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UNIVERSAL CAMERA  
MOUNTING.

This descriptive Handbook on the Universal Camera Mounting is issued for the information and guidance of all concerned.

*By Command of the Air Council,*

*W F Nicholson*

AIR MINISTRY.

*November, 1922.*

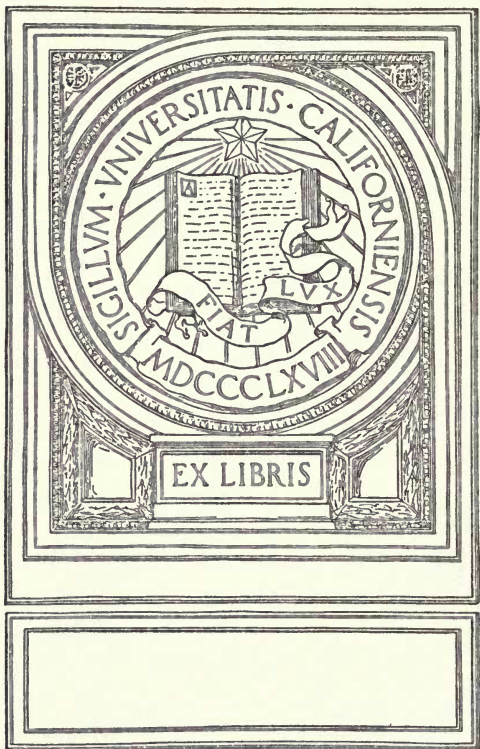
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*Frontispiece.*



AERIAL PHOTOGRAPH TAKEN WITH THE UNIVERSAL CAMERA MOUNTING.



AL PHOTOGRAPH TAKEN WITHOUT THE UNIVERSAL CAMERA MOUNTING.

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# UNIVERSAL CAMERA MOUNTING.

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## I.—GENERAL REMARKS.

1. A camera fixed rigidly to an aircraft fuselage is subjected to a number of vibrations the chief of which is caused by the engine. These vibrations are of relatively high frequency compared with the average time of exposure of a photographic plate, and the camera, therefore, will be moved by a measurable amount during the process of exposure, with a consequent adverse effect on the quality of the negatives obtained.

2. The resultant vibration may be compounded of vibrations in three directions, as follow :—(i) along the axis of the aircraft; (ii) in a direction at right angles to the axis and in a horizontal plane; (iii) at right angles to the axis and in a vertical plane.

3. Vibrations as in (iii) do not affect the quality of the negative since their amplitude is negligible in comparison with distance between the photographic field and the camera; their only tendency is to enlarge and diminish the photographic field to an inconsiderable extent.

4. It is the vibrations as in (i) and (ii) that adversely affect the character of the photographs because a very small angular displacement of the optical axis of the lens during an exposure will give a relative movement between the optical field and the photographic plate.

5. If, therefore, the axial and transverse component vibrations be made, through the mechanism of the mounting, to effect only vertical displacements of the camera, these conditions will be far more favourable to successful photography than when the camera is attached by a rigid mounting to the fuselage.

6. A partial conversion of some of the adverse components of the vibrations and the damping out of others not so converted is carried out in the Universal Camera Mounting.

7. That the results justify the added complication of the spring mounting may be seen from the two photographs forming the frontispiece of this handbook. Both photographs were taken simultaneously from the same machine, that on the right being taken by a camera supported on the L.B. Tray, that on the left by a camera supported on the Universal Mounting.

## II.—UNIVERSAL CAMERA MOUNTING.

8. The mounting itself is illustrated in Fig. 1, and to it are fitted adapters to suit various service cameras. The base of the mounting has been so designed that it can be fitted,

without alteration, to movable cross bars mounted between special struts between the upper and lower longerons of an aircraft.

9. The mounting consists of three ash frames; the first, or base frame, is secured by bolting to the movable cross bars; the second, or swivelling frame, is pivoted about the centre points of the port and starboard members of the base frame and locked to it by an adjusting screw; the third, or sprung frame, is mounted inside the swivelling frame and at the ends of the horizontal arms of four bell-crank levers carried in the swivelling frame. To the sprung frame the camera adapter is fitted.

### **Base Frame.**

10. The base frame is built up from two heavy side members, a fixed rear member and detachable front member. The shape of the side members is shown in Fig. 1.

11. Mounted beneath the foot formed at each end of both side pieces is a hand operated bolt which secures the mounting by engaging beneath the movable cross bars in the aircraft. Spring loaded ball catches mounted in the side members retain the bolts in either the free or engaged position. On the inner face of each side member a brass fulcrum plate is mounted and is drilled to receive a bolt which is located with its centre in line with the apex of the V-shaped upper edges of the side plates.

12. A channel sectioned protecting plate is fitted at the forward end of each side member and each plate is drilled and tapped to receive one of the two securing bolts of the detachable front member of the frame.

13. The detachable front member takes the form of a plain ash bar having its ends stepped to space the open ends of the side pieces.

14. The rear member of the frame is fitted into extensions formed behind the rear feet of the side members. Mounted centrally on its rear face is a bracket between the cheeks of which is pivoted a thrust block to take the lower end of the adjusting screw of the swivelling frame. Two studs are mounted in the base of the bracket and are taken through the rear member of the frame to which they are secured by nuts split-pinned in position. A brass plate backs these nuts to protect the wood.

15. Except when the mounting is fitted to the D.H.9A., the detachable front member is not removed. In that aircraft the internal bracing wires demand the removal of this member as well as the corresponding member of the sprung frame.

