing angle pulley, fig. 51

The screw securing the upper tangent arm to the pulley passes through a slot in the pulley.

APPENDIX 3

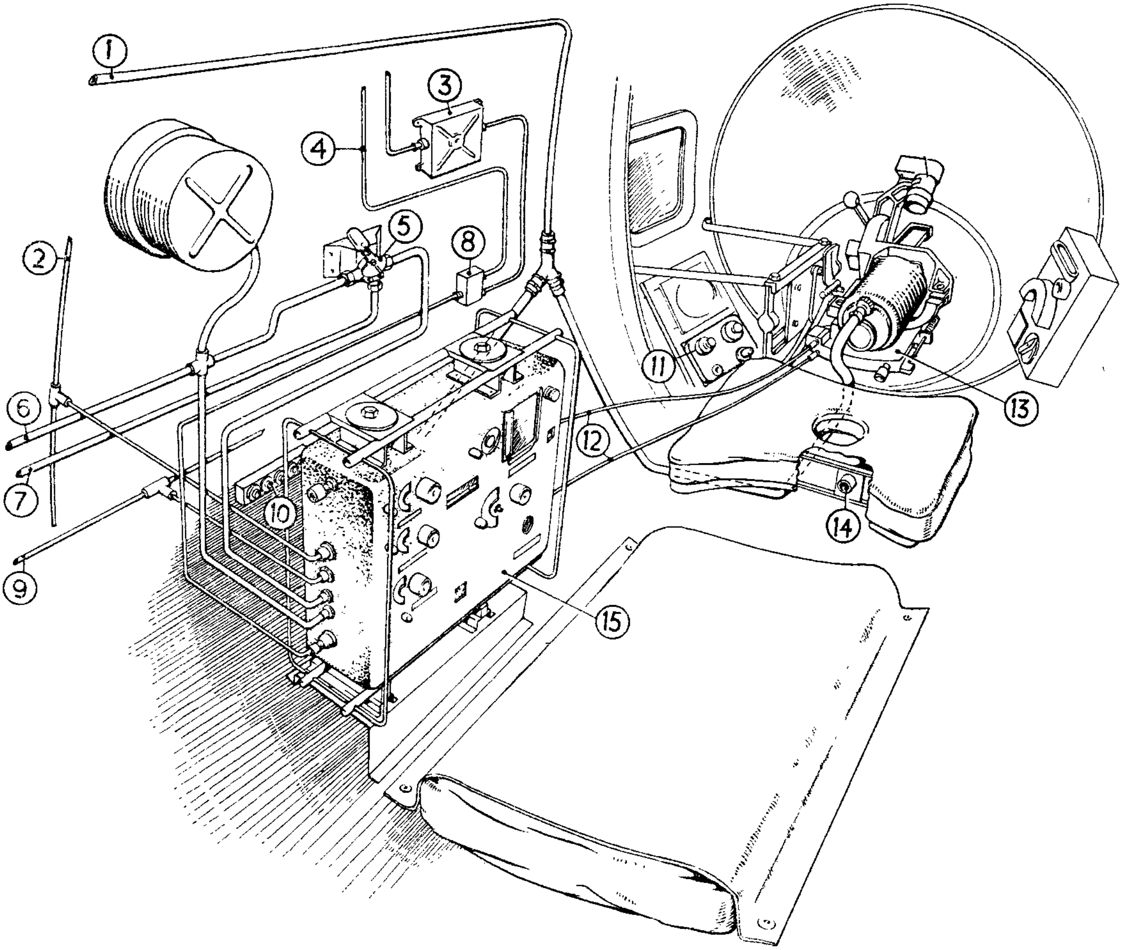
Bomb sight, Mk. XIV, installation in the Lancaster

Leading particulars

1. Levelling speed	For Type Y computors, Stores Ref. No. 9/2636.	...	190 m.p.h. (rectified)
Levelling factor		...	0·11
Levelling speed	For Type B computors, Stores Ref. No. 9/2326.	...	145 m.p.h. (rectified)
Levelling factor		...	0·18

	Stores Ref.
Computor unit, Type Y, 24 volt, complete with lamps ...	9/2636
Computor unit, Type B, 24 volt, complete with lamps (early type) ...	9/2326
Flexible shafts, Type A, length 3 ft. 2 in. ...	9/2335
Emergency computor for Type Y computor ...	9/2648
Emergency computor for Type B computor ...	9/2618

Note.—Stores Ref. numbers of other components used on this installation are given in the leading particulars following the list of illustrations to Chap. 9.



1—SUCTION (TO CHANGE-OVER COCK)
2—STATIC (TO STATIC VENT)
3—RADIO INTERFERENCE SUPPRESSOR
4—CONNECTION TO D.R. COMPASS
5—BOMB SIGHT COCK
6—EXHAUST (AUTO. CONTROLS)
7—COMPRESSED AIR SUPPLY (FROM BOMB SIGHT AIR DRIER)
8—DISTRIBUTION BOX
9—PITOT (TO PITOT HEAD)
10—STOWAGE FOR SERVICES TO COMPUTOR
11—SWITCHBOX
12—FLEXIBLE SHAFTS
13—SIGHTING HEAD
14—STOWAGE FOR SIGHTING HEAD SUCTION PIPE
15—COMPUTOR UNIT

Fig. 1.—General arrangement of the bomb sight installation

Note.—Positions of components approximately correct; run of pipes and cables diagrammatic only.

General description, fig. 1

2. The general arrangement of the installation is shown in fig. 1, the computor being mounted on the port side of the aircraft. Course is set automatically by connection to the D.R. compass installation. The air drier in the pipe taking compressed air to the computor is mounted on the bulkhead at the rear of the bomb aimer's compartment and is not shown in fig. 1.

Static vent

3. The static vent is on the port side of the aircraft, 6 or 7 ft. in front of the leading edge of the tail plane, on a line joining it with the trailing edge of the main plane. On the Lancaster Mk. III it is 7 in. above the same line.

APPENDIX 4

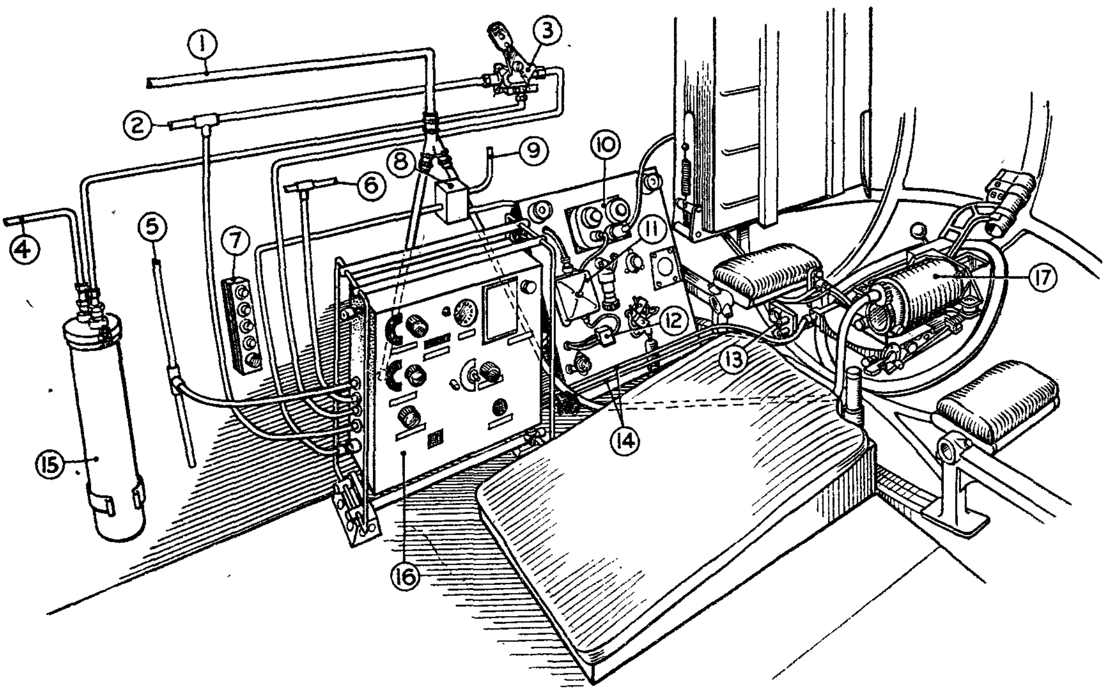
Bomb sight, Mk. XIV, installation in the Halifax

Leading particulars

1. Levelling speed } For Type X computors, Stores Ref. 9/2637. ... 170 m.p.h. (rectified)
   Levelling factor } ... 0·14
   Levelling speed } For Type A computors, Stores Ref. No. 9/2325. ... 150 m.p.h. (rectified)
   Levelling factor } ... 0·18

	Stores Ref.
Computor unit, Type X, 24 volt, complete with lamps ...	9/2637
Computor unit, Type A, 24 volt, complete with lamps (early type) ...	9/2325
Flexible shafts, Type A, length 3 ft. 2 in. ...	9/2335
Emergency computor—For Type A computor ...	9/2573
Emergency computor—For Type X computor ...	9/2650

Note.—Stores Ref. numbers of other components used on this installation are given in the leading particulars following the list of illustrations to Chap. 9.



1—SUCTION (TO CHANGE-OVER COCK)
2—EXHAUST (TO PIPE JOINING AUTO CONTROL GYRO UNITS IN ENGINEER'S COCKPIT)
3—BOMB SIGHT COCK
4—AIR SUPPLY (FROM PILOT'S MAIN CONTROL COCK)
5—STATIC (TO STATIC VENT)
6—PITOT (TO PITOT HEAD)
7—STOWAGE FOR SERVICES TO COMPUTOR
8—DISTRIBUTION BOX
9—CONNECTION TO D.R. COMPASS
10—SWITCHBOX
11—RADIO INTERFERENCE SUPPRESSOR
12—FUSEBOX, TYPE E, AND FUSE, TYPE S
13—STOWAGE FOR SERVICES TO SIGHTING HEAD
14—FLEXIBLE SHAFTS
15—BOMB SIGHT AIR DRIER
16—COMPUTOR UNIT
17—SIGHTING HEAD

Fig. 1.—General arrangement of the bomb sight installation

Note.—Positions of components approximately correct; run of pipes and cables diagrammatic only.

General description, fig. 1

2. The general arrangement of the installation is shown in fig. 1, the computor being mounted on the port side of the aircraft. The air drier and part of the computor are underneath the navigator's table, which is not shown in fig. 1. Course is set automatically by the D.R. compass.

