

## SECTION XII

## CHAPTER 2

## GOGGLES, MK. IV, MK. IVA, AND MK. IVB.

## General

1. The goggles described in this chapter are worn by aeroplane pilots and observers to protect the eyes and to eliminate glare. They are worn attached to the flying helmet. The protection they afford includes full frontal vision and side windows, the latter forming a portion of the main frontal vision windows. A sun vizer, suitably tinted, is also provided which is readily adjustable for the differing conditions met with in flight. Spare windows are supplied and are interchangeable to meet varying flight conditions.

2. Although primarily for use in open cockpits, they can also be worn as a protection to the eyes in cabin type aeroplanes. The goggles are attached to the helmet by elastic cords and a strap, which allows them to be moved on to the forehead of the wearer when not in immediate use. All the windows and the sun vizer are shatterproof.

## Description

3. The goggles described in this chapter have been designed for use in conjunction with the flying helmet, oxygen mask and ancillary equipment. Their construction permits adjustments to be made to suit individual requirements. The interchangeable windows combined with the use of the adjustable vizer meet almost all conditions of glare. In instances where spectacles or glasses are usually worn, correcting lenses can be obtained and substituted for the windows normally issued.

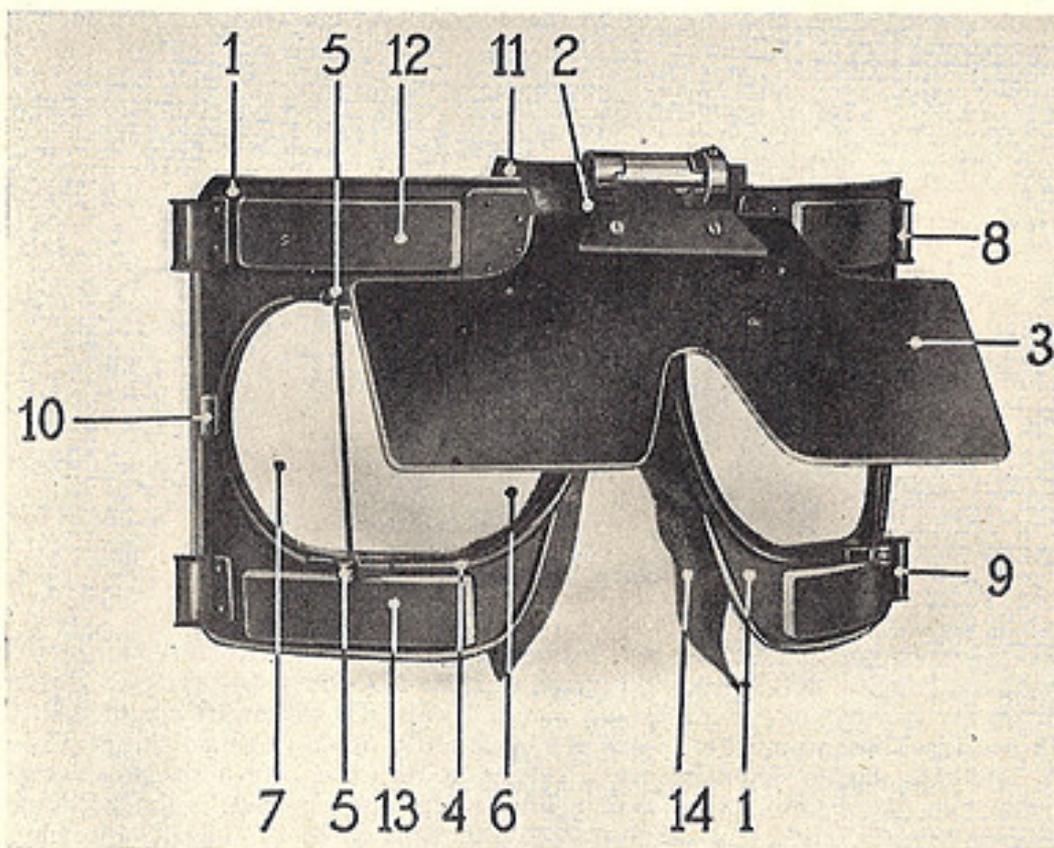


FIG. 1—GOGGLES, MK. IV

4. The essential requirements of these goggles are met by the method of construction described in this chapter, but issues may vary somewhat in detail owing to the latitude which is allowed to individual manufacturers. Three types are described in this chapter, namely the MK. IV, MK. IVA and MK. IVB goggles. They are relatively light, easily manipulated and the field of vision is wide

and practically unobstructed. The windows are held in raised frames, whilst the vizor in each instance is frameless and hinged to the top of the frame of the goggles.

5. *The Mk. IV goggles* are illustrated in fig. 1. It will be seen that they consist of two pressed metal frames (1) which are joined together by an adjustable bridge (2) carrying the vizor (3). Each of the frames (1), carries a projecting window frame (4) hinged at the point (5). The window is divided into two parts and is set back at the hinge so that in effect about five-eighths of the window (6) is available for frontal vision, whilst the remaining three-eighths (7) is mainly used for side vision. The angle of the set-back portion is approximately 45 degrees which gives almost unobstructed vision. The frontal vision portion (6) of the window frame is fixed to the main frame, whilst the side window portion (7) opens at the hinge and when folded back, away from the main frame, allows the window glasses to be removed and replaced. Small ventilation holes are provided in some instances above and below the rim of the frames.

6. Each frame also carries two metal runners (8) and (9) at the top and bottom corners respectively, remote from the nose. These are actually pressed over portions of the frame. Between these two runners is a spring grip (10) which acts as a snap fastening for the opening portion of the window frame. The two runners (8) and (9) carry one of the elastic cords by which the goggles are attached to the flying helmet. The elastic cords are not in position in the illustration.

7. The frames are shaped at the edges, being turned up away from the face of the wearer in order to avoid damage to the helmet or oxygen mask over which the goggles fit. Each frame has two pressed metal boxes (12) and (13), one above and one below the window. These metal boxes house the backs of sponge rubber pads which are inserted to raise the goggles somewhat from the face of the wearer as well as to give added protection and comfort. The back of one of these metal boxes may be seen in fig. 2 which shows that a slot (1) in the metal frame, with a cross slot (2) at one end, allows the reinforced back (4) of a soft rubber pad (3) to be inserted in the frame.

8. A soft leather nose piece (14), fig. 1, properly shaped to cover the exposed portion of the wearer's nose is sewn to the inner portion of each frame on assembly. To the top of this nose cover is attached a pad (11) which rests between the rubber pads over the bridge of the nose and fills up this space, affording protection and comfort to the wearer over the whole of the portion of the face upon which the goggles rest.