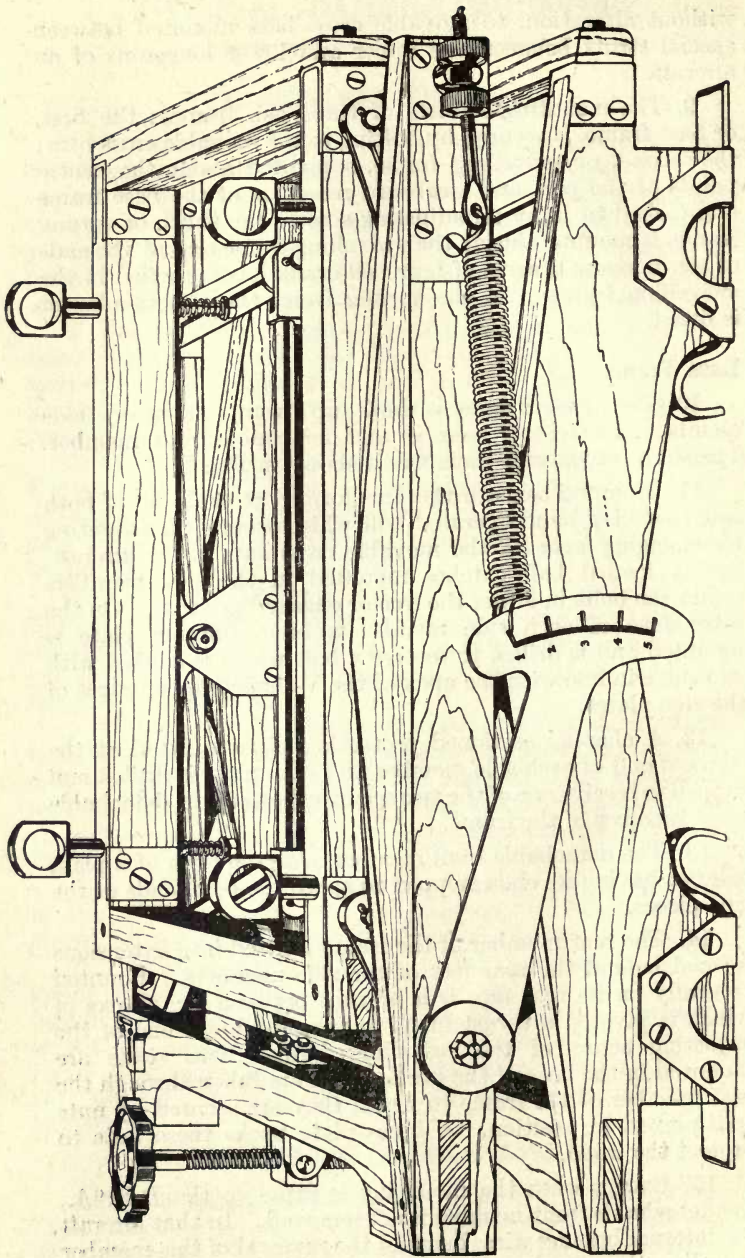


FIG. 1.—UNIVERSAL CAMERA MOUNTING.

## Swivelling Frame.

16. The swivelling frame is constructed of two side members and a rear transverse member. The shape of the side members and also one of the fulcrum plates secured to their inner faces is shown in Fig. 1. Through these fulcrum plates, and those of the side members of the base frame, special bolts are passed about which the swivelling frame is pivoted. A spring washer is clipped beneath the nuts of each of these bolts and split pins prevent the nuts working loose.

17. A bracket similar to that fitted to the base frame is fitted to the rear member of the swivelling frame, and pivoted between its cheeks is a square nut which engages the adjusting screw by which the two frames are locked together.

18. On the inner faces of each side member of this frame two bell crank levers or rocker arms are mounted. The two rear rocker arms are keyed to a transverse coupling spindle upon which they are located axially by means of clamping-screws taken through split lugs. The two forward rocker arms are mounted freely about the ends of set screws taken through channel-sectioned clips straddling and countersunk into the side members of the frame. These rocker arms are located axially on the studs by washers mounted on the inner ends of the latter and secured by split pins.

19. Brass channel clips are fitted to the side members of the frame at the points where the transverse coupling spindle passes through them, and rocker levers are fitted to the ends of the spindle as shown in Fig. 1. The shanks of these levers are of heavy gauge steel plate and are secured by set screws to gunmetal bosses. A plain washer, nut and split pin secure each lever to the spindle.

20. At the open ends of the side members of this frame, channel-sectioned armouring clips are fitted. Mounted in these clips are the fixing bolts of the rocker lever tension spring. These fixing bolts take the form of eye-headed pins and are taken through the armouring clips in which they may be rotated freely. A split pin taken through the inner extremities of each bolt locates them axially in their sockets, and passing through the eye of each bolt is a rocking lever spring tension screw. These screws have threaded shanks with an integral eyed head of larger diameter than their shanks. On the shanks of the tension screws are two knurled adjusting nuts, one on each side of the head of the fixing bolts. A wire loop is passed through the end of the shank of each tension screw to prevent the loss of the outer nut. A coil spring of steel wire connects the eye of each tension bolt with the slotted end of its rocker lever. As will be seen from Fig. 1, the ends of the springs may be engaged in any one of five positions in the rocker lever. By this means cameras and adapters of different

weights can be made to have the same initial depression of the sprung frame, when mounted.

21. A coupling rod connects the lower arms of the rocker levers of each side member of the frame, and consists of a length of mild steel tube into which forked ends are screwed. These ends form knuckle joints with the ends of the rocker arms and work on flat-headed pins which are secured by split pins at their inner ends.

22. The adjusting screw has a steel shank with a two-start square thread. At its lower end the shank is stepped down in diameter and has a plain portion for accommodation in the thrust block fitted to the base frame. Beyond this plain portion is a thread to take two lock nuts. A plain and a spring washer are interposed between the upper nut and the lower face of the thrust block. At the upper end of the shank a fluted handle is permanently secured. A two-way spirit level is mounted on the left-hand end of the rear member of the swivelling frame.

### **Sprung Frame.**

23. The sprung frame, like the base frame, is built up from four members, three of which are connected together by mortised and pegged joints; the fourth (and forward) member is detachable.

24. In plan the frame is square. The detachable member of the frame is removed only when the mounting is installed in the D.H.9A. In the side members of this frame four special set screws are fitted, two of which are taken through channel-sectioned clips similar to those used at the ends of the transverse connecting spindle. The forward set screws pass through armouring clips similar to those fitted to the open ends of the side members of the swivelling frame. These set screws are stepped down in diameter at their outer ends and form journals about which the upper ends of the rocker arms are pivoted. Axial location of the rocker arms about their journals is effected by split pins. Between the clips fitted to the side members of the frame and the ends of the rocker arm are distance pieces secured to the set screws by smaller countersunk set screws.

25. The attachment of the camera adapter to this frame is by four adapter fixing bolts; one fitted towards the ends of each side member as shown in Fig. 1.

26. The bolts take the form of eye-headed spindles the lower ends of which are fitted with a plain hexagonal nut. The bolts are entered from the upper face of the frame and pass through brass bushes fitted in the side members. A spiral spring is mounted on the shank of each bolt beneath the frame and is retained by one of the nuts mentioned above. A plain washer is fitted between each end of the spring and

the under side of the frame member and nut respectively. To prevent the loss of the nuts a split pin is passed through the lower end of each bolt.

27. The attachment of the adapter to the mounting is effected by passing the heads of these bolts through slots formed in the base of the adapter and then drawing the bolts sufficiently far through the slots to permit their heads being turned through a right angle. The under sides of the heads are machined to a V edge to engage V slots in small plates attached to the base of the adapter or on the base of the adapter itself.

### III.—CAMERA FITTING IN AIRCRAFT.

28. A brief description of the type of the camera fitting as used in aircraft, and instructions for fitting and mounting will now be given.