Static vent

3. The static vent is placed on the port side of the aircraft, almost opposite the rear exit.

APPENDIX 5

BOMB SIGHT, Mk. XIV, INSTALLATION IN THE STIRLING

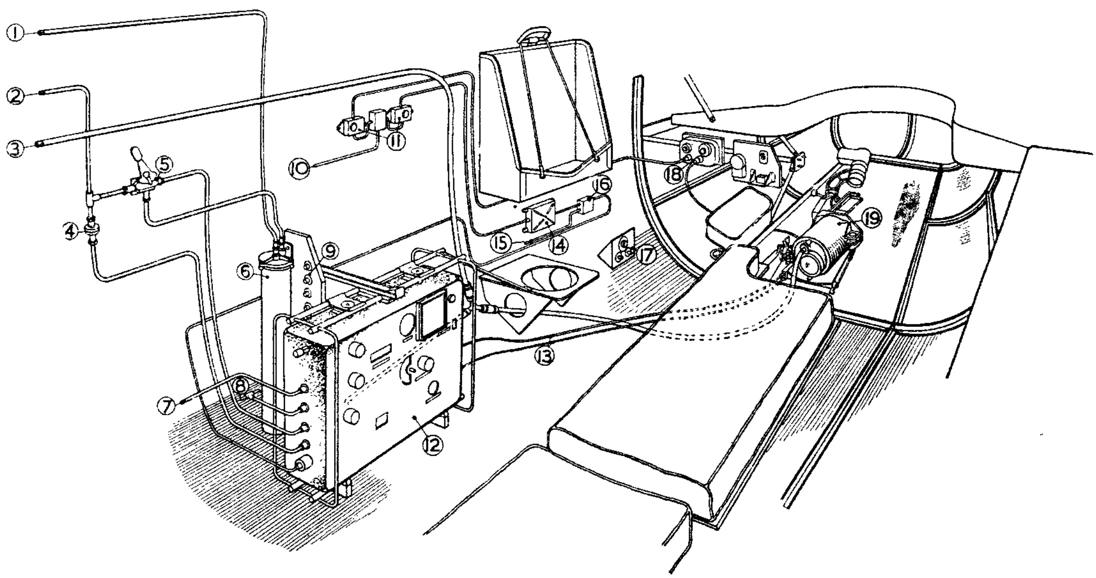
Leading particulars

1. Levelling speed ... ... 170 m.p.h. (rectified)
   Levelling factor ... ... 0·12
   } For Type X computors, Stores Ref. 9/2637.

   Levelling speed ... ... 150 m.p.h. (rectified)
   Levelling factor ... ... 0·17
   } For Type B computors, Stores Ref. 9/2326.

	Stores Ref.
Computor unit, Type X, 24 v., complete with lamps	9/2637
Computor unit, Type B, 24 v., complete with lamps (early type of computor)	9/2326
Flexible shaft, Type A, length 5 ft.	9/2336
Emergency computor—For Type X computor	9/2650
Emergency computor—For Type B computor	9/2573

Note.—Stores Ref. numbers of other components used on this installation are given in the Leading Particulars following the List of Appendices to Chap. 9.



1—AIR SUPPLY (FROM MAIN CONTROL COCK)
2—EXHAUST (TO REGENERATIVE SIDE OF AUTO CONTROLS)
3—SUCTION (TO CHANGE-OVER COCK)
4—FILTER UNIT
5—BOMB SIGHT COCK
6—AIR DRIER
7—STATIC (TO STATIC VENT)
8—PITOT (TO PITOT HEAD)
9—STOWAGES FOR CONNECTIONS TO COMPUTOR
10—ELECTRICAL SUPPLY
11—FUSE BOXES
12—COMPUTOR UNIT
13—FLEXIBLE SHAFTS
14—RADIO INTERFERENCE SUPPRESSOR
15—CONNECTION TO D.R. COMPASS INSTALLATION
16—DISTRIBUTION BOX
17—STOWAGES FOR CONNECTIONS TO SIGHTING HEAD
18—SWITCHBOX
19—SIGHTING HEAD

Fig. 1.—General arrangement of the bomb sight installation

Note.—Positions of components approximately correct; run of pipes and cables diagrammatic only.

General description

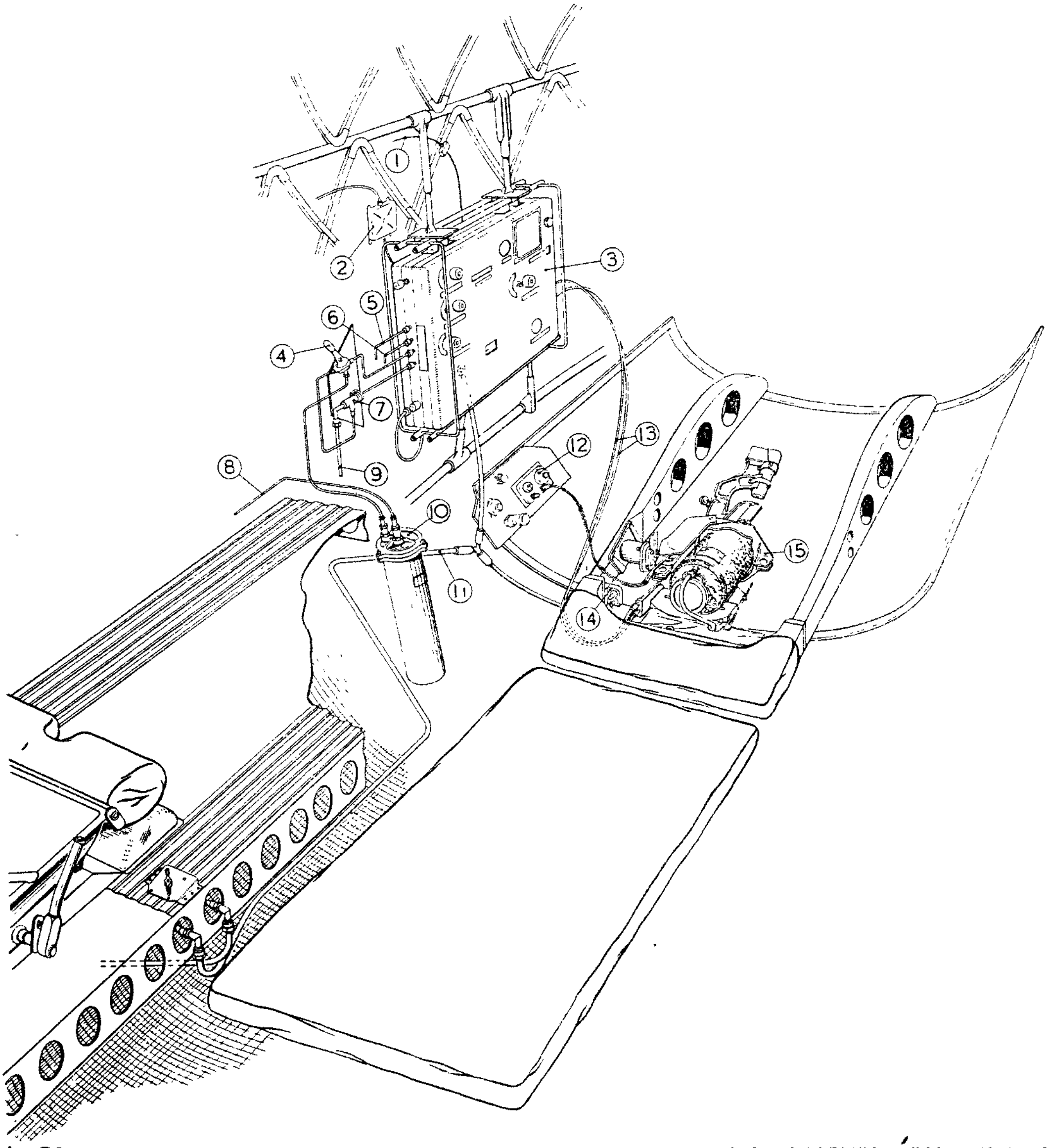
2. The general arrangement of the installation is shown in fig. 1, the computor being mounted on the port side of the bomb aimer's compartment. Course is set automatically by D.R. Compass and compressed air is obtained from the automatic controls. It is probable that the brackets shown holding the computor in fig. 1 will be replaced by different brackets to make it easier to remove and install the computor.

Static vent

3. The static vent for the sight is placed approx. 16 ft. 4 in. in front of the leading edge of the tail plane, on the port side.

APPENDIX 6

BOMB SIGHT, Mk. XIV, INSTALLATION IN WELLINGTON AIRCRAFT FITTED WITH D.R. COMPASS



1—CONNECTION TO D.R. COMPASS INSTALLATION
2—RADIO INTERFERENCE SUPPRESSOR
3—COMPUTOR UNIT
4—BOMB SIGHT COCK
5—STATIC (TO STATIC VENT)
6—PITOT (TO PITOT HEAD)
7—FILTER UNIT
8—AIR SUPPLY (FROM MAIN CONTROL COCK)
9—EXHAUST (TO REGENERATIVE SIDE OF AUTO CONTROLS)
10—AIR DRIER
11—SUCTION (TO CHANGE-OVER COCK)
12—SWITCHBOX
13—FLEXIBLE SHAFTS
14—STOWAGES FOR SIGHTING HEAD CONNECTIONS
15—SIGHTING HEAD

Fig. 1.—General arrangement of bomb sight installation

Note.—Positions of components approximately correct; run of pipes and cables diagrammatic only

Leading particulars

1. Levelling speed ... ... 170 m.p.h. (rectified) } For Type Z computors, Stores Ref. 9/2635
Levelling factor ... ... 0·20
Levelling speed ... ... 170 m.p.h. (rectified) } For Type D computors, Stores Ref. 9/2328
Levelling factor ... ... 0·20

	Stores Ref.
Computor unit, Type Z, 24 v., complete with lamps ...	9/2635
Computor unit, Type D, 24 v., complete with lamps (early type of computor)	9/2328
Flexible shafts, Type A, 6 ft. 3 in.	9/2567
Emergency computor—For Type D computor	9/2574
Emergency computor—For Type Z computor	9/2650

Note.—Stores Ref. numbers of other components used on this installation are given in the Leading Particulars following the List of Appendices to Chap. 9.

General description

3. Fig. 1 shows the general arrangement of the bomb sight installation in a Wellington aircraft fitted with automatic controls and D.R. compass. The stowage for the computor connections, and the distribution box bringing together the D.R. compass and supply leads, are behind the computor and are not shown in fig. 1. It is possible that different computor brackets from those shown in fig. 1, will be fitted to make easier the removal and installating of a computor.

Static vent

4. The static vent is 10 ft. in front of, and 17 in. below, the leading edge of the tail plane on the port side of the aircraft.

