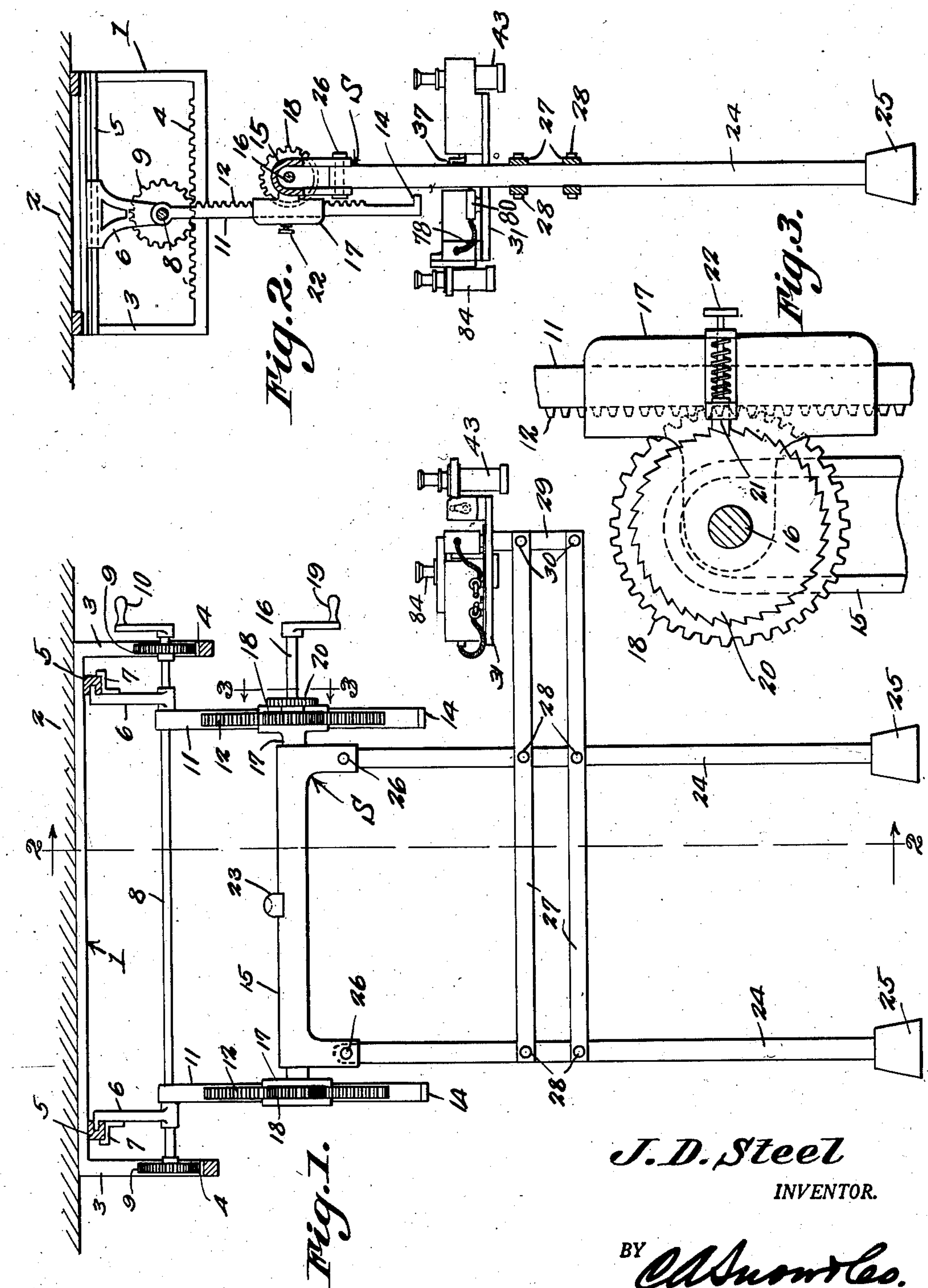
June 4, 1946. J. D. STEEL 2,401,521

BOMBSIGHT

Filed March 28, 1944 5 Sheets-Sheet 1



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June 4, 1946. J. D. STEEL 2,401,521

BOMBSIGHT

Filed March 28, 1944 5 Sheets-Sheet 2

Fig. 4.