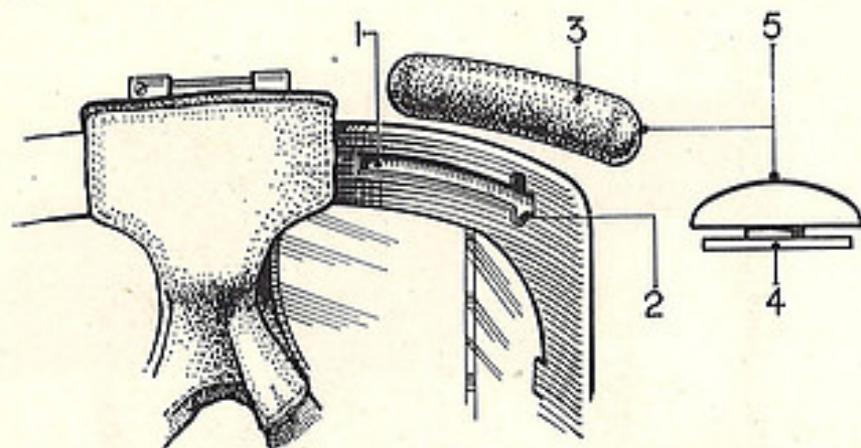


FIG. 2—SOFT RUBBER PAD FITTING

9. The bridge piece (2) joining the two frames together is of great importance to the comfort and efficiency of the goggles, and is adopted in each of the three types described. Referring to fig. 3 it will be seen that it consists of two extension pieces (1) and (2) which are rivetted to the top nasal corner of each frame. These extension pieces are set slightly at an angle to conform to the shape of the face. The left-hand frame extension piece carries at its extremity a threaded stud (3). Above it is fixed a small pin (4) of light gauge, and below it, similarly spaced, is fixed a longer pin (5) of somewhat heavier gauge. The right-hand frame extension piece (2) has a slot which takes the screwed stud (3) of the left-hand frame. Above it are seven holes of a size suitable to take the light gauge pin (4) and below it three holes to take the heavier gauge pin (5) of the extension piece of the left-hand frame.

10. On assembly, the right-hand extension piece (2) fits over the left-hand extension piece (1) and engages the screwed stud (3) and the pins (4) and (5). A thin flat nut (6) having a knurled edge and four pin-spanner holes in the top, screws on to the threaded stud (3) and locks the two frames together. This nut is undercut to allow the heavier gauge pin (5), which is longer than the lighter gauge pin (4) to stand proud of the right-hand extension piece (2) when the two frames are locked in position. The reason for the various lengths of pins is to facilitate adjustment, as will be described later, as well as to form a guide and steady pin for the vizor (7) when used.

11. The adjustable bridge also carries the vizor mounting which is itself adjustable to any of four positions. It consists of a bent up portion (8) of the vizor mounting (10) and is formed into a tube having its centre portion cut away. In this tube is housed a rod (9) on which is mounted the vizor bracket (11). It is somewhat shorter than the tube (8) and has its end bored out and a coiled spring housed therein. This spring is held in place by a cap (13) retained by three small screws in the end of the tube (8). The outer tube (8) has four slots cut into the inner edge of one of the walls formed by the cut-away portion. The vizor bracket (11), attached to the rod (9), engages one of these slots and is held there by the spring which is provided between the sealed end of the tube (8) and the rod (9). The rod (9) can be moved with respect to the tube (8) by pushing the vizor (7) against the spring pressure, until the bracket plate (11) is pushed out of the slot in which it is engaged. The rod (9) can then be rotated and allowed to engage with any slot, as required. The vizor is attached to its bracket by two screws (12) and the vizor bracket (10) is clamped on to the stud (3) by the nut (6).

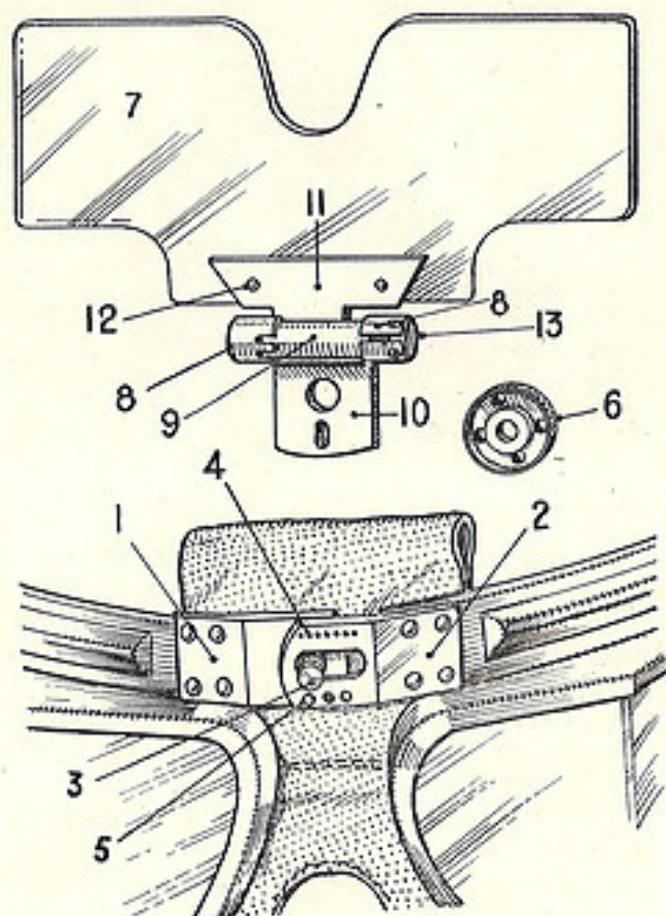


FIG. 3—BRIDGE ADJUSTMENT AND VIZOR ATTACHMENT

12. The *Mk. IVA goggles* are an interim issue and only a limited number are being supplied. They are illustrated in fig. 4 which shows them to be essentially similar to the *Mk. IV goggles*, with the exception that the frames are of black moulded composition which necessitates one fundamental and certain minor differences in the design and construction of the goggles. For all practical purposes, the only difference of importance to the user, is the method of fixing the windows. This is illustrated in fig. 5 wherein it will be seen that the *Mk. IVA goggles* employ light metal sub-frames (1) to which the two pieces of each window (2) and (3) are permanently clipped. Each of these assembled windows fits into a recessed portion (4) of the moulded window frame on the goggles, from the inside. They are each held in position by a tab (5) on the sub-frame which fits into a slot (6) and a sliding catch (7) operated by the knob (8) on the outside of the frame remote from the nose. Another point of difference between the *Mk. IV* and the *Mk. IVA goggles* is the housing for the face pads. In the *Mk. IVA goggles*, illustrated in fig. 4, the slot which holds these rubber pads has a domed cover (1) moulded with the frame, and the backs of the rubber pads have a different shape to fit into the slots in the frame, but the essential function of these pads remains the same.