Fuses

5. The fuses for the sighting head and computor are on the main fuse panel.

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CHAPTER 11

BOMB SIGHT, TYPE T-1

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LIST OF APPENDICES

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APPENDIX 2	—	T-1 bomb sight installation in Marauder	(*To be issued later*)
APPENDIX 3	—	T-1 bomb sight installation in Liberator	(*To be issued later*)
APPENDIX 4	—	T-1 bomb sight installation in Fortress	(*To be issued later*)
APPENDIX 5	—	T-1 bomb sight installation in Catalina	(*To be issued later*)
APPENDIX 6	—	T-1 bomb sight installation in Anson	(*To be issued later*)
APPENDIX 7	—	T-1 bomb sight installation in Oxford	(*To be issued later*)
APPENDIX 8	—	T-1 bomb sight installation in Mosquito	(*To be issued later*)
APPENDIX 9	—	T-1 bomb sight installation in Lancaster	(*To be issued later*)
APPENDIX 10	—	T-1 bomb sight installation in Wellington	(*To be issued later*)

CHAPTER 11

BOMB SIGHT, TYPE T–1

GENERAL INFORMATION

Introduction

1. The T–1 bomb sight is the American version of the original British Mk. XIV bomb sight, with which it is functionally identical and from which it differs only in method of construction. This chapter describes briefly the general differences and treats in detail those points—either differences or similarities—which are important. No mention is made of the many unimportant differences. Most of Chapter 9 on the Mk. XIV bomb sight is equally applicable to the T–1 sight, and the following information is supplementary to that chapter, which should therefore be read first. The lay-out of this chapter follows closely that of the Mk. XIV chapter.

2. The chief difference between the T–1 and the Mk. XIV bomb sight is that the T–1 is mainly made of light alloy castings. Standard American screw threads and electrical connections are used, and the general dimensions of the two instruments are different. This means that they are almost completely non-interchangeable, and so far as installation is concerned are virtually two different sights (but see para. 50). Both the T–1 and the Mk. XIV sighting heads will however fit on to the same kind of mounting bracket.

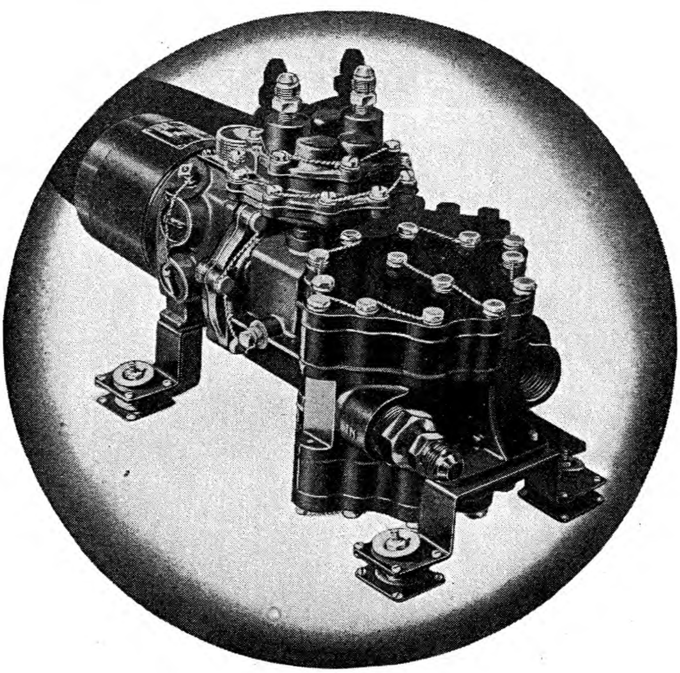

Fig. 1.—Vacuum-pressure pump

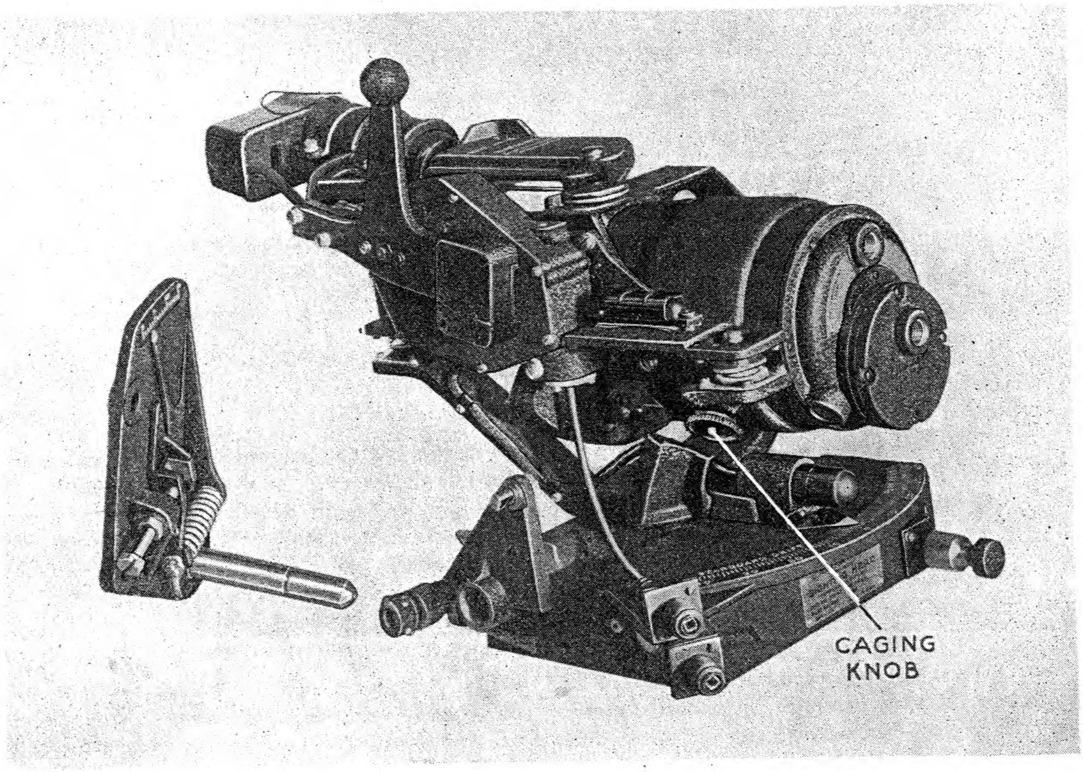

Fig. 2.—Sighting head *(compare with Fig. 6 in Chap. 9)*

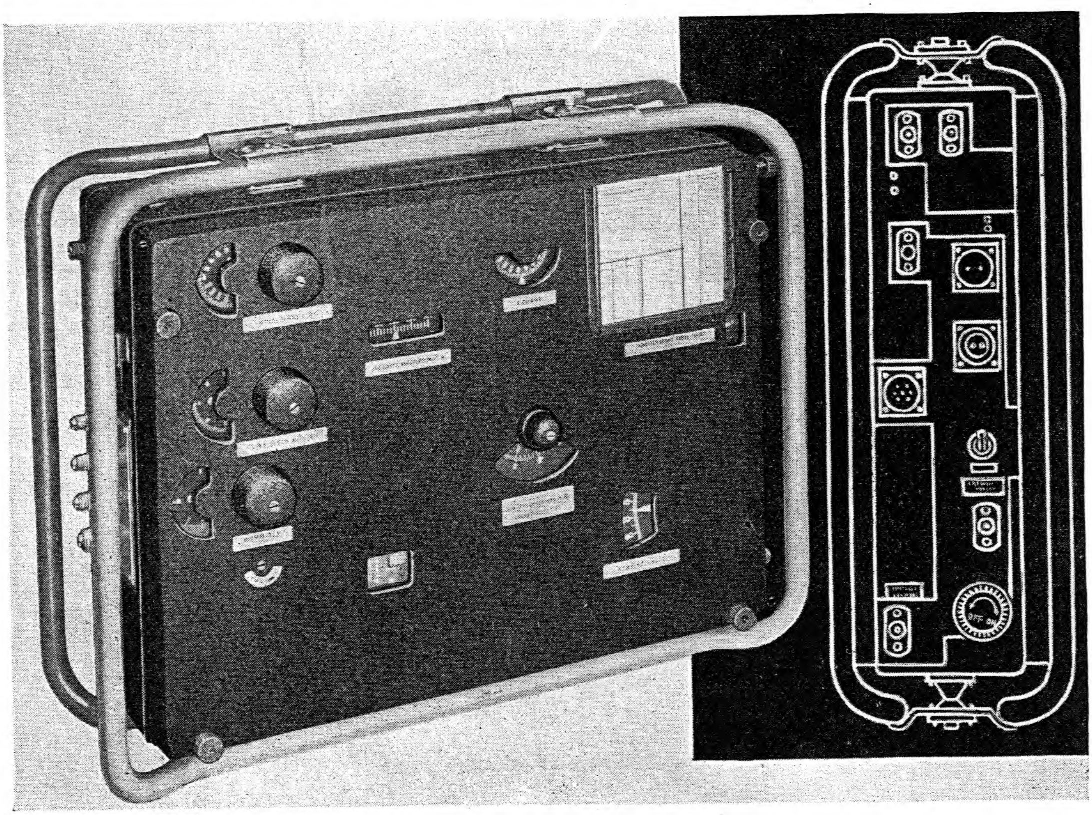

Fig. 4.—Computor unit *(compare with Fig, 4 in Chap. 9)*

3. Unlike the Mk. XIV bomb sight the T–1 is provided with its own electrically driven vacuum-pressure pump which renders it independent of the aircraft supplies of suction for the gyros and compressed air for the computor. There are some installations, however, in which the vacuum-pressure pump is not used.

Sighting head, fig. 1

4. The sighting head is very similar to the Mk. XIV one, the main difference being that the lower part totally encloses the drift mechanism. Another feature is a spring-loaded plunger on the collimator arm which may be released by a half turn to engage a notch in the gearbox. This locks the collimator arm at a certain angle, so that the sighting head may be used in conjunction with a special mounting bracket and manually set computor as a low level bomb sight. Up to now (1944) this technique is not being used by the Royal Air Force. The plunger also serves to lock the collimator arm during transit.

Control panel, fig. 3

5. The control panel for the sighting head looks different from the Mk. XIV one, but it serves the same purpose, and is functionally similar.

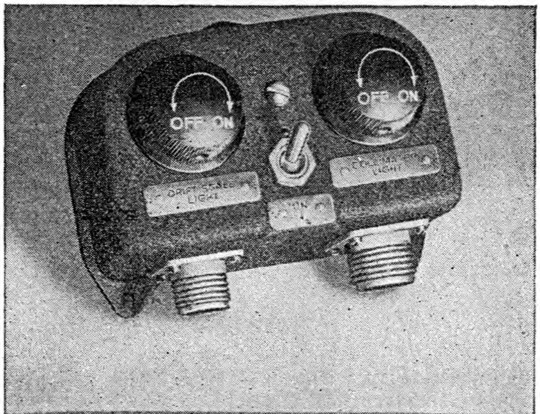

FIG. 3—CONTROL PANEL
(COMPARE WITH FIG. 10 IN CHAP. 9)

Mounting bracket

6. The sighting head mounting bracket is very similar to the Mk. XIV one.

Computor unit, fig. 2

7. The T–1 computor unit is the component which differs most from the Mk. XIV version. The layout of the controls is much the same except that the on-off and dimmer switches are at the right-hand end. Normally there is no course synchronising knob, the emergency sighting angle setting knob off the sight head being used instead. There are course drive stowage points at the top of each end of the computor, and next to the stowages are the course control connections, to either of which the knob is fitted when it is necessary to synchronise the course setting. If manual course control is used instead of a D.R. Compass, a flex drive from the course control handle goes to one of the course connections on the computor.