29. The mounting rests on two transverse bearer bars which may be secured by pinning between four special inter-longeron struts mounted at some convenient position in the fuselage of the aircraft. The inter-longeron struts are of ash and of plain rectangular section, and have a number of holes drilled through them from their forward faces to provide the means of anchorage for the transverse bearers.

30. The latter components are also of ash and of such a length as to butt in between corresponding pairs of inter-longeron struts. The attachment of the bearers to the struts is by heavy gauge steel plates secured by two bolts to each side of both ends of the struts. These plates project beyond the ends of the bearers to straddle the sides of the struts, and have holes in track with those through the struts. A split pin is passed through both plate and strut to retain each end of the bearers in position. To effect easy withdrawal of these pins a large diameter ring, to which is attached a webbing loop, is threaded on to the head of each pin. A large diameter washer is fitted beneath the head and out-turned ends of each split pin.

31. The mounting is fitted across the two bearers, shown in Fig. 2, with the rocker levers facing port and starboard and with the adjusting screw nearest the observer. Having placed the mounting in this position, the bolts beneath the base frame are engaged beneath the bearers.

32. The base frame locates the mounting axially on the bearers and a plain bolt taken through the rear bearer and rear member of the frame locates the mounting transversely. This bolt is secured by a wing nut.

33. When fitting the mounting in the D.H.9A., the detachable members of the base and sprung frames must be removed.

34. The mounting is not levelled by means of the adjusting screw, until the aircraft is over the field to be photographed.

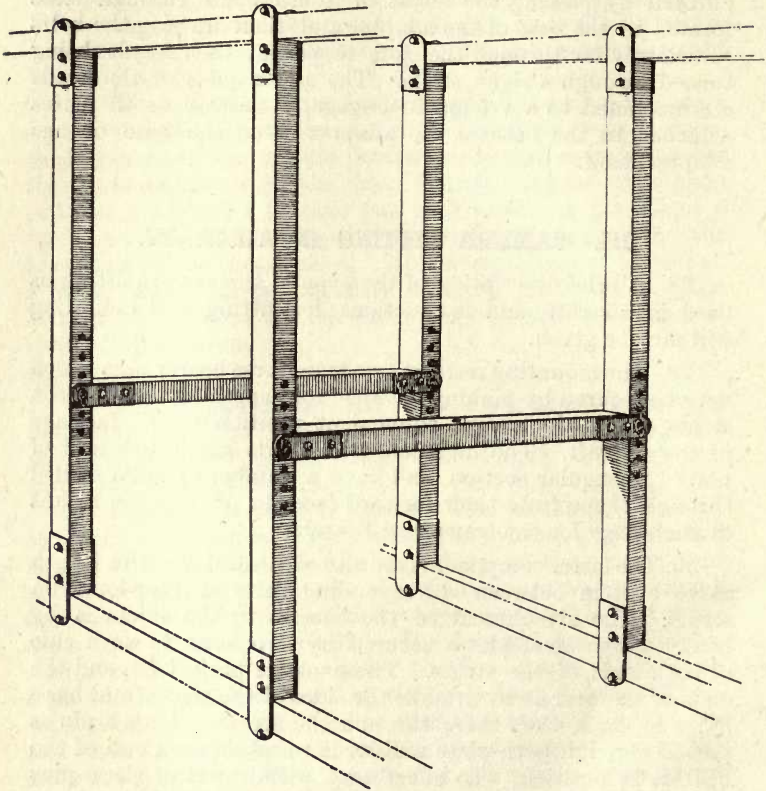


FIG. 2.—CAMERA FITTING IN AIRCRAFT.

#### IV.—ADAPTERS.

35. Adapters have been designed for the L.B., B.M. and P type cameras when used in the Bristol Fighter or D.H.9A. aircraft. Adapter Type 1 is for mounting the B.M. camera (7-in., 10-in., 14-in., 20-in. and 36-in. cones) in the Bristol Fighter. Adapter Oblique Type 2 is for mounting the P type camera in either the Bristol Fighter or the D.H.9A. Adapter Type 3 is for mounting the L.B. camera (all lenses except the 20-in. focus) in the Bristol Fighter, and with the distance blocks and cone support this adapter is also used for the L.B.



camera with the 20-in. focus lens, in the same type of aircraft. Adapter Type 4 provides the mounting for the L.B. camera (all lenses except the 20-in. focus) in the D.H.9A., and with the distance blocks and cone support this type is used for the L.B. camera with the 20-in. focus lens in the D.H.9A.

36. Detailed descriptions of the adapters with instructions for fitting the cameras concerned will now be given.

### Adapter, Type 1.

37. Adapter, Type 1 takes the B.M. camera and is for use in the Bristol Fighter. In effect, the adapter consists of a conical socket of aluminium into which the camera cone is dropped and in which it is a snug fit. The socket is mounted on eight rollers fitted around the inner periphery of an aluminium cage which is secured by four bolts to a six-ply base plate. This base plate is in turn secured to the sprung frame of the mounting by means of the four adapter fixing bolts.

38. The cone socket is capable of rotation in the cage, but may be locked in any one of four positions by a spring loaded bolt mounted in the cage to engage with one of four holes equidistant around the periphery of the socket.

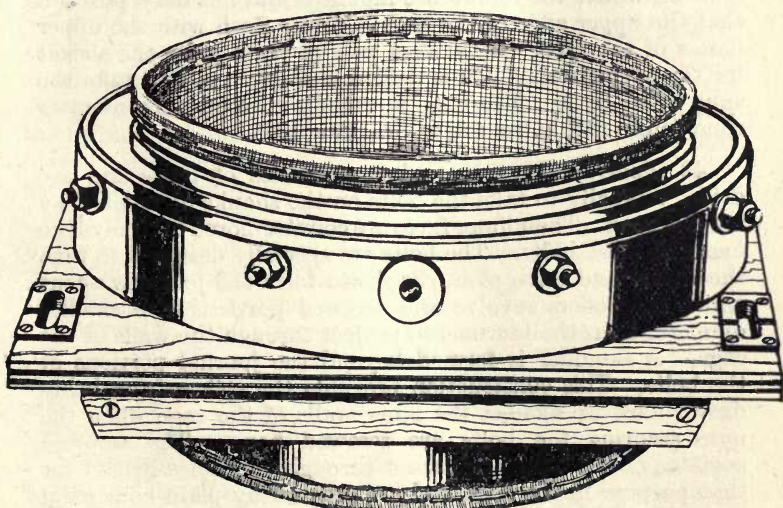


FIG. 3.—ADAPTER, TYPE 1.

39. *Cone Socket.*—Although treated above as a single component, the socket is built up in two parts—the socket proper and the roller race.

40. The socket is of aluminium, about 10 inches diameter at its upper end, 9 inches diameter at its lower end and about  $6\frac{1}{2}$  inches in depth. Internally it is lined with hessian.