13. The *Mk. IVB goggles* are illustrated in fig. 6. They are essentially similar to the *Mk. IV* model, with the exception that the windows are in sub-frames as is also the case of the *Mk. IVA*

model. In effect the MK. IVB goggles have the metal frame characteristics of MK. IV and the window sub-frames of the MK. IVA. The clip fastening of the sub-framed windows of the MK. IVB model

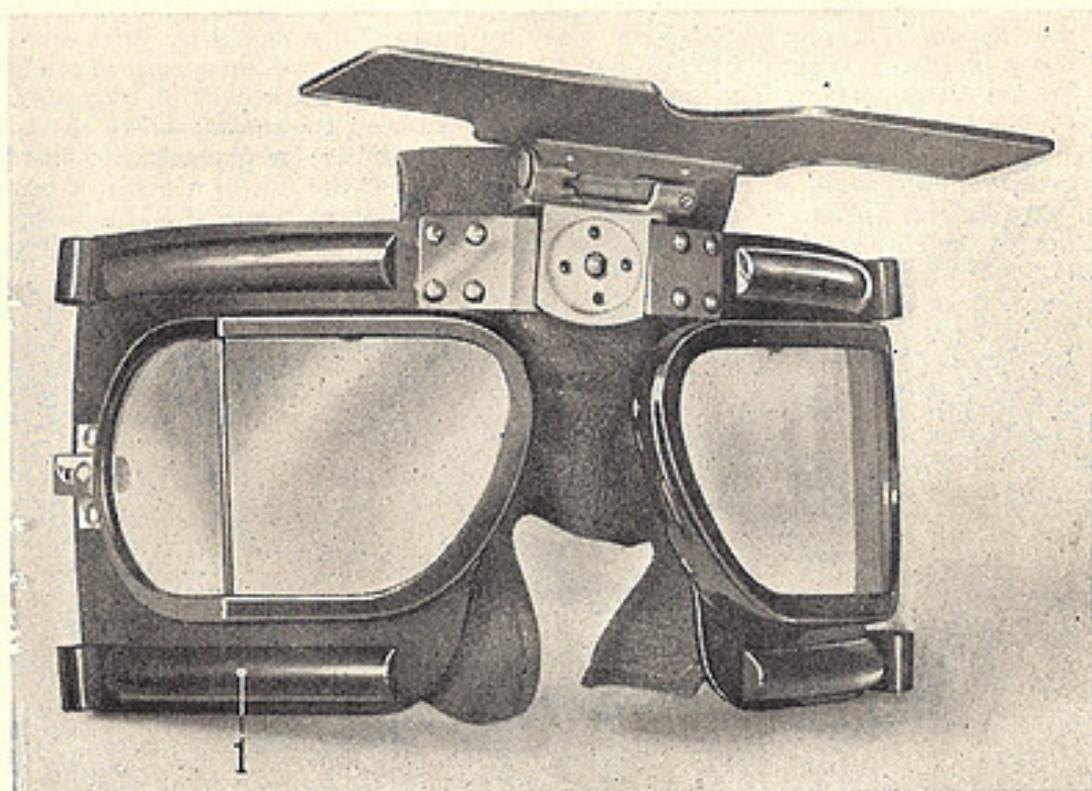


FIG. 4—GOGGLES, MK. IVA

is somewhat different from the MK. IVA model. It is illustrated in fig. 7 which shows that it comprises a lever (1) with a tab (3) which engages the sub-frame through a slot (4) in the window frame on the goggles. This lever is hinged to the frame at (5) and is sprung over a retaining pin (2) which is fixed to the frame of the goggles.

14. A rear view of the goggles is given in fig. 8 and with the exception of the shape of the rubber face pads is typical of all three types. It shows the leather nose piece (1) with the bridge pad at (2) and indicates how the goggles are fitted to the face of the wearer with the maximum comfort.

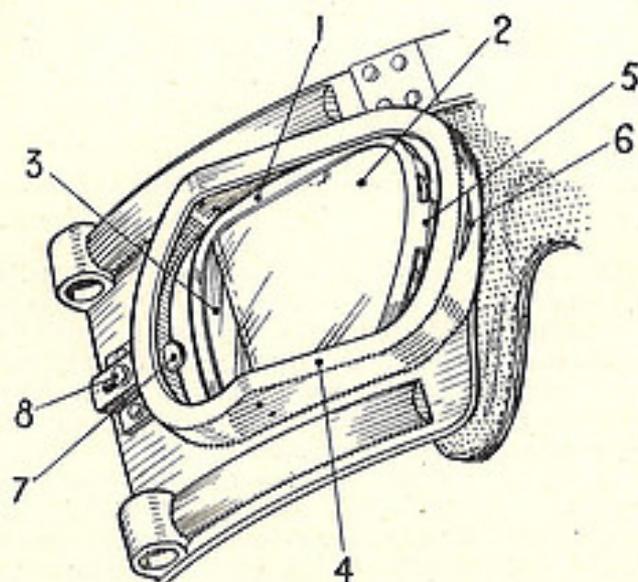


FIG. 5—REMOVABLE WINDOW OF MK. IVA GOGGLES

#### *Windows*

15. The windows which are available for use with the goggles cover a wide range of light conditions and all are shatterproof. Those in the MK. IVA and MK. IVB goggles are clipped in sets

to a light metal sub-frame so that each set of windows comprise two pieces instead of four as is the case with the MK. IV windows.

- |                          |  |
|--------------------------|--|
| (i) Crookes A 2 tinted.  | For use on normal days.  |
| (ii) Crookes B 1 tinted. | For use on bright days.  |
| (iii) Clear (untinted).  | For use on normal days or at night, with the deep vizor; the latter is issued for use against searchlight glare. |

### Operation

16. One of the principal features of the goggles described in this chapter is that they may be worn for long periods under flying conditions. This essential requirement can only be obtained by exercising the greatest care in fitting the goggles to the flying helmet and making the necessary adjustments. Once the correct fitting and adjustment have been obtained no further alterations should be found necessary.