8. All the electrical connections are on the right-hand end of the computor, and the various pipe connections are on the other end. Course leads from the D.R. compass do not come into the same socket as the power leads. The upper 2-pin socket connects to the 24 volt power supply, and the 7-pin socket connects to the D.R. Compass or an American Pioneer Gyro Fluxgate Compass if either is fitted. The remaining 2-pin socket is for a connection to the vacuum-pressure pump.

Services required by the sight

9. The information in the chapter on the Mk. XIV bomb sight entitled "Services required by the sight" is not generally applicable to the T–1 bomb sight.

10. The supplies needed to work the computor are the same as those for the Mk. XIV, except that suction and pressure are normally provided by the special pump, which is mounted near the computor. The electrical supply to the pump motor is controlled by the computor on-off switch. *This fact is important,* because it means that the gyros are not running all the time the aircraft is flying; they only begin to work when the pump is started by switching on the computor switch. Because the gyros take some time to settle down after being started, the computor must be switched on *at least 20 minutes* before reaching the target.

Course set by hand, fig. 5

11. Course may be set manually as on the Mk. XIV sight.

Emergency use

12. The sighting head may be used with a hand held computor if the automatic computor breaks down, provided that the vacuum-pressure pump is functioning and supplying suction to the gyro.

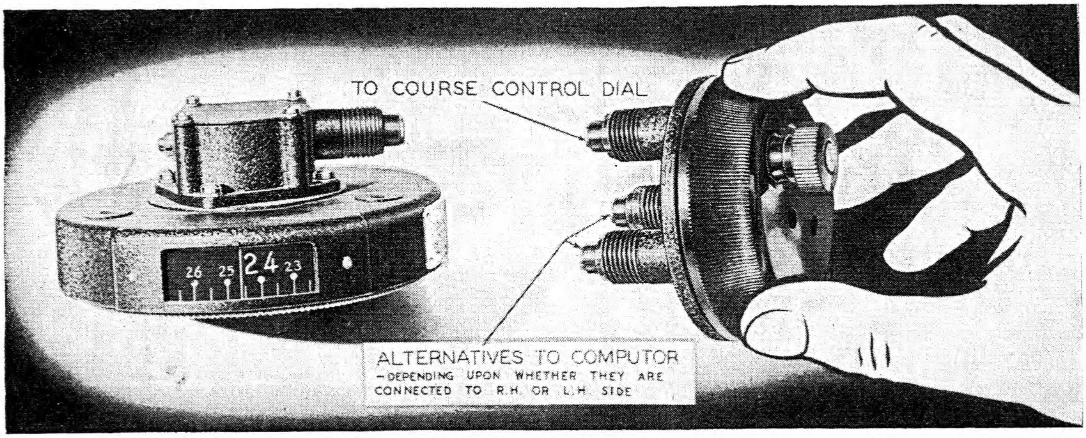

Fig. 5.—Course control dial and control handle (*compare with Fig. 14 in Chap. 9*)

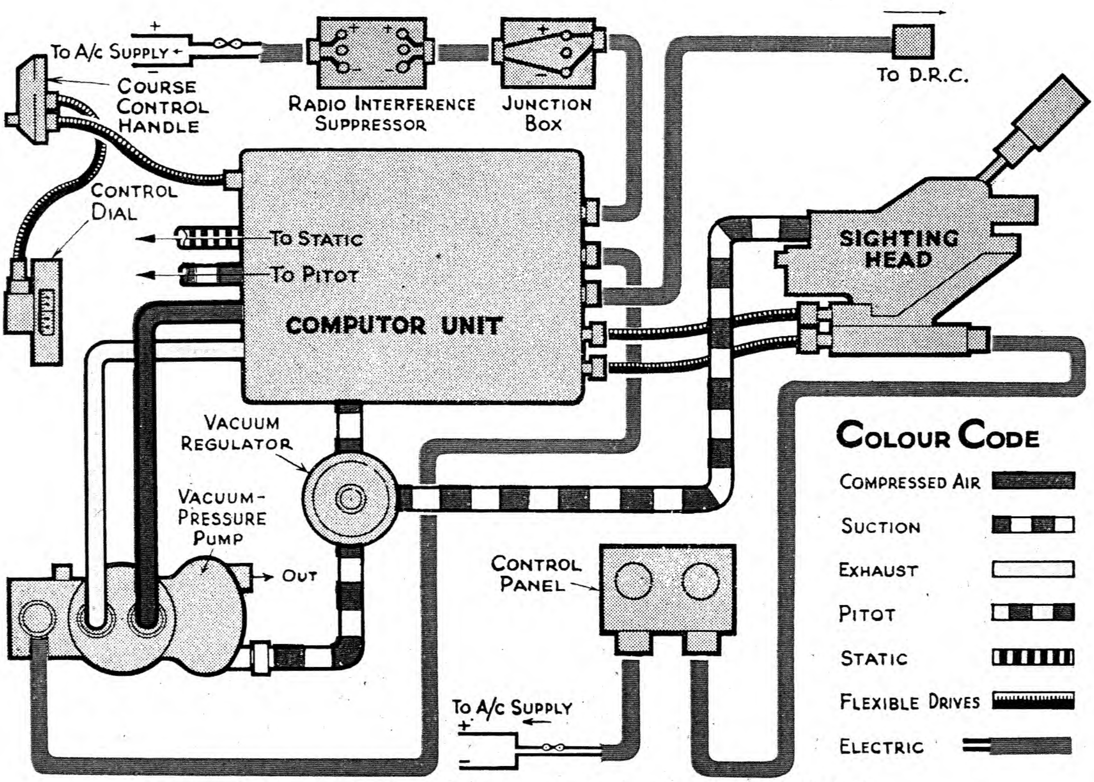

Fig. 6.—Complete installation (*compare with Fig. 5 in Chap. 9*)

INSTRUCTIONS FOR USE

13. The sight is used in the same way as the Mk. XIV sight, except in two minor respects.

Synchronising course when a D.R. compass is fitted

14. Remove the sighting angle emergency setting knob from its stowage on the sighting head and fit it to either course connection. Synchronise the course dial. Remove the knob and replace on its stowage; *do not* leave it on the connection.

Switching on and off

15. Since an electrically driven vacuum-pressure pump is fitted there will be no bomb sight cock to turn on and the gyros will not start until the computor switch is put on. Therefore switch on the computor switch *at least 20 minutes* before reaching the target. Switch off after the sight has been used.

Setting target height

16. A sea level setting cursor is controlled by the larger of the two concentric target height adjustment knobs. Setting target height is made easier if the sea level pressure is marked by means of the cursor first, and the target height then set opposite it. The sea level pressure is marked in inches of mercury instead of in millibars.

LEVELLING THE SIGHT

17. The instrument is levelled in exactly the same way as the Mk. XIV bomb sight.

HOW THE COMPUTOR UNIT WORKS

18. The mechanisms of the T–1 and the Mk. XIV sights are based upon identical principles

DESCRIPTION OF THE SIGHTING HEAD MECHANISM

Drift unit, fig. 7

19. The mechanism of the drift unit is similar to that of the Mk. XIV unit, but is completely enclosed within the baseplate. The main difference is in the drift release and brake arrangements. The drift release lever is fixed to the end of a shaft which runs parallel to the drift leadscrew. Next to the lever but inside the baseplate an eccentric is also fixed to the shaft, and this is linked **by**

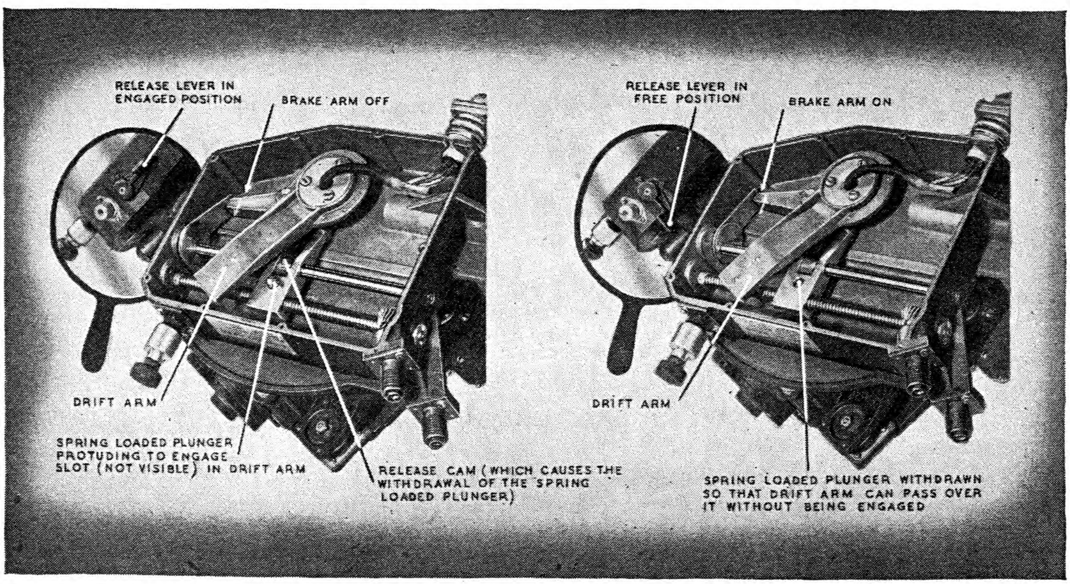

Fig. 7.—Release mechanism in engaged and free positions *(compare with Fig. 29 in Chap. 9)*

an eccentric rod to the brake arm. A drift release cam is mounted on the shaft and it locates in a slot in the drift nut, so that as the latter traverses it carries the cam with it along the shaft. The shaft has a flat on it so that if it turns it turns the cam with it.

20. When the drift release lever is raised it turns the shaft, eccentric, and cam. The eccentric rod then releases the brake arm so that the arm is pressed by a spring against the brake drum. This causes friction on the drum to prevent the head from swinging too freely in azimuth while it is being used as a drift sight. Meanwhile the cam turns and deflects a leaf spring which withdraws the drift locating peg from the slot in the drift arm, thereby freeing the drift drive.

21. When the drift release lever is lowered it turns the eccentric which then releases the brake. It also turns the cam so as to free the leaf spring, which then pushes the drift locating peg down so that it can engage the drift arm.