41. The roller race is also aluminium and takes the form of a taper sleeve of about  $2\frac{1}{4}$  inches depth around which two flanges about  $\frac{1}{2}$  inch deep are formed. The inner faces of these flanges are machined so that a groove  $\frac{1}{2}$  inch deep and about  $\frac{3}{4}$  inch in breadth is formed. The rollers on which the socket revolves project into this groove. The sleeve is mounted around the extension of the cone to which it is secured by four copper rivets. To provide the socket for the locking bolt mounted in the roller cage, four holes of about  $\frac{3}{4}$  inch diameter are drilled at equidistant intervals around the base of the roller race. One of these is taken right through the adapter cone and its hessian lining and provides the means of assembly of the rollers and the spring bolt.

42. *Roller Cage.*—This is an L sectioned ring of aluminium. The base of the ring is secured by four bolts to the six-ply base plate of the adapter whilst around the inner periphery of the vertical wall the eight rollers and the spring bolt are mounted. Internally, the cylindrical portion of the cage is of a diameter slightly in excess of that of the race portion of the cone. Eight holes are drilled at equidistant intervals around the periphery of the cage to take the shanks of the bolts on which the rollers are mounted and in such a position that the upper edge of the cage becomes flush with the upper flange of the race. Between a pair of these holes the socket for the spring bolt guide is drilled and has a slot to take the snug fitted to it. The cage is mounted around the adapter cone before fitting the rollers or spring bolt.

43. *Rollers.*—These are plain cylinders of brass and are drilled centrally to take the bolts on the shanks of which they are mounted. Their inner faces are counter-bored to receive the heads of these bolts. The bolts are specially designed to take the rollers and have plain shanks to form the journals about which the rollers revolve and screwed portions of a smaller diameter than the journals to project through the walls of the cage. A shoulder is formed beyond the journal portions of the bolts. This construction prevents the rollers from being drawn hard up against the inner walls of the cage when the nuts securing the bolts are screwed home. The screwed portions of the bolts are passed through the holes drilled for that purpose in the cage and are secured by plain hexagonal nuts. Beneath each of these nuts a spring and a plain brass washer are placed. The rollers are fitted with the cage in position around the cone adapter and are inserted in succession through the hole taken through the walls of the adapter.

44. *Spring Bolt.*—The actual bolt is of steel and is of similar design to those on which the rollers are mounted; it is, however, much larger. The head is of such a size as to be an easy fit in

the holes drilled around the base of the roller race. Its shank is accommodated in a brass guide fitted to the cage and the shoulder formed beyond its larger diameter portion forms the anchorage for a coil spring. The other end of this spring is anchored against a shoulder formed in the bore of the guide. Screwed to the outer end of the shank is a knurled thumb nut by which the bolt may be disengaged from the race.

45. The guide is of brass and is bored to two diameters to receive the shank of the bolt. At its inner end a shoulder is formed around the guide whilst the shank beyond this shoulder is threaded to take a ring nut by which it is secured to the cage. A feather is fitted in the inner face of the shoulder to engage in the slot in the socket of the cage. The bush which is inserted through the hole taken through the wall of the adapter cone is entered into its socket and its ring nut is then screwed home. The bolt with the spring on its shank is then inserted and the knurled thumb nut tightened.

46. *Base Plate.*—The plate is itself formed by a  $13\frac{1}{2}$  inch of squaresix-ply wood from which a disc of about  $9\frac{1}{2}$  inches diameter has been cut in an eccentric position. Through the aperture occasioned by the removal of this disc the lower end of the adapter cone is inserted.

47. A square locating frame is attached to the lower face of the base plate and engages between the side members of the sprung frame of the adapter. Four elongated apertures are cut in the base plate to take the adapter fixing bolts of the mounting and mounted above each is a brass armouring plate in which are transverse V grooves to locate the bolts in the engaged position.

48. *Fitting the Camera and Adapter.*—The adapter is fitted to the mounting with the spring bolt of the roller cage nearest the adjusting screw. The adapter fixing bolts are secured and the camera dropped into position. Before adjusting the mounting a full and an empty magazine should be mounted on the camera. This having been done, the first point to be observed is that the rocker levers on each side of the mounting are horizontal. This may be adjusted by fitting the tension springs in the most suitable slots in the ends of the levers. It is essential that the two tension springs be engaged in corresponding slots of their respective levers. Having thus adjusted the springing of the mounting it should next be observed whether the whole mounting should be lowered so as to bring the end of the lens cone closer to the aperture in the floor of the aircraft, or whether it should be raised therefrom. The end of the cone is in correct position when it clears the floor of the aircraft by about one inch. When the aircraft is over the district to be photographed, the swivelling frame is levelled by means of the adjusting screw.

### Adapter, Oblique Type 2.

49. Adapter, Oblique Type 2 provides for the mounting of the P type aerial camera in the Bristol Fighter and D.H.9A. machines. When using this adapter it is necessary to fit a release lever attachment in order to operate the shutter through a bowden control. The attachment and method of fitting are shown in Fig. 8.

50. Two main components constitute the adapter—the base and the adapter proper. Both portions are of aluminium and the forward end of the adapter is hinged to one side of the base. An adjusting screw similar to that fitted to the mounting is employed to lock the adapter to the base. To indicate the angle at which the adapter is inclined to the base a quadrant graduated in degrees is fitted to the latter and a pointer to the former.

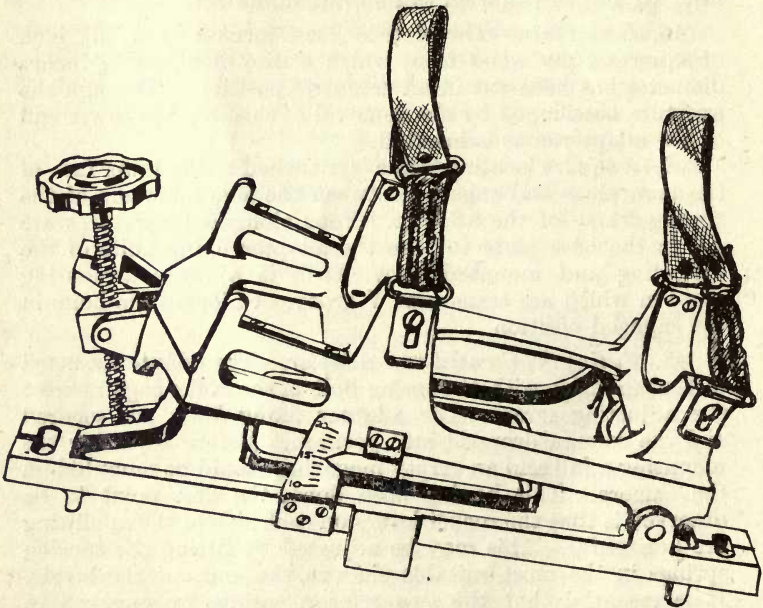


FIG. 4.—ADAPTER, OBLIQUE TYPE 2.