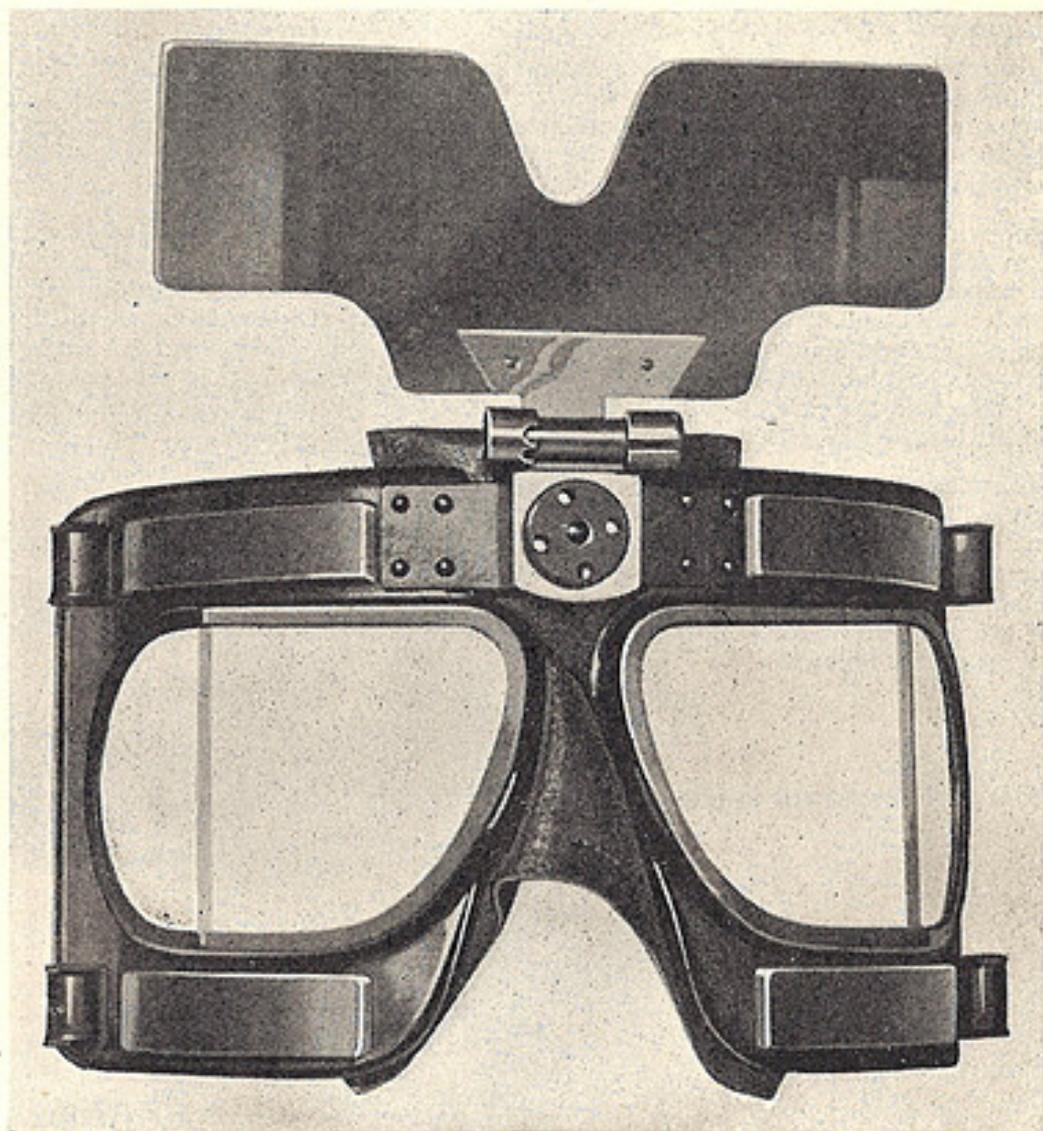


FIG. 6—GOGGLES, MK. IVB

### Helmet fitting

17. Before attempting to fit the goggles it is necessary to fix certain attachments to the helmet which engage with the goggles. The MK. IV and MK. IVB goggles require four  $\frac{1}{8}$  in. straps to be fixed to the helmet. The illustration, fig. 9, shows two straps (1) and (2) which are sewn to one side of a helmet in such a manner that the snap fastenings are one above and one below the helmet strap when in position. Two others are similarly positioned on the other side. The free ends of these straps are fastened by two press studs which are attached, one half to the helmet and the other half to the straps. The back strap of the goggles fits under the straps (1) and (2) and is held in position by them. The MK. IVA goggles require four helmet plates to be fixed to the helmet. The illustration, fig. 10,

shows two of these plates (1) and (2) in position on one side of the helmet; two more are fixed to the other side. Some of the plates have position markings stamped upon them. They are fitted to the helmet above and below the earphone pocket (3) so that the flanged portion rests closely and snugly against the pocket with the centre of each of the flanges in line with the diameter of the earphone pockets. When the correct position has been found the helmet should be marked through the holes in the plates to indicate the position where it should be pierced. The dome-headed rivets (4) of which there are four in each top plate and three in each lower plate, should be inserted with the domed head in the *inside* of the helmet so as to project through the leather of the helmet and the holes in the plates. These rivets, when properly in position, should be secured by burring over the ends on the outside of the helmet plates. Both top and lower plates are fixed in the same manner.

18. If when the goggles have been properly fitted to the helmet, it is found that in use there is a gap between the lower edge of the helmet and the top of the goggles, the strip of leather supplied with the goggles should be sewn to the lower edge of the forehead of the helmet. This effectively fills that gap which protects the wearer and reduces wind entrance at this point.

#### *Method of adjustment*

19. The vizor should be raised to the vertical position by pressing against its side, from right to left. This releases it from the slot in which it is held by spring pressure and, holding it against this spring pressure, it should be raised to the vertical position where, upon release, it will fall into the slot appropriate to that position. Lifting the vizor exposes the bridge adjustment locknut which should be released with the pin spanner provided in the spare window case.

20. Unscrewing and removing the nut allows the vizor and its bracket to be taken off the screwed stud, which in turn exposes the bridge adjustment. The adjustment to be made at this point is of the greatest importance to the fit and comfort of the goggles. The best method of making this adjustment is by trial and error, and reference to fig. 11 shows the details of the bridge. The two extension pieces, (1) and (2) should be disengaged and set as shown in this diagram, with the threaded stud (3) of the one half, in the slot (4) of the other, and with the pin at B in the central of the lower of the three holes, and the small pin at (4) in the centre hole of the seven small holes at the top. The nut should then be replaced and tightened by the thumb and finger.

21. At this stage the goggles should be held well into the face and the way they fit in regard to the bridge of the nose should be tried and examined carefully. In some few instances, they may be exactly right, but in the majority of cases they will require adjustment. Any malalignment of the goggles can be corrected by an intelligent use of the adjustment provided. It will be observed that for each of the three horizontal width-adjusting positions A, B or C, there are three corresponding small pin holes in the group 1 to 7 which give three inclination-adjusting or vertical off-setting positions. Thus the groups are as follows:—

- A and 1, 2 or 3,
- B and 3, 4 or 5,
- C and 5, 6 or 7.

Complete width and nasal angle adjustment is thus provided.

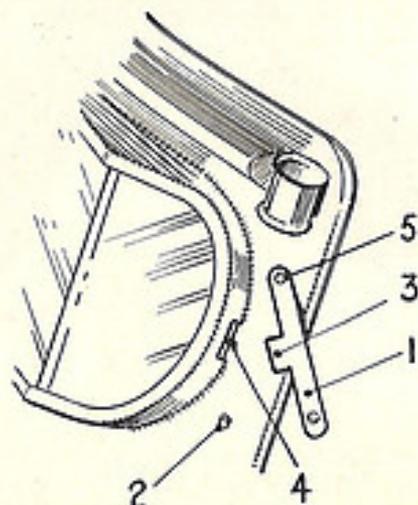


FIG. 7—WINDOW FASTENING OF GOGGLES, MK. IVB

22. If the goggles fit loosely, an adjustment must be made to include the group A and 1, 2 or 3. If they fit too tightly, an adjustment must be made to include the group C and 5, 6 or 7. If only the inclination is incorrect at the centre position B, then adjustment to holes 3 or 5 must be

made. When the correct adjustment has been found, the nut should be replaced and screwed up finger tight. A further trial against the face, with deliberate study and adjustment should finally be made, and if found to be firm and comfortable, the nut should be tightened, but not locked at this stage.

#### *Fitting the goggles to helmet*

23. The helmet should be put on in the normal manner, adjusted so as to be well-fitting and comfortable and strapped firmly to the head. The goggles should then be held in position over the nose and the back strap fitted under the respective side straps on each side of the helmet and fastened by the press studs. When the helmet straps are properly in position the back strap should be tightened.