Gyro unit, fig. 8

22. The gyro unit is almost identical with the Mk. XIV one, but incorporates a caging device. This is a mechanism operated by a knob on the outside of the gyro case, which is used for clamping the gyro during transit to stop it from swinging freely and so becoming damaged. The caging knob turns a small gear which engages two toothed rings each carrying a clamping jaw, which fit inside the gyro case. The gyro rotor housing carries an arm which protrudes through a semi-circular slot in the outer gimbal. When the caging knob is turned clockwise it rotates the two rings in opposite directions, so that their clamping jaws eventually grip the arm on the rotor housing and prevent free movement of the mechanism.

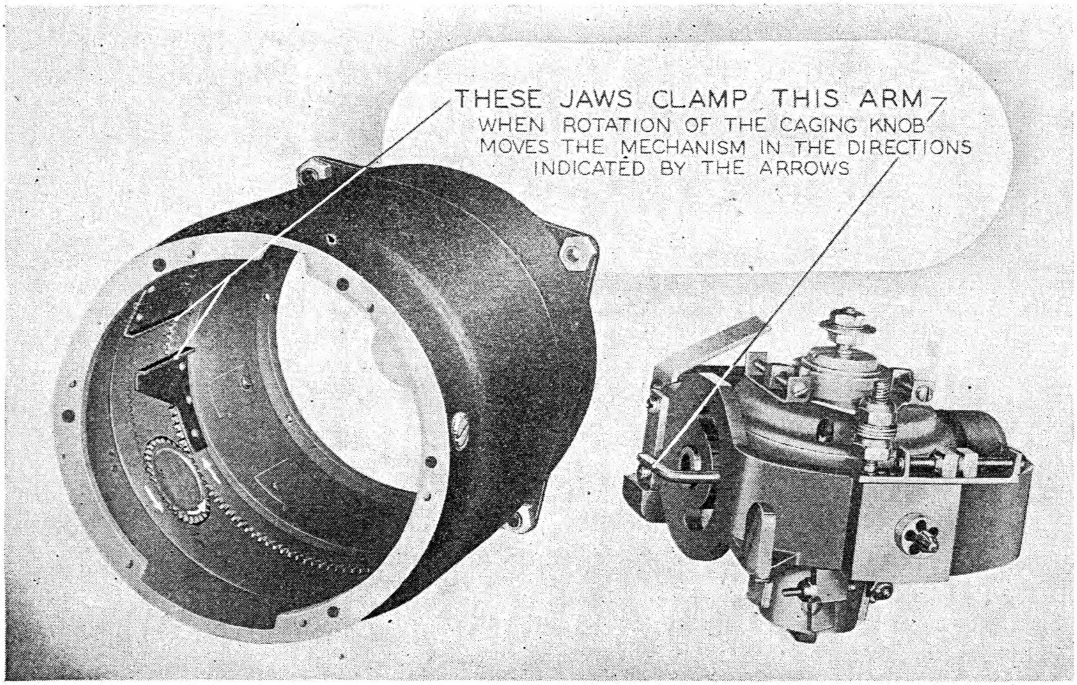

Fig. 8.—Gyro, showing caging mechanism *(compare with Fig. 31 in Chap. 9)*

DESCRIPTION OF THE COMPUTOR UNIT MECHANISM

Introduction

23. No attempt will be made in the following description to cover all the detailed differences of the sight from the Mk. XIV sight. Basically the two mechanisms are similar, and any given sub-assembly in the one sight has its counterpart in the other, although the actual construction of those sub-assemblies themselves may differ considerably.

General construction

24. The components of the computor are divided up into more self-contained sub-assemblies than are those of the Mk. XIV computor. Extensive use is made of aluminium die castings; the

main baseplate complete with flanges is such a casting. Ball-races are extensively used throughout the instrument, e.g. on the servo tyre spindles, tangent arm location pins, etc. Several of the adjustment devices used in tuning the assemblies are an improvement on those in the Mk. XIV computor.

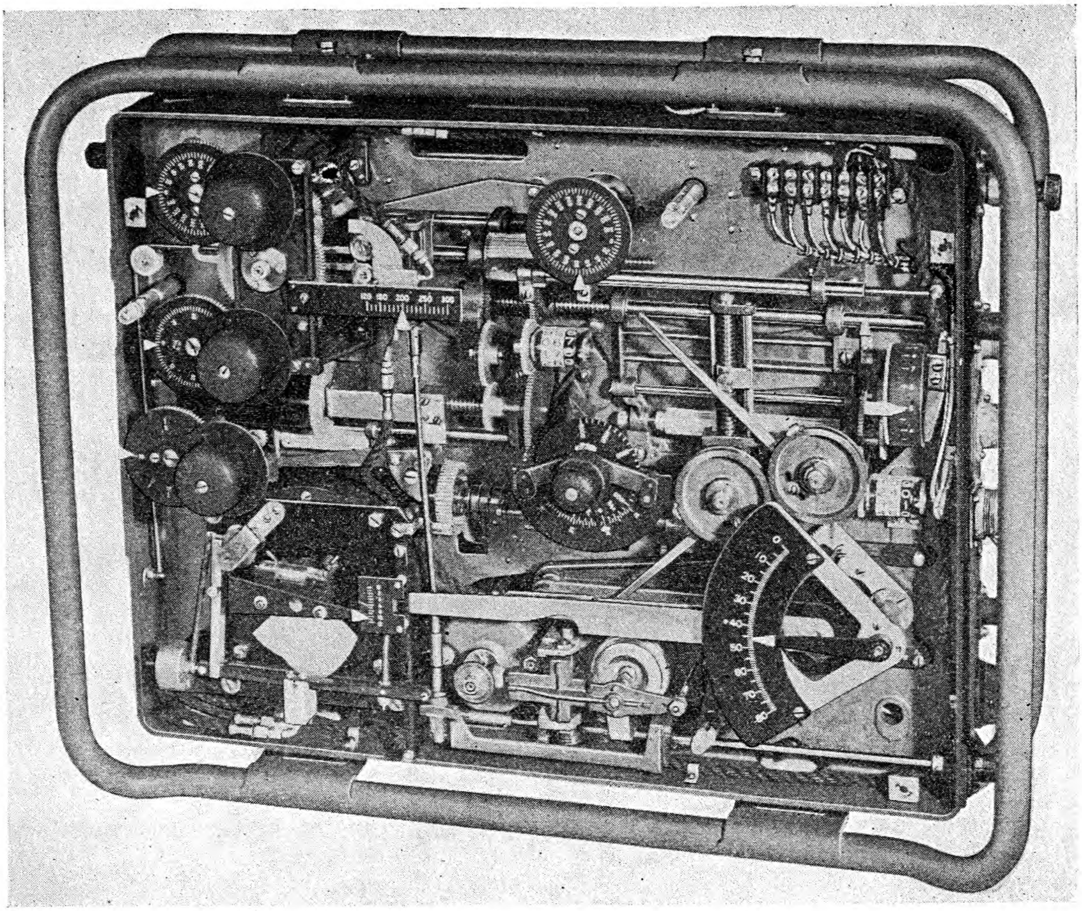

Fig. 9.—Front of computor with cover removed (*compare with Fig. 36 in Chap. 9*)

Height and air speed unit, fig. 11

25. The design of the first few thousand height and air speed units was based on that of the original Mk. XIV altas unit, the main feature being a more complicated bellows linkage than on current Mk. XIV altas units. The jet blocks traverse on lead screws which do not have the anti-backlash and self-aligning devices that are used on the Mk. XIV altas unit.

Reducing valve and relief valve

26. The air supply to the computor is controlled in most cases, by a reducing valve. Early reducing valves would only control high pressures of 60 lb. per sq. in. (as supplied by the Mk. IV auto-controls), but the later type of reducing valve will, by adjustment, suit input pressures over the range of 6–60 lb. per sq. in. and is therefore suitable for all types of computor.

27. A relief valve has been fitted to some of the computors working off a low pressure supply. This is a spring-loaded blow-off or safety valve which lifts if the pressure in the line exceeds a set value, and is fitted in the position normally occupied by a reducing valve.

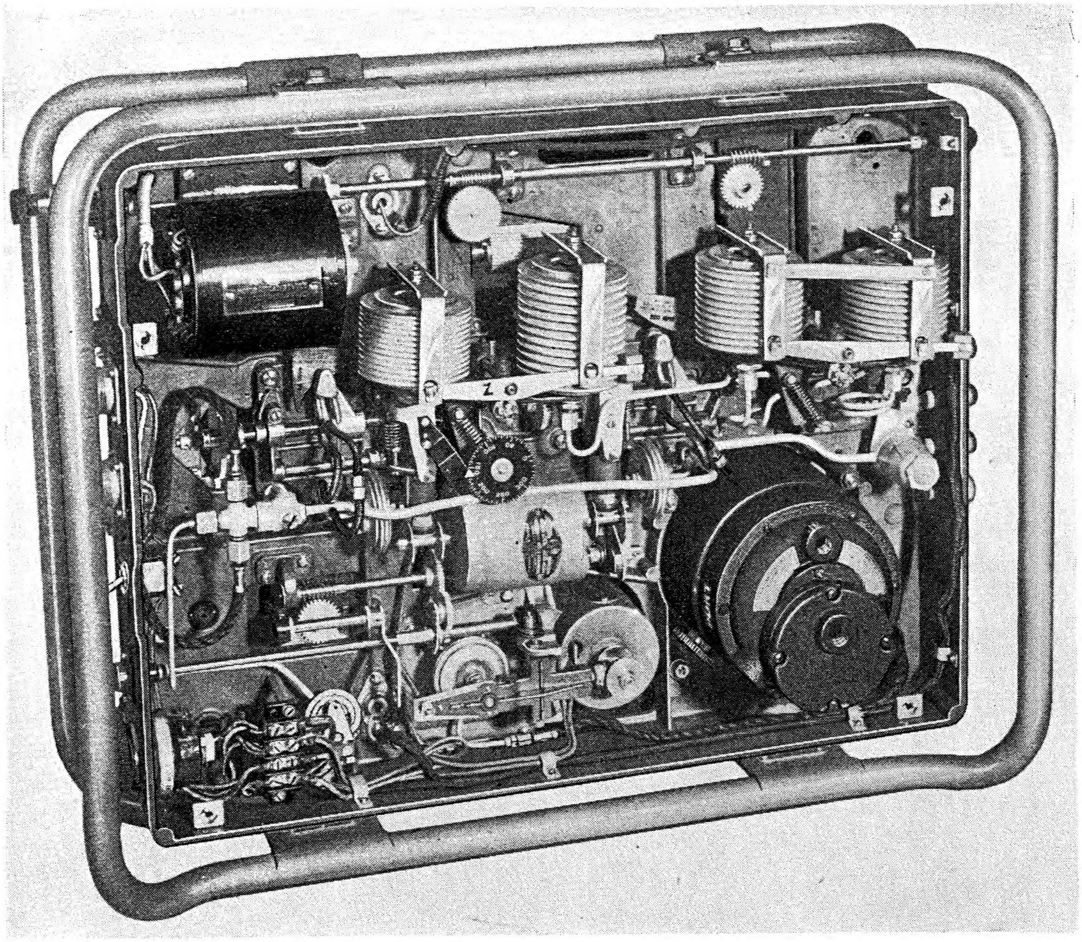

Fig. 10.—Back of computor with cover removed (*compare with Fig. 37 in Chap. 9*)