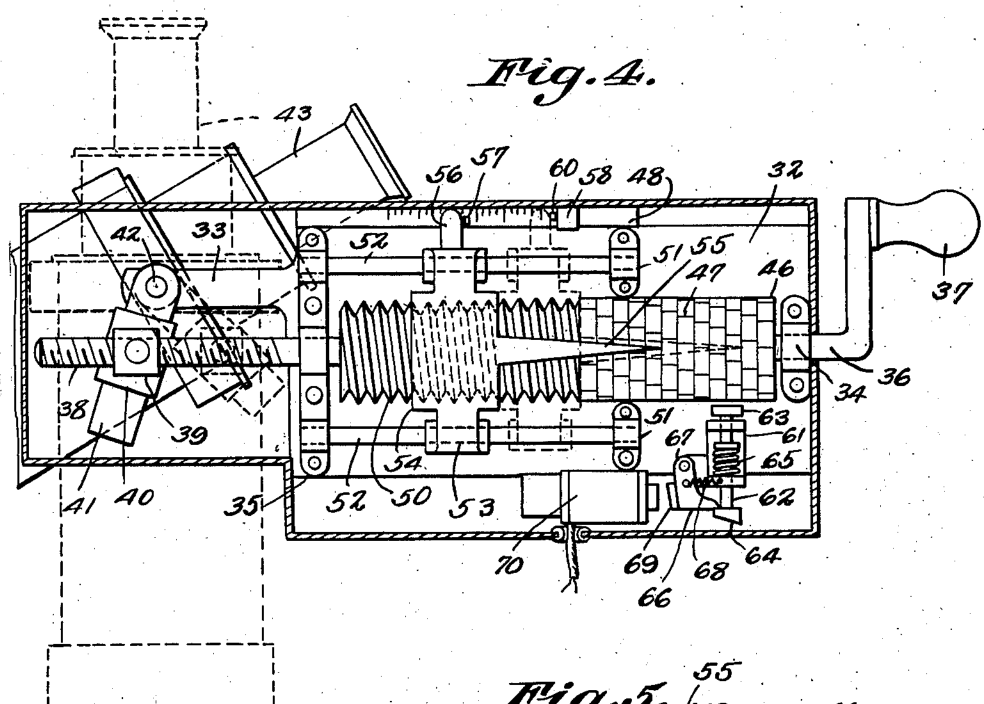

Fig. 5.

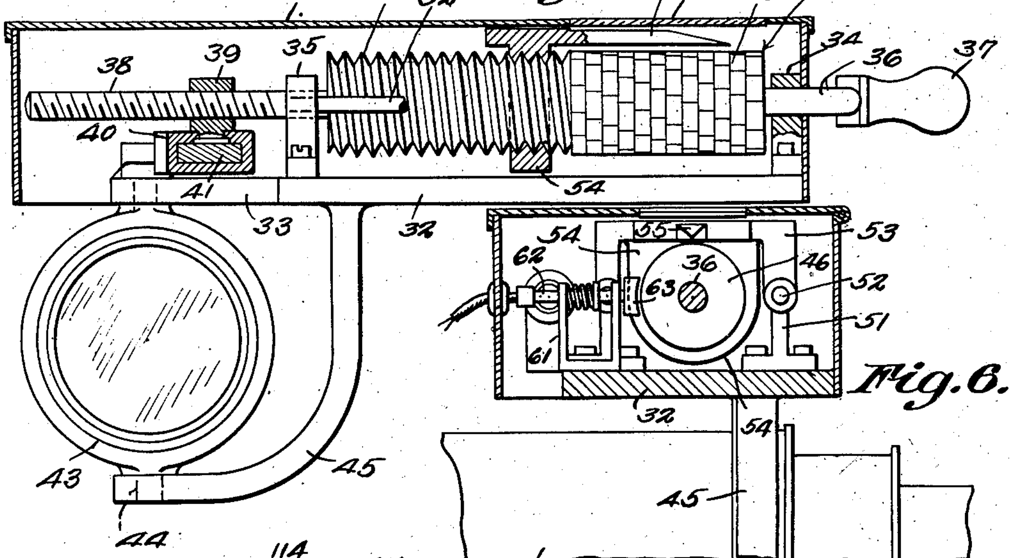

Fig. 6.