24. The helmet with goggles attached should be worn for a few minutes, and the fit of the goggles over the nose should then be examined, because although the goggles seem to fit comfortably when held to the nose, they may need further adjustment when fitted to the helmet. The nasal sides of the goggles should be resting well down about the nose and fit the contour closely. If there is a gap from top to bottom between the nasal sides of the windows and nose, the horizontal width needs to be reduced and *vice versa*. The goggles should be removed and the necessary adjustments made as previously described.

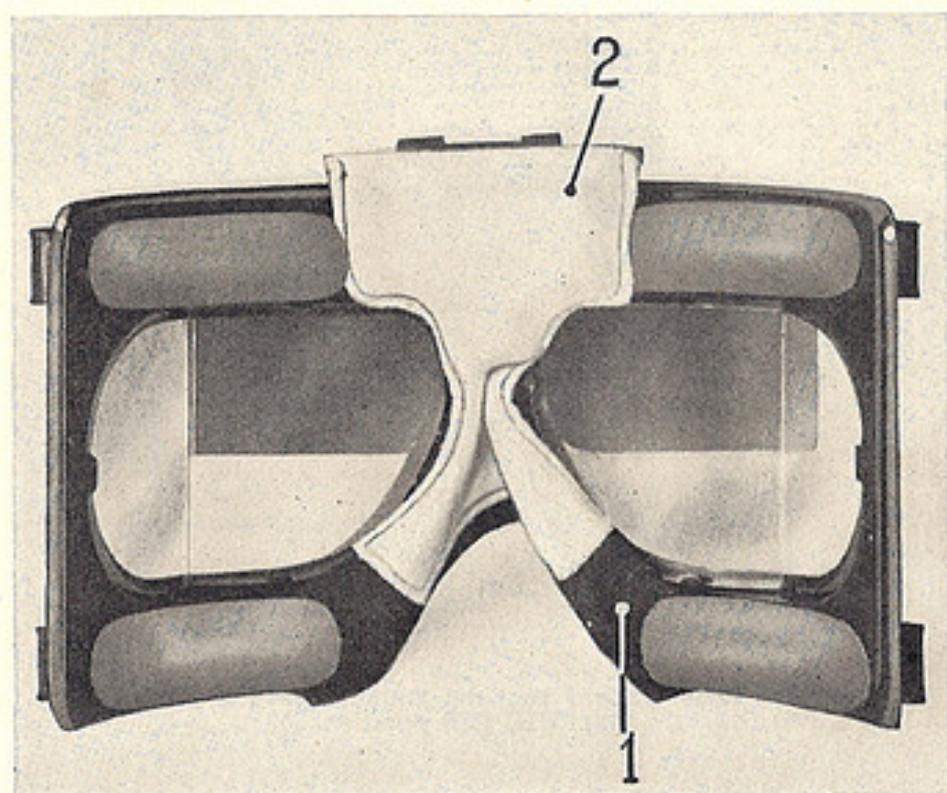


FIG. 8—BACK VIEW OF MK. IVB GOGGLES

25. The goggles should be replaced on the helmet, adjusted into position and the back strap again tightened. If the nasal sides of the frames touch the nose at the top and have a gap at the base of the nose, the inclination of the goggles needs to be adjusted, that is the bridge requires adjustment with respect to the top pins only, which can be done without releasing the larger pin from its correct hole. Again the goggles should be replaced on the head, the band tightened and the goggles worn for a few minutes. If when observing the fit of the goggles as indicated in the previous paragraph, the nasal sides of the frames touch the nose at the base and there is a gap at the top of the nose, the adjustment described with respect to the top should be carried out.

26. Whilst in the description given it has been assumed that these fittings and adjustments are made by the wearer, if the assistance of a second person is available, they can be made *in situ* by loosening the back strap and then performing the adjustment as previously described. When the correct and most comfortable position has been found, the holes used should be memorised or noted in order to avoid any further trouble in case the pins slip out of their respective holes when changing over vizors.

27. A further and final adjustment to ensure comfort and eliminate draughts, concerns the leather nose piece. If when the whole fitting of the goggles has been completed there is a fullness in the leather of the nose piece over the nose, this can and should be remedied by pinching up a pleat in the leather down the centre line and sewing along this line at a suitable distance from the edge of the fold, to form a permanent pleat.