51. *Base*.—This is formed by a skeleton frame of aluminium. Four feet project from the central portion or platform of this frame and have elongated slots to accommodate the heads of the adapter fixing bolts. As may be seen from Fig. 4, the feet on opposite sides are of unequal length; this permits the platform portion of the base being located nearer the adjusting

screw of the mounting. A lug beneath each foot provides for the lateral location of the adapter in the sprung frame of the mounting. On the upper face of one end of the platform portion of the base are two lugs with holes to accommodate the pins about which the adapter proper is pivoted. To a lug at the opposite end of the platform two brackets are fitted and between these brackets a thrust block similar to that of the mounting is pivoted. The quadrant previously mentioned is graduated so as to give readings between  $10^{\circ}$  and  $20^{\circ}$  and is secured by three set screws.

52. *Adapter*.—This also is of aluminium and takes the form of a rectangular frame bridged by two cradles in which rests the lens cone of the camera. To the rear of the larger cradle two brackets are formed for the support of the body portion of the camera. The bearing surfaces of both cradles and brackets are faced with heavy leather strip.

53. Lugs beneath the frame under the smaller of the two cradles are drilled to take the pins about which the adapter is pivoted. These lugs are fitted between those on the upper surface of the base and the fulcrum pins are entered from the outer side of the joints. They are secured on the inner side of the joints by split pins passed through their extremities.

54. Two brackets are fitted to a lug at the opposite end of the adapter, and between the cheeks of these the nut of the adjusting screw is pivoted.

55. Retention of the camera in the cradles is effected by two straps of a composite construction. The main portion of the straps is of webbing and each end of the webbing is passed through a steel link, folded back over itself, and secured by a U strap of brass riveted to it. One end of each length of webbing is then secured by its link to a hinge plate fitted to one end of each cradle. The free ends of the webbing portions of the straps are connected by leather covered elastic links to brass latches which may be engaged with set screws fitted in the opposite ends of the cradles to which the further ends of the straps are secured.

56. *Adjusting Screw*.—This is identical with that fitted to the mounting.

57. *Fitting the Camera and Adapter*.—The adapter is fitted to the sprung frame of the mounting with the smaller cradle facing that side of the fuselage from which the photographs are to be taken, and is secured by the adapter fixing bolts in the normal manner.

58. The camera is placed in the cradles of the adapter with the operating side of the body portion convenient to the hand

of the operator. The straps are then carried over the lens cone and their latches engaged with the set screws fitted to the ends of the cradles.

59. Having thus fitted the camera and adapter to the mounting, the rocker levers are set horizontally by the method described above and, if necessary, the whole mounting raised or lowered in the fuselage to permit the camera lens being registered with the aperture in the side of the fuselage. The last operation is to set the camera to the angle at which it is desired to take the photographs. When flying over the district to be photographed, and previous to making an exposure, the swivelling frame of the mounting is levelled by the adjusting screw.

### Adapter, Type 3.

60. Adapter, Type 3 provides for the mounting of the L.B. camera (with any lens but the 20-in. focus) in the Bristol Fighter. By fitting two distance blocks and a cone support the camera fitted with the 20-in. focus lens may be accommodated in the adapter.

61. The adapter takes the form of a built up cradle fitted to a base plate of 12-ply wood, as shown in Fig. 5. Rubber sponge faced packing blocks are fitted in the arms of the cradle and upon these the platform of the camera is supported. A bag filled with rubber sponge is attached by one end to each of these blocks and when the camera is in place is folded

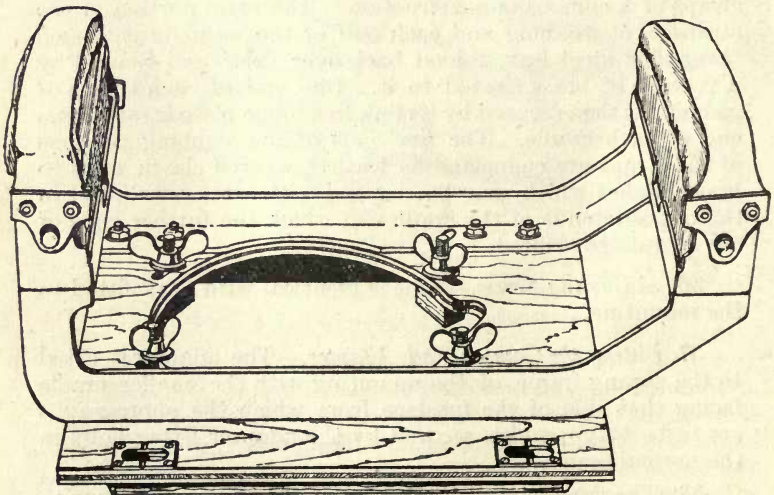


FIG. 5.--ADAPTER, TYPE 3.

back over the upper surface of the platform after which a rubber strap is stretched over it to secure the camera to the adapter.

62. The lens cone projects through an aperture cut in the base plate.

63. *Base Plate.*—This is provided by a plate of 12-ply wood about  $13\frac{1}{2}$ -in. square with an aperture of about 8-in. in diameter cut eccentrically to it. A notch is cut in the edge of the aperture nearest that edge of the base plate located furthest from the adjusting screw of the mounting. To provide the means of attachment of the cone support, four retaining bolts are fitted to the base plate around the aperture. The bolts which have the normal type of threaded shank are provided with cylindrical heads drilled diametrically to take a  $\frac{3}{16}$ -in. diameter anchor rod. The latter is passed through the head of each bolt and has its ends riveted into the cheeks of channel-sectioned clips fitted to the under surface of the base plate. Slots are machined through the base portions of this clip and through the base plate itself. Through these slots the shanks of the retaining bolts project. It will be seen, therefore, that the bolts may be moved sideways in their slots and along their anchor rods, but may not be rotated.

64. Flanged wing nuts are mounted on the shanks of the bolts and are retained by wire loops taken through the ends of the bolts. Close to the edges of the base board, four elongated holes are cut for the reception of the adapter fixing bolts. Brass plates armour the surface of the base plates around these holes and have V grooves to locate the fixing bolts in the engaged position. Fitted to the under surface of the base plate is a square frame which by fitting between the members of the sprung frame locates the base plate on the mounting with the notch cut in the opening furthest from the adjusting screw.

65. *Cradle.*—The cradle is built up of four aluminium castings—two bearers and two housings for the shock absorbing blocks.

66. The bearers are of angle section and of the shape shown in Fig. 5. They are each secured to the base board by four bolts and are located with their axes parallel to that of the fuselage with their inclined up-turned ends furthest from the adjusting screw.