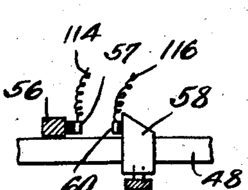

Fig. 7.

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June 4, 1946. J. D. STEEL 2,401,521

BOMBSIGHT

Filed March 28, 1944 5 Sheets-Sheet 3

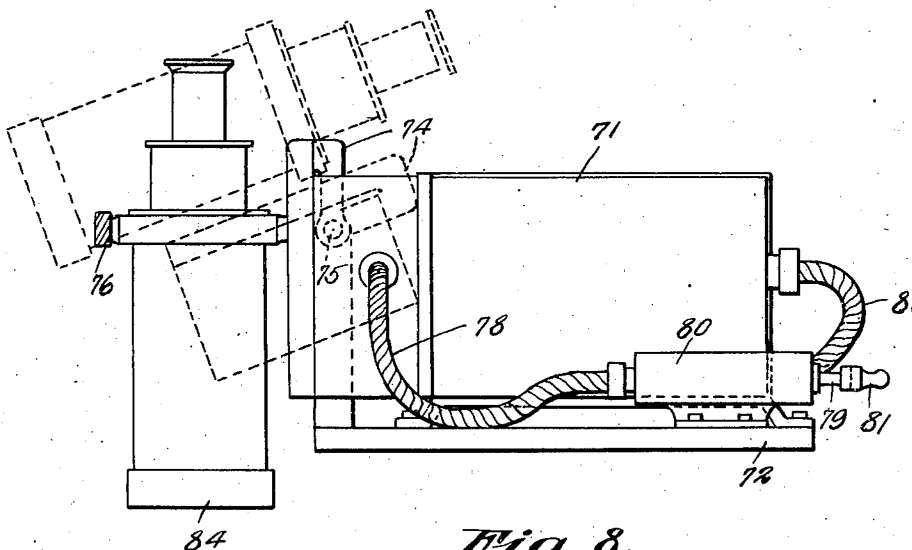

Fig. 8.

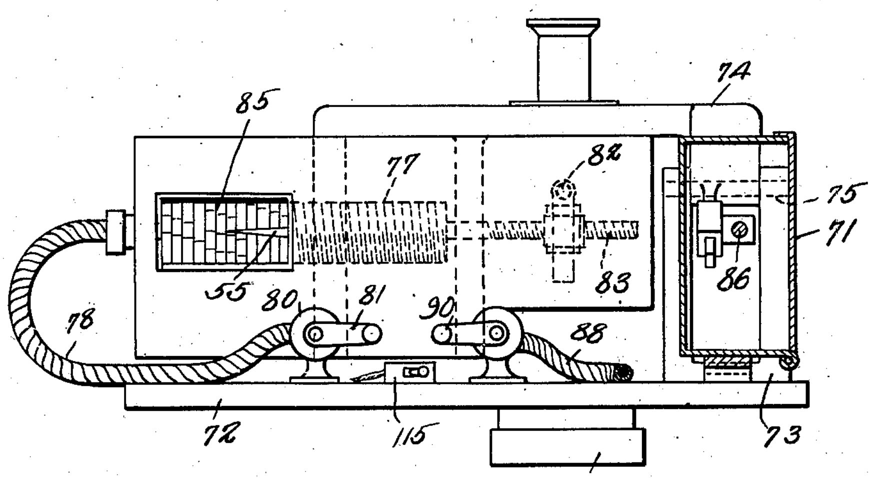

Fig. 9.

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June 4, 1946. J. D. STEEL 2,401,521

BOMBSIGHT

Filed March 28, 1944 5 Sheets-Sheet 4

Fig. 10.