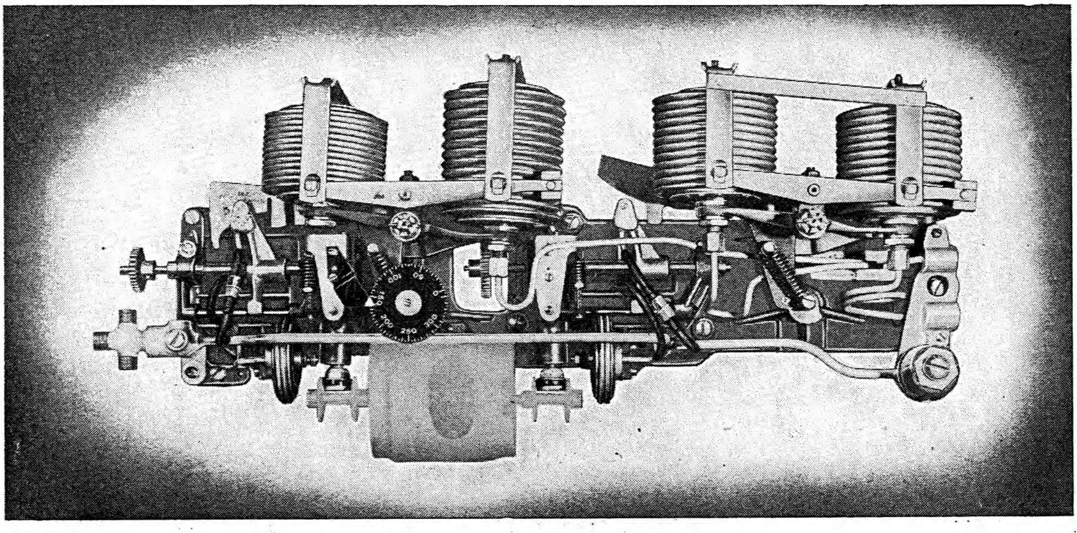

Fig. 11.—Altas unit (*compare with Fig. 39 in Chap. 9*)

28. The difference between the reducing valve and the relief valve is that the former throttles the air supply back to give the required pressure, while the latter works by spilling to atmosphere any surplus air above that needed to maintain the required pressure.

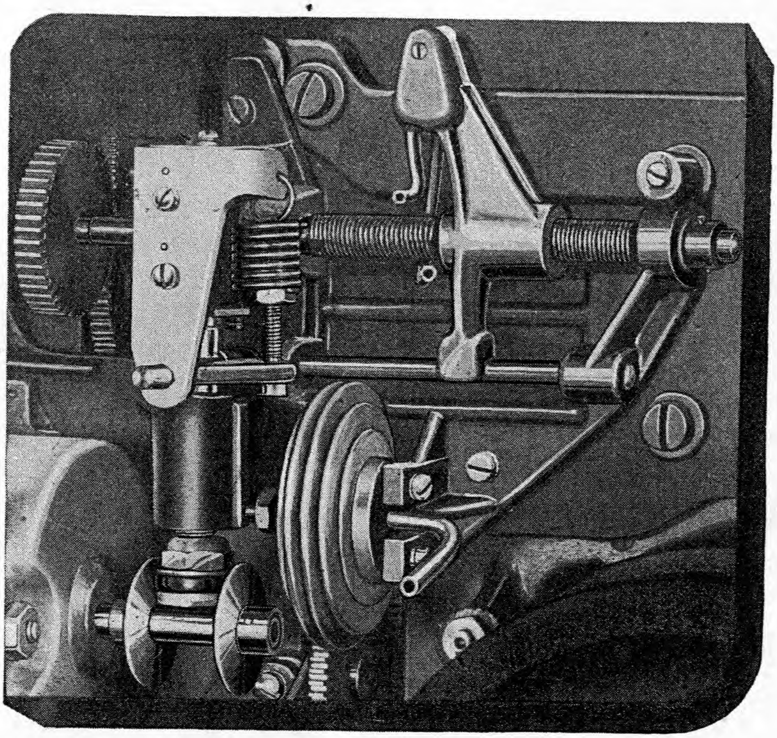

Fig. 12.—Jet block, spindles, and gearbox of altas unit (*compare with Fig. 41 in Chap. 9*)

29. The following types of pressure control may therefore be found:—

(i) Low pressure supply computors fitted with:—

(*a*) A reducing valve which can be adjusted to control a low pressure, or

(*b*) A relief valve in the position usually occupied by the reducing valve, or

(*c*) A reducing valve in the usual position and a relief valve on the T piece at the left-hand end of the pipe line for the altas unit.

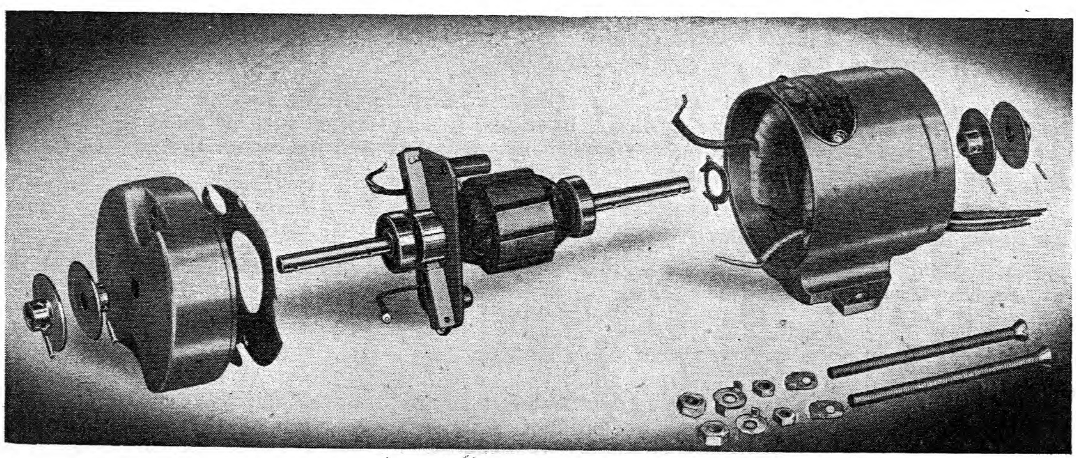

Fig. 13.—Exploded view of driving motor (*compare with Fig. 42 in Chap. 9*)

(ii) High pressure supply computors fitted with:—

(*a*) A reducing valve for 60 lb. per sq. in., or

(*b*) A reducing valve in the usual position and a relief valve on the T piece at the left-hand end of the pipe line for the altas unit.

Servo motor assemblies, fig. 14 and 15

30. The drift and sighting angle servos have a worm gear reduction drive instead of spur gearing, and the output drive shafts run right up to the flex drive connections on the flanges.

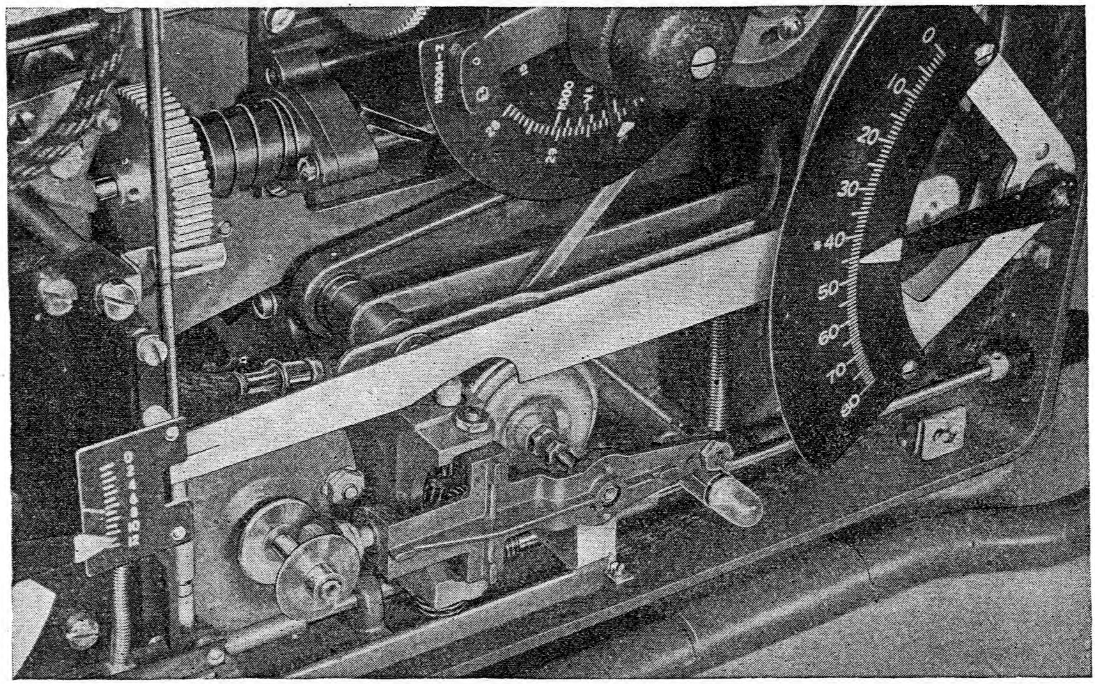

Fig. 14.—Drift angle servo motor assembly (*compare with Fig. 49 in Chap. 9*)

Revolution counters, fig. 9

31. Two revolution counters are coupled to the computor height and air speed mechanisms respectively, so that they indicate total and fractional turns of height and air speed lead screws on the altas unit. They make calibration of the height and air speed indicators and of the computor mechanism simpler and more accurate.

Air speed and wind speed scales

32. Double-sided air speed and wind speed scales, which are calibrated in knots and m.p.h., will replace the early single-sided scales.

Circuit diagram

33. The electrical circuit of the computor differs mainly from the Mk. XIV version in that the power and D.R. compass connections are brought in through two different plugs, and that there is a third plug for the supply to the vacuum-pressure pump. There are two junction boxes in the computor, for the power and the repeater circuits respectively.