67. As shown in Fig. 5, the housings for the shock absorbing blocks straddle the ends of the bearers to which they are each attached by four bolts. These sockets take the form of three-sided rectangular boxes, the upper and inner faces of which are left open to expose the shock absorber blocks. A rubber strap  $1\frac{3}{4}$ -in. wide is fitted to each socket,

one end of each strap is bolted beneath an armouring plate to one end of the sockets whilst the other ends of the straps have latches clipped to them for engagement with studs fitted to the opposite sides of the sockets. The fixed ends of the straps are protected by strips of hessian, the ends of which are clipped between them and the sides of the sockets.

68. *Shock Absorber Blocks.*—The official nomenclature for these components is “Sponge, Supporting, Camera.” As may be seen from Fig. 6, these components are constructed in two portions, of which the upper is stitched along one edge to the lower. The lower portion consists of a rectangular packing block of wood on the upper face of which is placed a strip of rubber sponge. The upper portion consists of a strip of rubber sponge similar to that mentioned above. Both portions of the block are sewn into rubbered fabric bags.

69. The adapter thus assembled is designed to take the L.B. Camera when fitted with any but the 20-inch focus lens. When it is desired to use the camera fitted with the 20-inch lens, the adapter is modified by the addition of distance blocks fitted beneath the sockets of the shock absorber blocks and a cone steady which is secured to the base board by four bolts.

70. *Distance Blocks.*—These, as shown in Fig. 6, are of box-like skeleton formation. Four holes are drilled in the under face of each to take the bolts securing them to the bearers. Four bolts are fitted to their upper faces for the attachment of the sockets of the shock absorber blocks. The distance blocks are of aluminium.

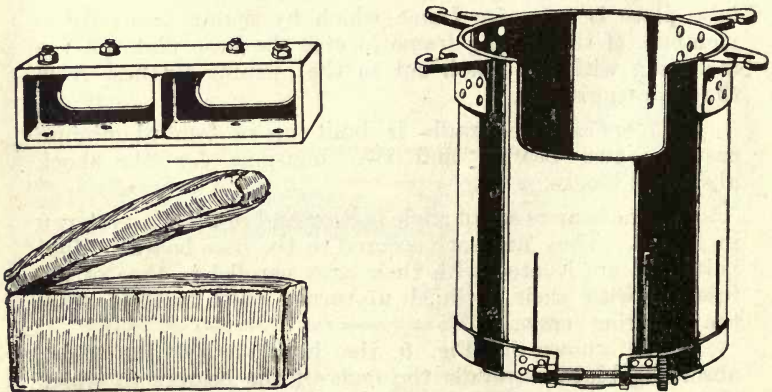


FIG. 6.—CONE SUPPORT AND DISTANCE BLOCKS.



71. *Cone Support*.—This component ensures that the 20-inch focus lens shall not swing in its cone with respect to the camera. The support consists of an aluminium tube of about  $6\frac{7}{8}$  inches internal diameter and  $7\frac{1}{2}$  inches in depth. Four brass brackets, of the shape shown in Fig. 6, are riveted around the upper end of the support and a rectangular portion of the tube is cut away. Eight vertical saw cuts about 3 inches in depth are made around the lower end of the support, and eight leather pads are riveted to the eight sections into which the support is divided. These pads are drawn up to grip around the lens cone by a steel strap mounted around the lower end of the support which may be tautened by a bolt and knurled thumb screw. The design of this clamping strap may be seen from Fig. 6.

72. To prevent the tautening strap from vibrating downwards and clear of the support, shallow tongues are bent outwards around the periphery of the lower end of the tube. The support is attached to the adapter by entering its lower end through the aperture cut in the adapter base plate, and working the brackets under the wing nuts of the retaining bolts. The nuts are then screwed home. The aperture cut in the upper edge of the support should be located furthest from the adjusting screw.

73. *Fitting the Camera and Adapter*.—The rubber strap fitted to the sockets of the shock absorber blocks is freed and the upper portions of the blocks folded back. If fitted, the clamp of the cone support is expanded. The camera is then placed with its platform resting on the shock absorber blocks and with its lens cone projecting through the aperture in the base board. The upper portions of the shock absorber blocks are then folded back over the camera platform and the rubber straps attached to their studs. The tautening strap of the lens support is then tightened up to grip the lens tube securely.

74. The adapter is then fitted to the mounting in the manner given for the fitting of Adapter, Type 1.

#### **Adapter, Type 4.**

75. Adapter, Type 4 provides for the fitting of the L.B. camera (with all lenses except the 20-inch focus lens) to the D.H.9A.

76. With the addition of the cone support and two distance blocks this adapter will accommodate the camera when fitted with the 20-inch focus lens. It will be seen from Fig. 7 that this adapter with the exception of the base plate is identical with Adapter, Type 3.

77. For this adapter (Type 4), the base plate has the lens cone aperture cut very close to one edge, which edge is located nearest the adjusting screw of the mounting. From the opposite edge of the base plate a crescent shaped section has been cut to avoid fouling the internal bracing of the fuselage. The frame fitted beneath the base plate to locate the adapter on the sprung frame of the mounting is modified to suit the alteration in the design of the base plate. The camera supporting cradle is fitted athwart the base plate instead of fore and aft.

78. The cone support and the distance blocks are identical with those of Adapter, Type 3.

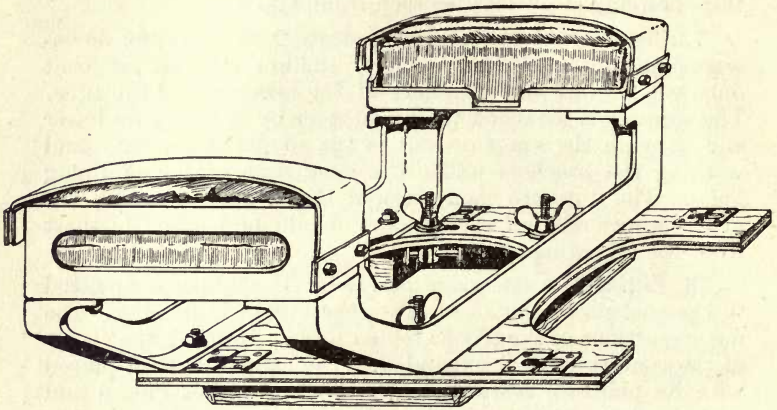


FIG. 7.—ADAPTER, TYPE 4.

79. *Fitting the Camera and Adapter.*—The operations of fitting the camera to the adapter and the adapter to the mounting are the same as those given for Adapter, Type 3.