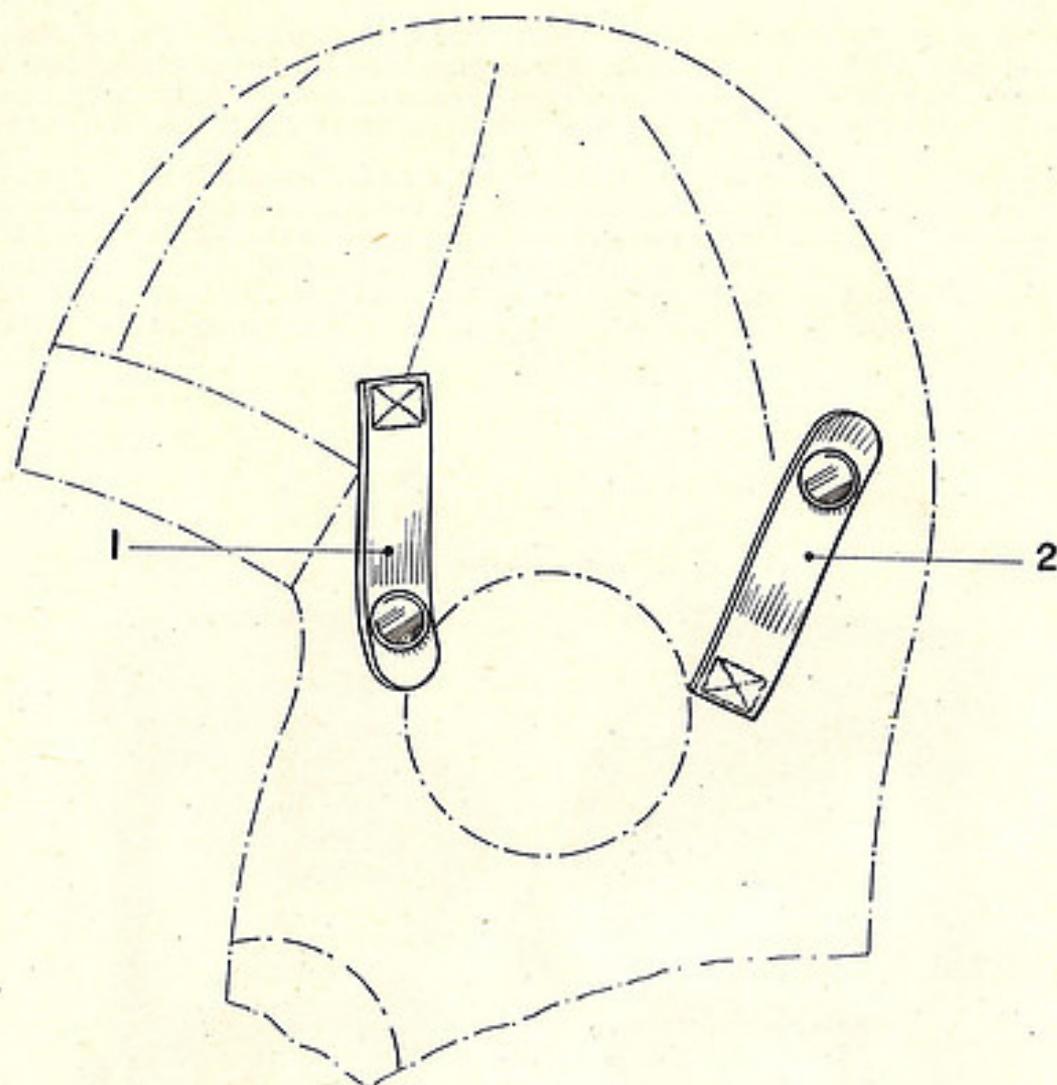


FIG. 9—FLYING HELMET SHOWING FIXING STRAPS FOR MK. IV AND MK. IVB GOGGLES

#### *Face pads*

28. The next adjustment to consider is the points of pressure on the face of the wearer where the rubber pads make contact. The distribution of this pressure can be varied somewhat by adjusting the back strap. If when such adjustment has been made, undue pressure is still felt from the sponge rubber pads, those fitted should be changed for the narrower set supplied. Three sets are provided, the medium set being fitted to the goggles on issue and a narrow and a deep set supplied as spares.

29. To remove the pads fitted in the goggles, it is essential to avoid pulling directly upon the soft rubber. The pads of the MK. IV and MK. IVB goggles have flat reinforced backs as can be seen by reference to fig. 2. These reinforced backs (4) slide into the slots provided on the goggles. To extract them, the end of the pad (5) remote from the nose should be gently lifted and the reinforced portion (4) in the slot eased out of the vertical slot (2) when the whole pad can be withdrawn by sliding it out of the horizontal slot (1). The MK. IVA goggles have pads with a tough rubber back. To remove them, the pad should be gently lifted at the outside end, when the tough rubber back piece, fitted into the slot on the goggles, will be exposed. This portion should be gripped and the whole pad removed from the groove by pulling on this tough rubber portion of the pad. To facilitate the insertion of a pad into a groove, the tough portion of the pad should be wetted, when it will be found to slip in easily.

30. Should it be found that there is a gap between the pads on either the forehead or the cheeks when the goggles are worn, the medium pads should be replaced by deep pads. It is well worth

while to give great care and attention to all these points. The alternatives have been provided with a view to giving the wearer absolute comfort and the maximum efficiency in the use of the goggles. The remaining two sets of pads should be retained when the set required has been fitted.

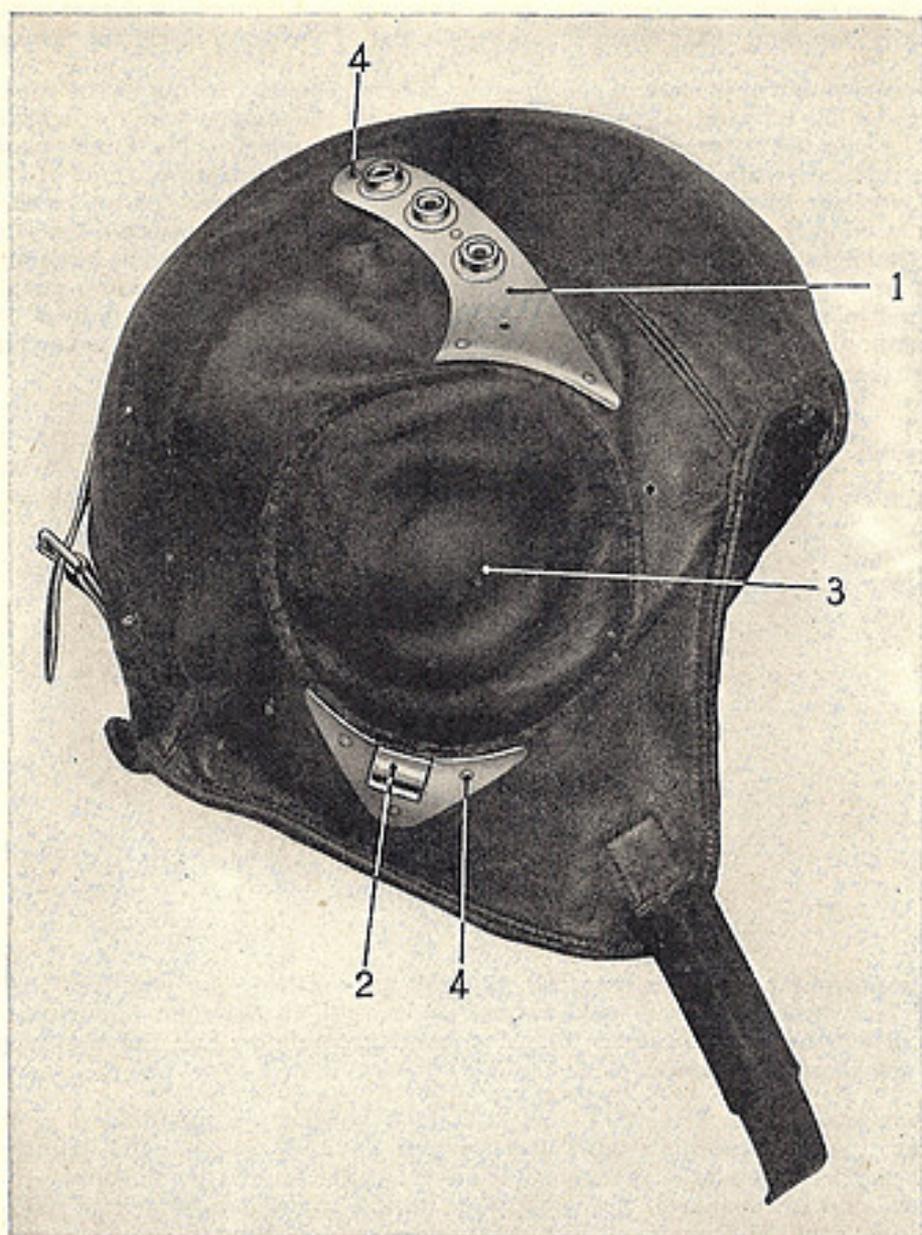


FIG. 10.—FLYING HELMET SHOWING FIXING PLATES FOR MK. IVA GOGGLES

#### Vizors

31. When the adjustments relative to the fitting and comfort of the goggles have been completed, it will be necessary to refit the vizor. Referring again to fig. 3, the nut (6) locking the bridge should be removed and the vizor plate (10) placed in position so that the circular hole fits over the threaded stud (3) and the lower slot over the pin (5) below it. The nut (6) should then be replaced and screwed up finger tight. Before finally screwing this nut home, the top of the vizor should be pressed downwards towards the central stud (3), as it is essential that the vizor should be rigid and prevented from rocking from side to side. The nut (6) should then be tightened and locked in position by means of the pin-spanner provided.