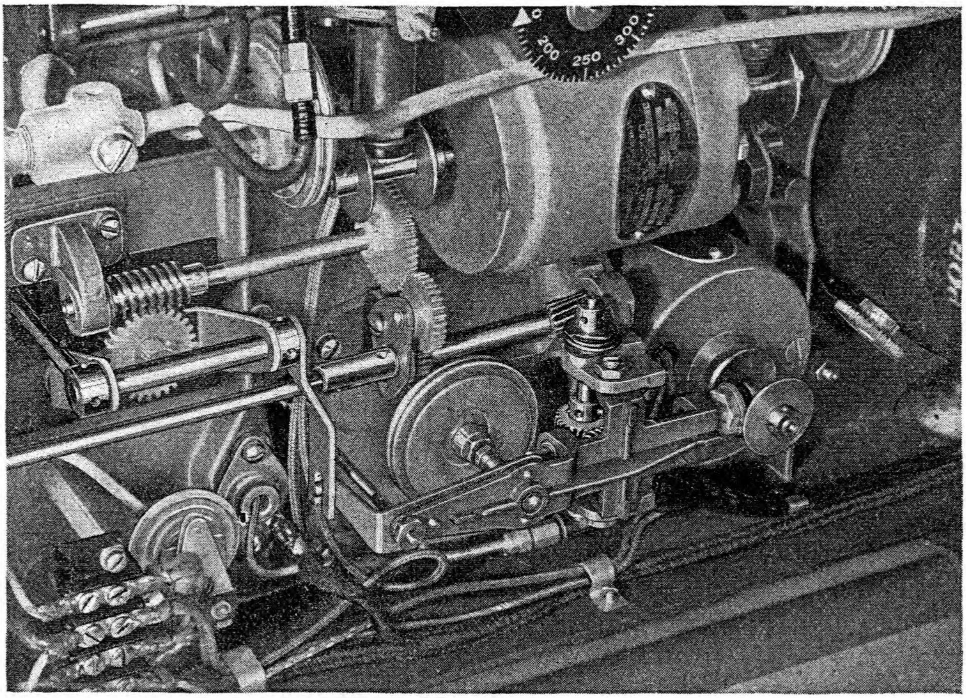

Fig. 15.—Sighting angle servo motor assembly (*compare with Fig. 54 in Chap. 9*)

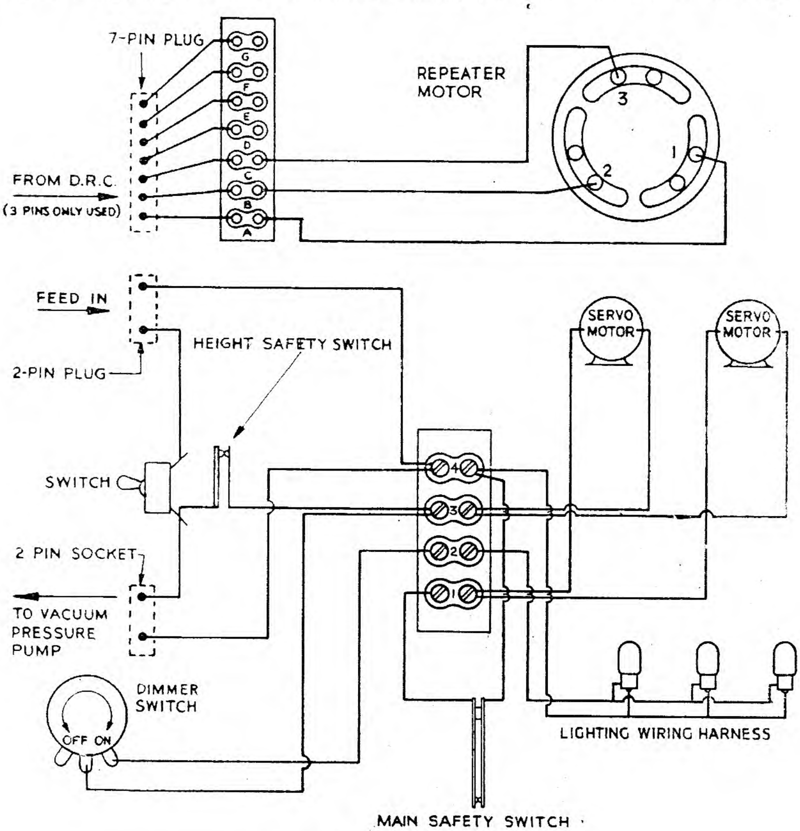

Fig. 16.—Circuit diagram

Air supply

34. In most installations, the sight is worked off suction and pressure supplied by the vacuum-pressure pump, though there are a number of installations in which the sight is worked off supplies other than the vacuum-pressure pump, e.g. Pesco pump or auto controls. Installation details are given in the appendices to this chapter.

Flexible drives

35. The flexible drives used with the sight are of one type only, which may be used for either course, sighting, or drift angle drives. The cores of the shafts have a collar pressed on to them near one of the square ends, to prevent the core from slipping through its casing. The flexible shafts should always be connected so that this collar is at the computor end of the drive. The reason for this is that the square hole inside the computor coupling is more deeply recessed than that on the sighting head. Having the shaft fitted with the collar at the computor end ensures that the square engages its coupling deeply; if it were fitted the other way round the square might become disengaged and fail to drive the sighting head.

VACUUM-PRESSURE SUPPLY

(*Standard*)

Vacuum-pressure pump, fig. 17

36. The vacuum-pressure pump, which is designed to supply a source of suction and pressure which is independent of engine operation, comprises a ¼ H.P. electric motor driving two diaphragm type pumps. The small pump, nearest the motor and on top, provides the pressure supply for the computor, and the other pump, which has two diaphragms, provides the suction for the gyro units.

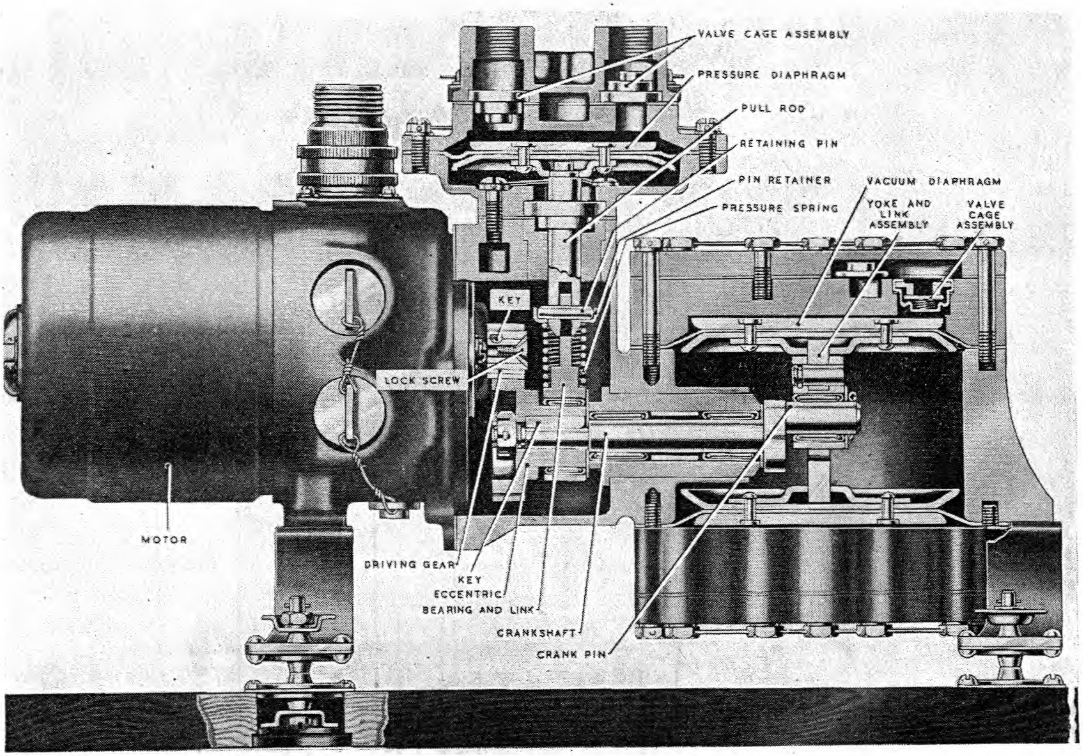

Fig. 17.—Vacuum-pressure pump

37. The motor, see fig. 17, drives a crankshaft through a simple reduction gear. The crankshaft runs in a double set of needle rollers, and has an eccentric at one end and a crank pin at the other. The eccentric operates the pressure pump, and the crank pin the suction pump. The pumps are similar in operation to the more common plunger type of pump, except that the plunger is replaced by the diaphragm assembly. The advantage of a diaphragm over a plunger is that friction is reduced,

and the air which is being pumped does not come into contact with oil—working parts which require lubrication are on one side of the diaphragm and the air is on the other. No oil separator is therefore required in the air lines.

Pressure pump

38. This is operated, through a variable stroke linkage, by the eccentric on the left-hand end of the crankshaft. The eccentric causes the diaphragm to reciprocate. As the diaphragm is lowered, air is drawn in through the left-hand valve cage assembly, which is a spring-loaded non-return valve. As the diaphragm is raised, air is forced out through the right-hand valve cage assembly, which is identical with the left-hand one except that it is mounted the other way up. There are six such valves in the pressure pump and twelve in the vacuum pump (to allow the necessary volume of air to pass) all are identical.

39. The diaphragm is connected to the eccentric by a variable stroke linkage the purpose of which is to prevent pressure build-up when the volume of air being accepted from the pump is small. The eccentric operates a bearing and link which moves a pull rod through the medium of a retaining pin. The hole for the retaining pin in the upper end of the bearing and link is slotted. The retaining pin is kept in contact with the upper end of the slot by a spring and pin retainer. Thus the pull rod is pulled downwards positively by the retaining pin, but is moved upwards only by the pressure of the spring. As pressure builds up above the diaphragm it limits the amount the spring is capable of raising the diaphragm, and so the stroke is automatically varied to suit the operating conditions.

Vacuum pump

40. The vacuum pump comprises two positively driven diaphragms interconnected to common inlet and outlet ports. The diaphragms are operated by a yoke and link assembly connected to a crank pin on the end of the crank shaft. The valve arrangement is similar to that for the pressure pump. The vacuum pump has no variable stroke arrangement, i.e. it is a positive displacement pump, and it must not therefore be run with the outlet port plugged. The two pumping diaphragms result in a continuous air flow through the pump, because one side is on its suction stroke while the other is on its discharge stroke.

Vacuum regulator, fig. 18

41. The vacuum regulator is fitted in the suction line from the vacuum-pressure pump, and controls the suction at the gyros at 4½ to 5½ in. of mercury. It is a simple spring-controlled flap valve.

42. Referring to fig. 18, air from the computor and sighting head enters the regulator on the left, passes around the flap valve, and leaves through a rectangular shaped opening on the right. The effective size of the opening is controlled by the flap; as the flap rises it reduces the size of the opening and so restricts the suction from the vacuum-pressure pump.