#### V.—PACKING.

80. Each component of the mounting system, *i.e.* :—

- (i) Universal Camera Mounting, Ref. No. 261 ;
- (ii) Adapter, Type 1. Ref. No. 263 ;
- (iii) Adapter, Oblique Type 2. Ref. No. 265 ;
- (iv) Adapter, Type 3. Ref. No. 267 ;
- (v) Adapter, Type 4. Ref. No. 269,

is supplied separately packed in a wooden case. Packed together with each of the adapters, Types 3 and 4, are two distance blocks and a cone support.

NOTE.—The adapters designated for use in the Bristol Fighter may be fitted to any aircraft designed for photographic purposes with the exception of the D.H.9A.

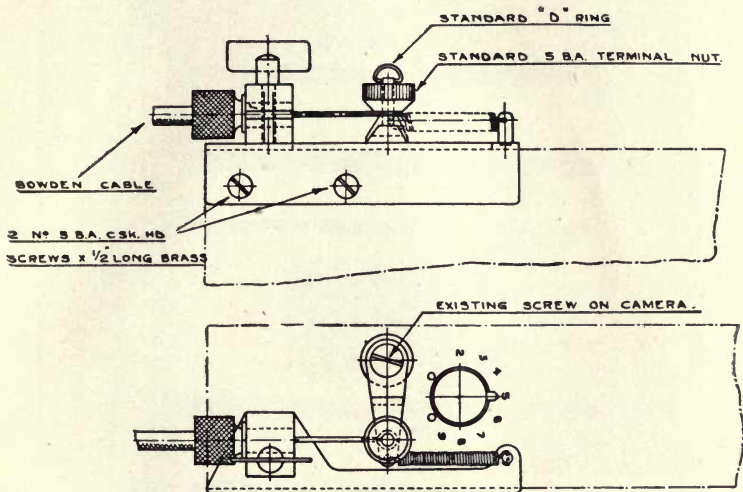


FIG. 8.—ATTACHMENT RELEASE LEVER, P. TYPE CAMERA.



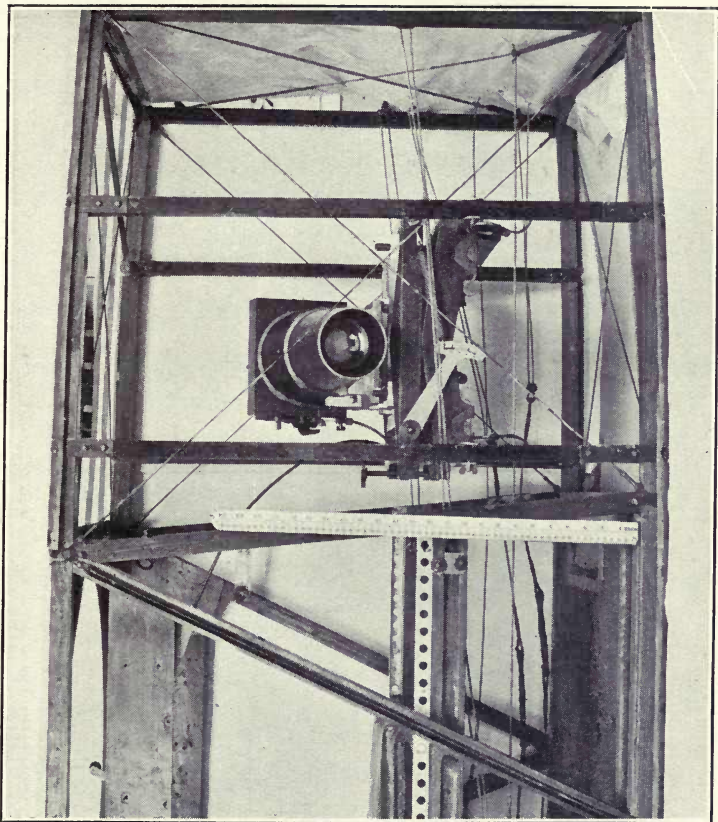


FIG. 9.—P. TYPE CAMERA FITTED TO BRISTOL FIGHTER.

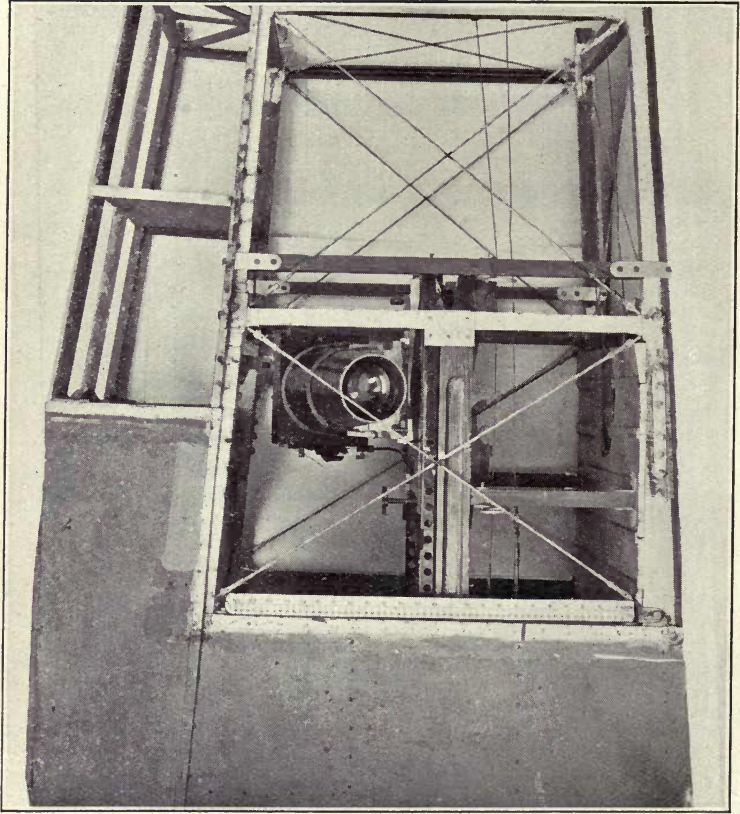


FIG. 10.—P. TYPE CAMERA FITTED TO D.H.9A.