32. The vizor with the larger shield, when provided, is intended for use against ground glare, such as from water, snow or searchlight. Adjustment to any of its four fixed positions should be practised, and consists of pressing the right side of the tinted shield to disengage it from its locking device and flicking it up or down, when it will automatically set itself to the angle of the next fixed position, or retaining the pressure on the right side, it can be moved to whichever new position it is required to take up.

### Changing windows

33. When it is desired to change the windows in the goggles for another of the sets supplied, the first essential is to avoid mixing the windows. This causes loss of time and annoyance if by inadvertence an odd set of windows is fitted and only discovered when it is desired to use the goggles. It is best to remove the whole set in the goggles, change them with the set that it is desired to use in the spare window case, and then, when the old set is out of the way, insert the new set of windows.

34. The actual removal of each of the windows is performed according to the type of the goggles. The MK. IV model has its windows changed by pushing up the smaller window, which is the window farthest from the nose, from the inside against the spring catch which holds it and opening the window to at least the vertical position. Each piece of window can then be slipped out of its frame toward the hinge. It is easier to remove the large window first in each case. To insert the new windows each must be placed in its right position. The small windows should be inserted first, care being taken to ensure that the edges of the windows coincide with the ends of the frame. The large windows can then be inserted, observing the same precautions. Before closing the open windows, push them together gently, observing in so doing that the edges of the larger and the smaller windows line up, in order to prevent straining the frames and possibly damaging the windows. This also ensures the elimination of wind against the eyes.

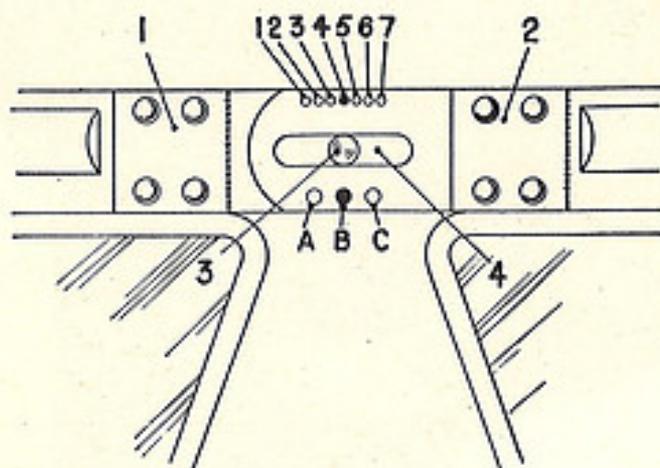


FIG. 11—BRIDGE ADJUSTMENT

35. It is important to observe that the windows are marked. An engraved "O" will be found on the outside face of side windows, and a small green spot on the right-hand front window. This small green spot will be found near the hinge on the large window and the engraved "O" near the outer edge on the smaller window.

36. The windows of the MK. IVA and MK. IVB goggles are mounted in a metal sub-frame so that each set of windows forms a pair. Reference to fig. 5 shows a window slightly removed from the frame. To replace a window, the knob (8) on the frame should be slid away from the window and when at the end of its travel, the window in its sub-frame can be gently pushed out towards the inside of the goggles. The window is completely removed by lifting it back and away from the nasal end so that the tab (5) at the end is disengaged from the slot (6) in the frame. The new window is inserted in the reverse order, placing the tab (5) in the slot (6) at the nasal end then, having brought the window up against the catch (7) at the other end of the window frame, the knob (8) should be slid back and when at its full extent the window can be pushed home from the back to the front and the knob (8) released, locking the window into the frame. As with the MK. IV goggles, care should be taken not to mix the pairs of windows or to insert odd sets.

37. The MK. IVB goggles have a spring lever fastener to hold the windows in place. This is illustrated in fig. 7 in the open position. To open the catch, the lever (1) has to be lifted off the pin (2) and swung away from the window frame. This withdraws the tab (3) from the slot (4) and releases the window. The opposite operation fastens the window in position.

### Raising goggles to forehead

38. If it is desired to remove the goggles from the normal flying position for any reason it can be effected very rapidly. Whenever the wearer moves the position of the goggles, the vizor should be lowered to the down vertical position. This is important, in order to avoid damaging the vizor by striking it against the roof of certain types of closed cabin aeroplanes.

39. The goggles should be grasped between fingers and thumb, with the fingers above and the thumb below the frame of the goggles, which should be pulled gently away from the face, just sufficiently to be well clear of the face, and then raised, or run upwards on the elastic cords to a suitable position on to the forehead and gently released. It will be found that the goggles sit comfortably and securely in this position. To replace the goggles, the movements should be reversed.