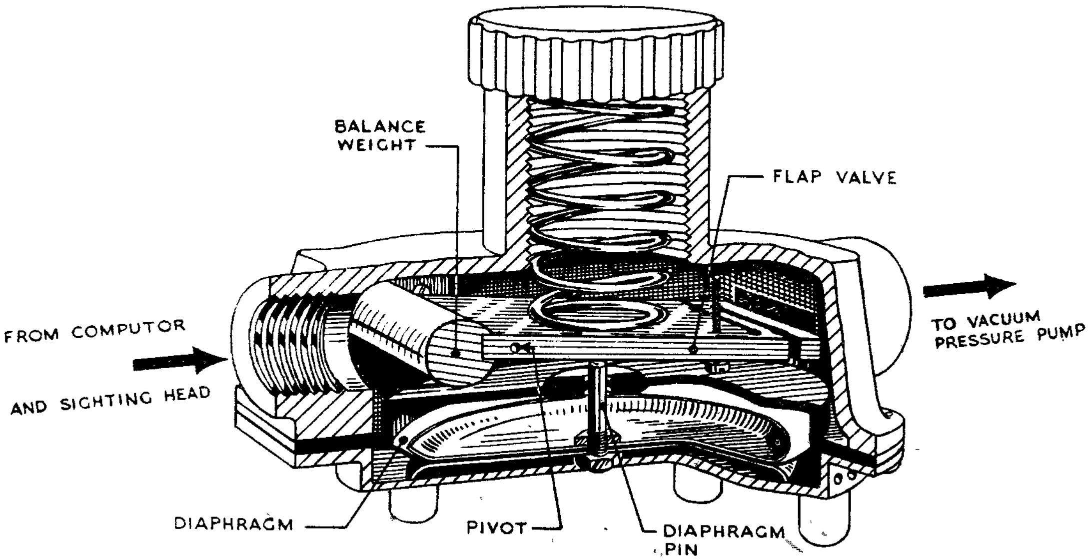

Fig. 18.—Vacuum regulator

43. The flap is controlled by a spring and a diaphragm. The spring tends to press the flap down. The diaphragm, under the reduced pressure within the body of the regulator, tends to push the flap up.

44. In operation, the suction from the vacuum-pressure pump increases until the upward thrust from the diaphragm balances the downward thrust from the spring. Any further decrease in pressure causes the diaphragm to raise the flap against the pressure of the spring, so partially closing the rectangular opening and preventing further decrease in pressure.

45. The underside of the diaphragm is connected to the atmosphere by two small holes visible in the bottom right-hand corner of the illustration.

46. The flap valve is fitted with a balance weight to prevent manoeuvres of the aircraft from causing variations in pressure.

47. The pressure of the spring, and thus the working pressure of the regulator, is adjustable by rotation of a threaded plug which locates the upper end of the spring.

MODIFICATIONS MADE TO THE SIGHT IN GREAT BRITAIN

General modifications

48. All T–1 computors delivered from U.S.A. loose (i.e. instruments other than those which arrive installed in aircraft) are tested and have certain modifications made to them in Great Britain. These are:—

(i) The fitting of pre-jet filters in the leads to the jets to prevent them becoming blocked by dirt.

(ii) The fitting of a height safety switch like that used in the Mk. XIV computors, as a safety precaution against seizure of the mechanism should the jet get blocked.

(iii) The fitting of a retaining screw to the variable fulcrum to overcome a tendency for it to become disengaged from the variable ratio lever.

All computors which have been slightly modified and tested as above are identified by the suffix "T" (standing for tested) added to the Stores Ref. No. on the label at the left-hand end.

49. Experience with the first T–1 computors delivered showed these retrospective modifications to be necessary, and they are being introduced on the production line in U.S.A.

T–1 computors for Wellington aircraft

50. Computors for use in Wellington aircraft have additional modifications made to them in Britain to make them interchangeable with the Mk. XIV computor in that aircraft. Such computors are therefore non-standard, and differ from the standard ones in the following respects:—

(i) The switch is moved from the right to the left-hand end of the instrument.

(ii) The American threaded pipe connections are removed and replaced by connections with British threads as used on the Mk. XIV computor.

(iii) The wiring is modified so that the course and power leads both come in on the 7-pin socket.

All computors which have been modified in this way have the suffix "M" (modified) added to the Stores Ref. No. on the label.

P5206 M /1559 9/44 10150 C & P Gp. 1

CHAPTER 16

UNIVERSAL MOUNTING BRACKET and ADAPTOR PLATE

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

Introduction

1. The universal mounting bracket and adaptor plate have been developed to fulfil the need for a standard bomb sight mounting bracket which is capable of mounting all operational types of bomb sights in standard types of operational aircraft. The bracket resembles the original Mk. XIV mounting bracket in many respects, and differs only in its application.

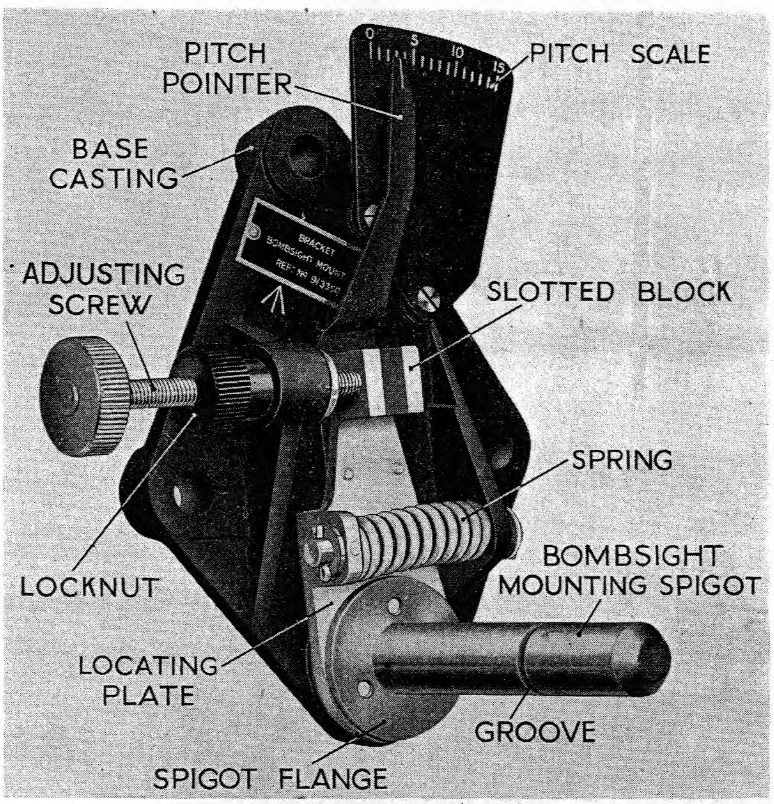

Fig. 1—Universal mounting bracket

2. The adaptor plate enables the bomb sight to be mounted in several different positions without altering the existing airframe mounting bolts. This is an advantage where there is a requirement for the fitting of more than one bomb sight as an alternative, and where the length of the nose, and the bomb aimer's position, vary in different aircraft.

General description

The mounting bracket

3. A general view of the bracket is shown in fig. 1. It consists of an alloy base casting having three holes drilled in it to receive the airframe mounting bolts. Projecting from the bottom of the casting is the bomb sight mounting spigot which has a groove cut on its circumference to receive the locking spring incorporated in the bomb sight. Mounted between the spigot flange and the base casting is the locating plate, the purpose of which is:—

(1) To receive the bomb sight locating lug.

(2) To give an indication of the pitch angle of the bomb sight relative to the aircraft.

This plate is bushed over the spigot and is free to rotate through an angle of 15 deg. The locating lug of the bomb sight fits in a slotted block attached to the top of the locating plate. Bearing against this block is an adjusting screw which is screwed through a projection on the casting and is provided with a knurled locknut to prevent alteration of the pitch angle during flight. In order to keep the block pressed against the adjusting screw, a strong coiled spring is attached between the casting and the locating plate. This spring also helps to prevent vibration from altering the setting of the pitch adjusting screw. The pitch angle is indicated by a pointer, attached to the locating plate, which moves over a scale screwed to the top of the base casting.

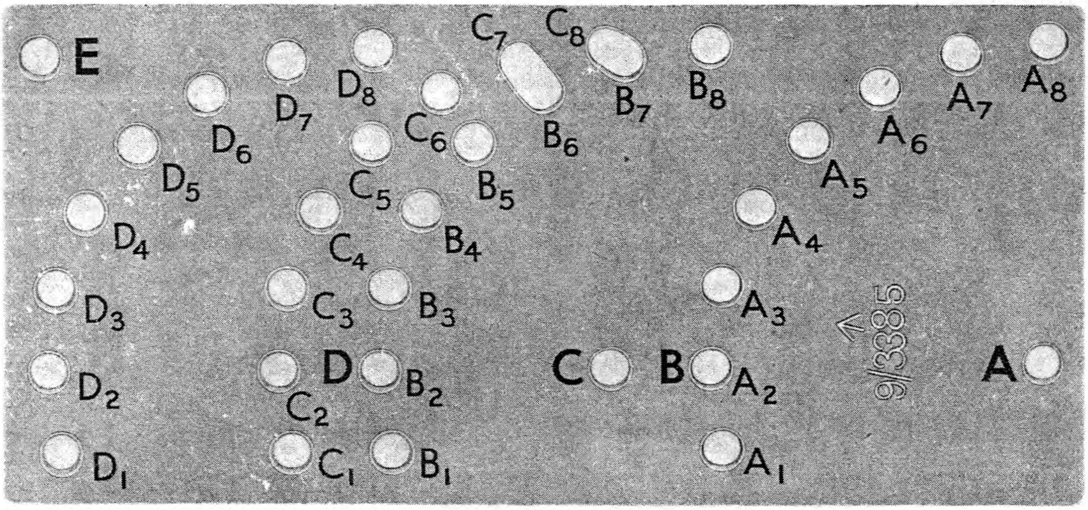

Fig. 2—Adaptor plate

The adaptor plate

4. The adaptor plate is made from steel plate and has four sets of holes arranged to provide an angular movement of 15 deg. between each hole. A general view of the plate is shown in fig. 2, with the holes lettered and numbered. By using hole A as a pivot, the whole range of holes marked A_1 to A_8 may be utilised for bracket or aircraft mounting. The plate may be reversed or the pivot bolt changed in order to give an ample angular adjustment to meet any requirement. Similarly holes B, C, and D, may be used as the pivoting hole, their respective ranges of adjustment being shown by the series B_1 to B_8, C_1 to C_8 and D_1 to D_8. It will be noticed that the two ranges marked B and C overlap at the top necessitating the holes C_7B_6 and C_8B_7 being made into elongated slots. Due to the weight of the plate, a supporting bolt from the airframe may be attached through the hole marked E or any other convenient hole. The position of this bolt on the airframe will vary with the angular position of the plate.

5. By choosing two suitable sets of three holes, the universal bracket may be attached to the adaptor plate in such a position that when the plate is bolted to the airframe the mounting spigot will be in the required installation position for the particular type of aircraft. It will be found that almost any position of the bracket and plate can be obtained by practical 'trial and error' methods prior to the final fixing.