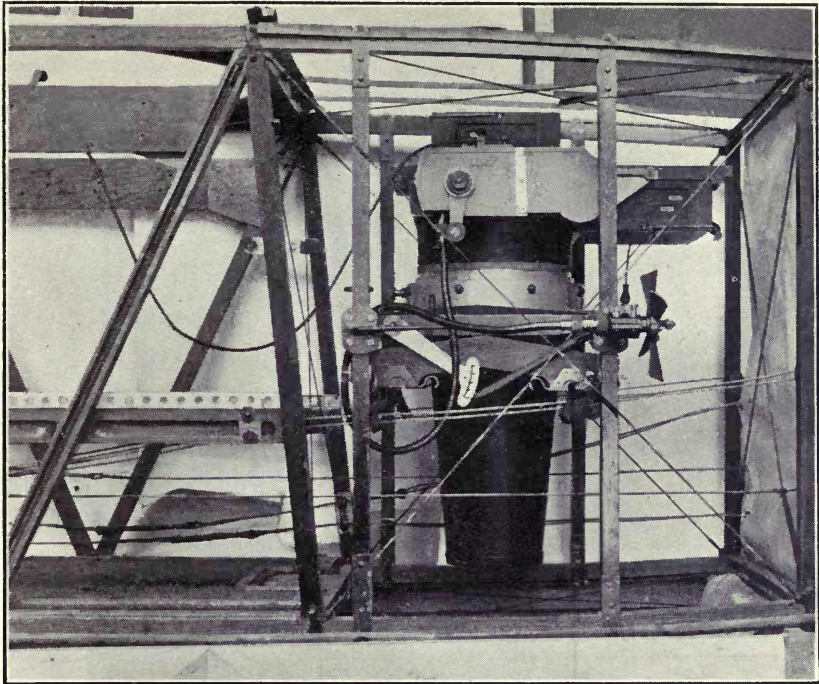


FIG. 11.—B.M. CAMERA (20-INCH LENS) FITTED IN BRISTOL FIGHTER.

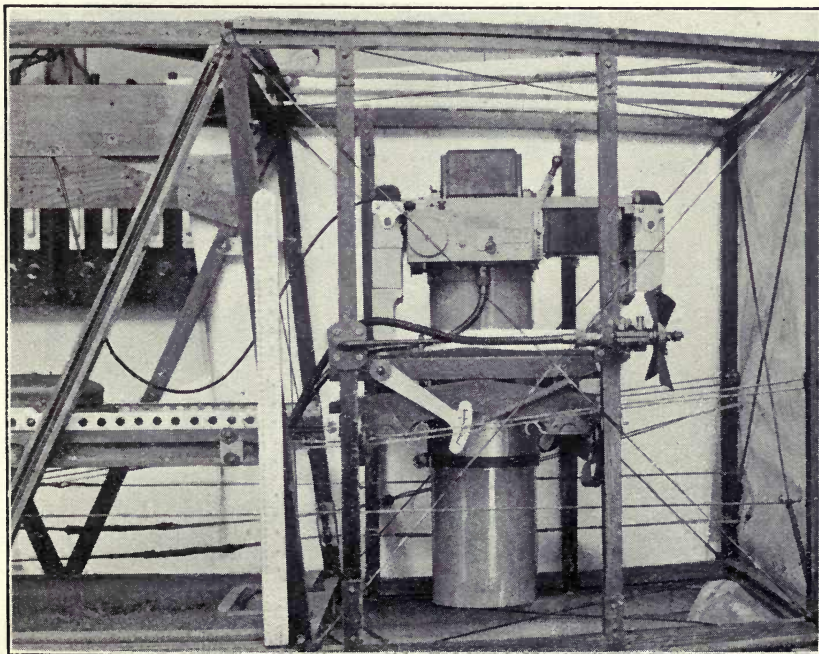


FIG. 12.—L.B. CAMERA (20-INCH LENS) FITTED IN BRISTOL FIGHTER.

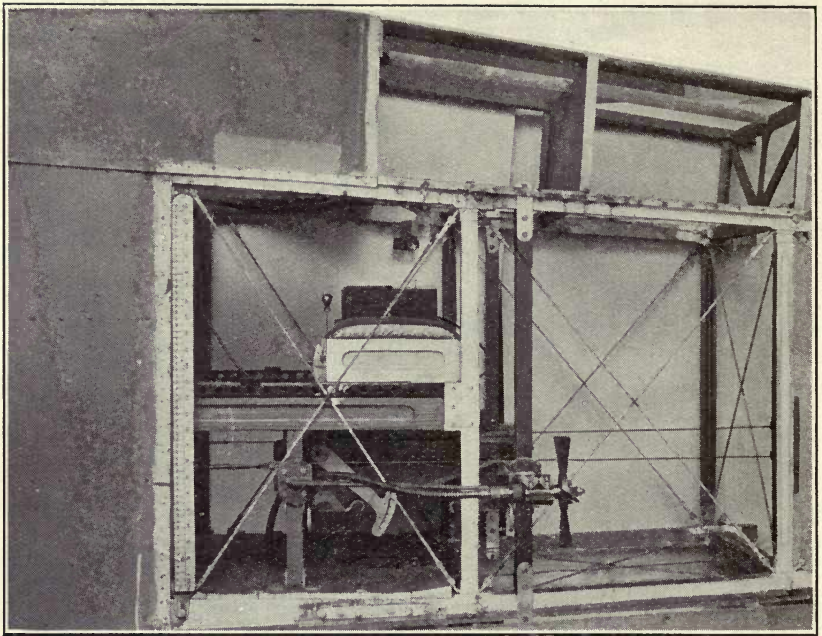


FIG. 13.—L.B. CAMERA (6-INCH LENS) FITTED IN D.H.9A.

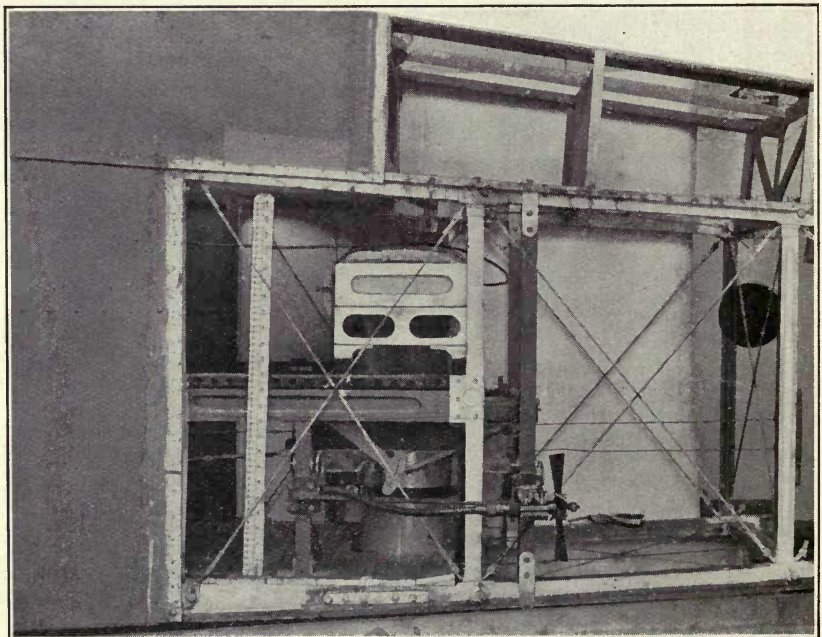


FIG. 14.—L.B. CAMERA (20-INCH LENS) FITTED IN D.H.9A.





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