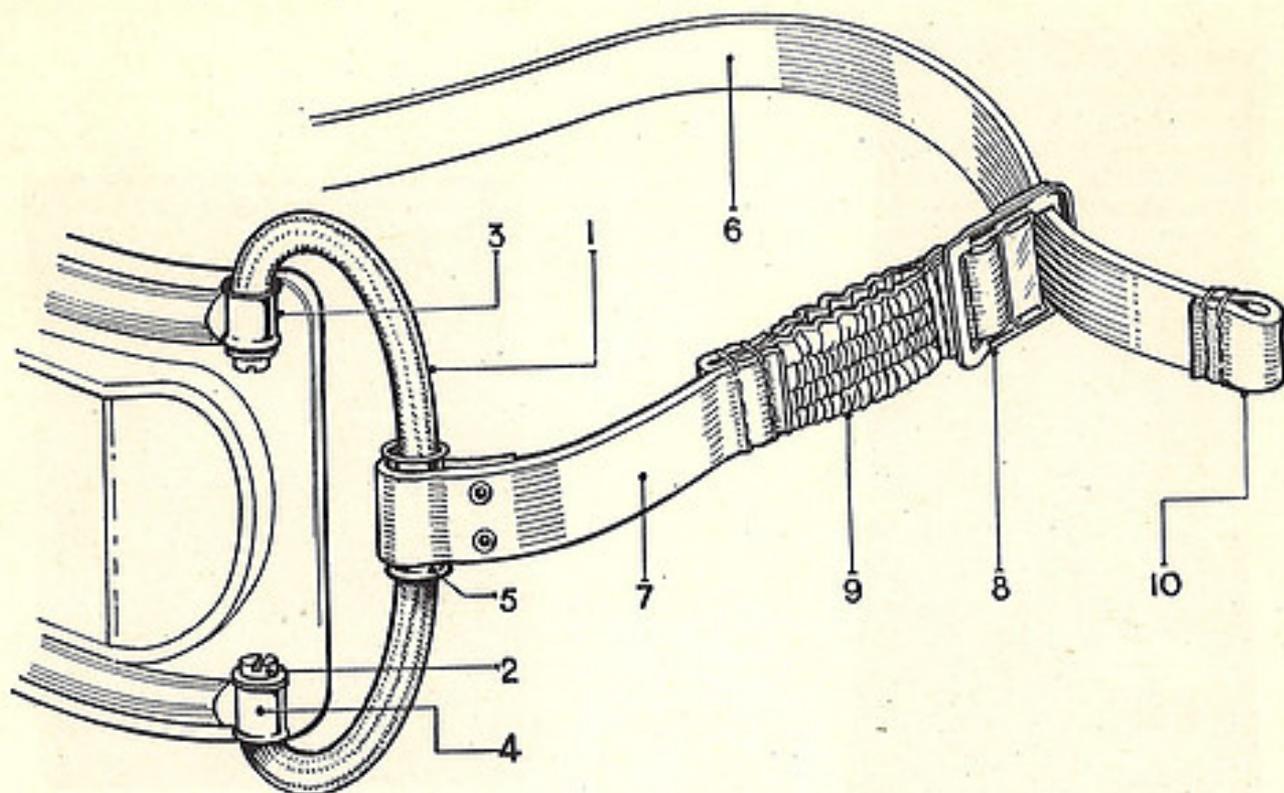


FIG. 12—BACK STRAP AND SPRING CORDS

#### Spring cords and back strap

40. The goggles are actually secured to the head of the wearer, over the flying helmet, by the back strap. This is illustrated in fig. 12 from which it will be seen that a pair of elastic cords (1) covered in cotton braiding, are secured to the goggles by means of a screw (2) in each spring end of the cords (1). These screws hold the cords in position in the runners (3) and (4) respectively. An oval metal ferrule (5) runs on each of the spring cords (1) and has fastened to it one end of each of the  $\frac{3}{4}$  in. leather straps (6) and (7); the other ends of these straps are attached, one through the buckle (8) and the other to a multiple spring covered by a sateen bag (9) and the buckle (8). The loose end (10) of the strap (6) is made captive in the buckle (8) by being looped back and stitched. The necessary adjustment to this back strap is important and should be carefully made to ensure that the goggles are firmly, but not too tightly strapped to the head of the wearer and that sufficient free elasticity remains to remove the goggles from the face to the forehead without the fitting being too loose on the face, and thus letting in draughts, in the flying position.

#### Types available

41. The types of goggles available for service are as follows:—

Stores Ref.	Mark	Specification	Weight (approx.) oz.
22C/111	IV	P.G. 517	10
22C/136	IVA		9
22C/167	IVB		10

42. Each set of goggles is supplied in a stout cardboard box, having partitions in which are contained, in the front space a wallet, in the centre section the goggles and in the rear partition the spare soft rubber pads and the leather forehead piece. The helmet plates for the MK. IVA goggles are beneath the goggles in the centre section. The wallet is usually provided to contain

the spare windows. The wallet for the MK. IVA goggles is illustrated in fig. 13 and that for the MK. IVB goggles in fig. 14. They contain, in addition to the two sets of spare windows, a 2-pin spanner for the nose adjusting locking nut, a tube of anti-dimming and cleaning compound and, in some instances, the wide vizor.

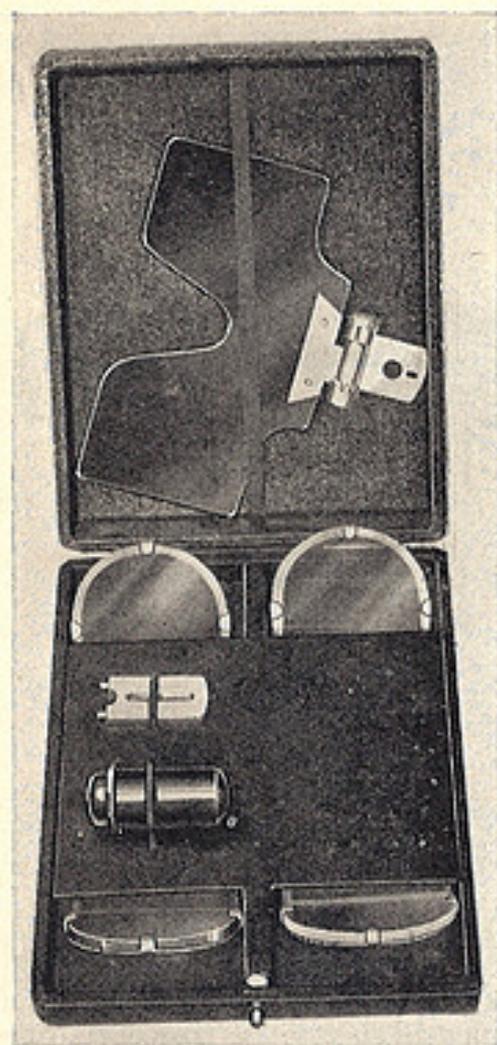


FIG. 13—SPARE WINDOW CASE FOR MK. IVA GOGGLES

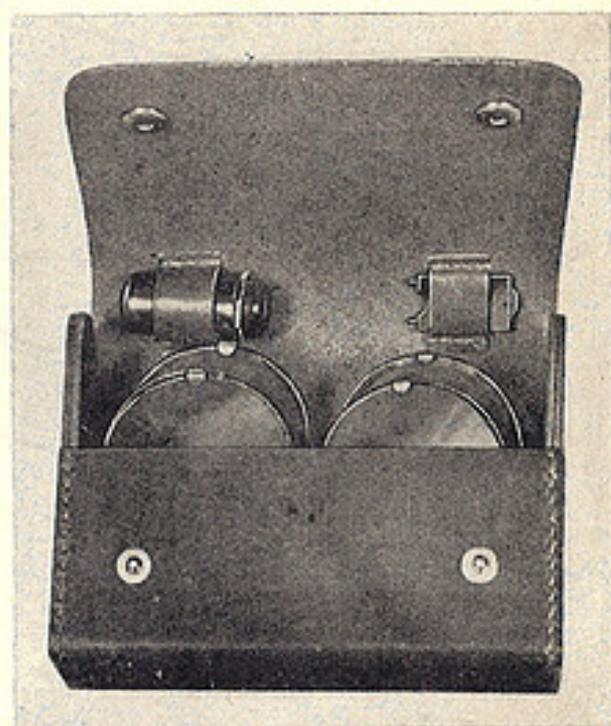


FIG. 14—SPARE WINDOW CASE FOR MK. IVB GOGGLES

### Maintenance

43. The goggles should be treated with great care at all times, and when not in use, they should be put in a place of safety, preferably in the cardboard box in which they are issued. They should be checked over at regular intervals to ensure that they are always ready for use and that no defects exist which may develop and render the goggles unserviceable. The contents of the wallet should also be checked over from time to time.

44. All the windows and the vizor should be kept clean by making use of the cleaning compound contained in a case in the wallet. It can be removed from its case by unscrewing the cap. One light smear should be rubbed over both surfaces of each window and the vizor until each surface is covered with a light film. Only the smallest quantity possible should be used. Each surface should then be polished gently with a clean soft cloth or handkerchief. The application of the cleaning compound prevents steaming up of the windows as well as polishing and protecting them, but care must be taken in its application to deal gently with the windows and vizor in order to avoid scratching their surfaces.

45. If, when moving the goggles up and down the forehead on the elastic loops, the runner material tends to pucker, this can be overcome by cutting the thread which binds the ends and pulling the surplus covering material forward. This should then be cut off and the ends carefully rebound. The operation should be undertaken only where the proper equipment is available to make a well finished and serviceable job.

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