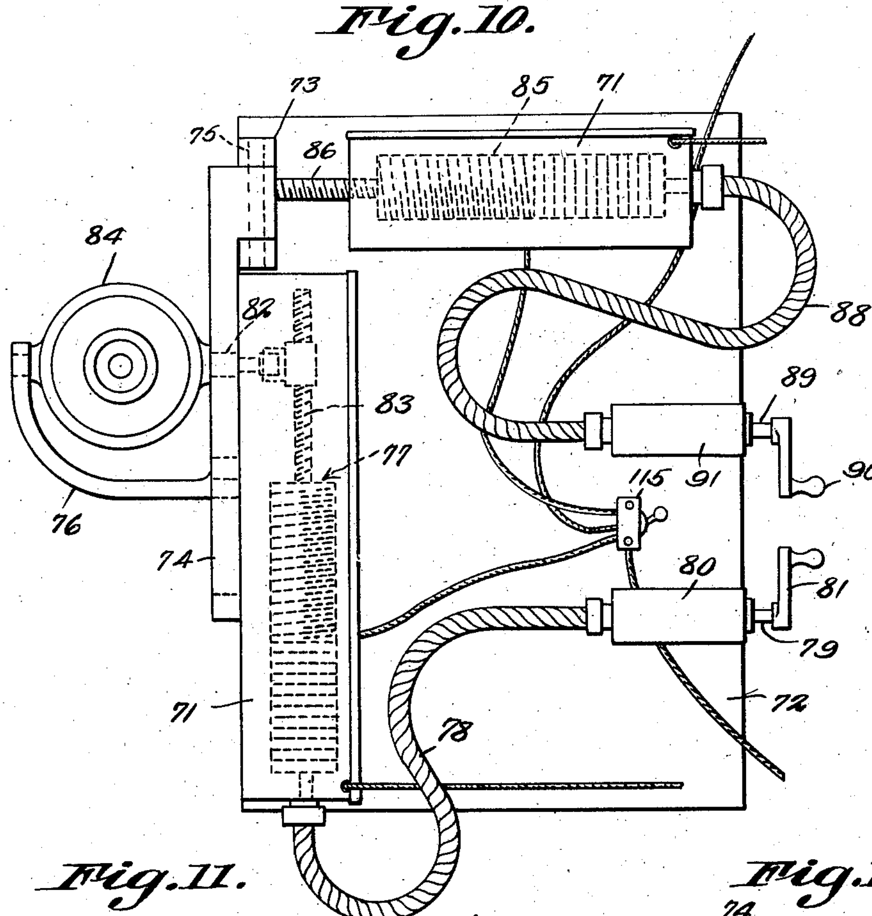


Fig. 11.

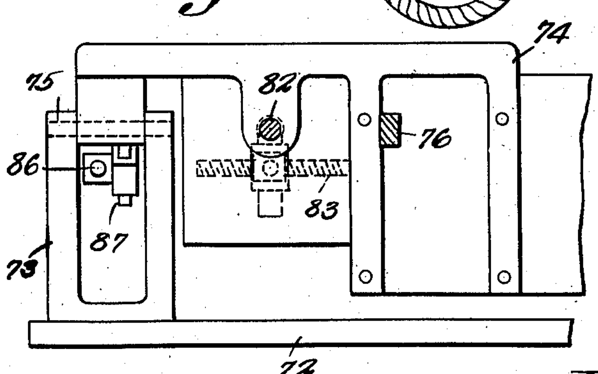
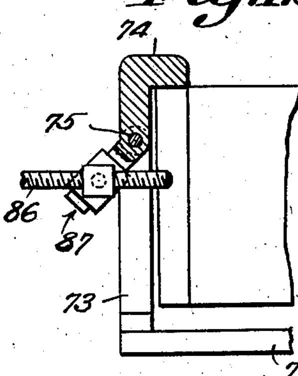


Fig. 12.



J. D. Steel INVENTOR.

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June 4, 1946. J. D. STEEL 2,401,521

BOMBSIGHT

Filed March 28, 1944 5 Sheets-Sheet 5

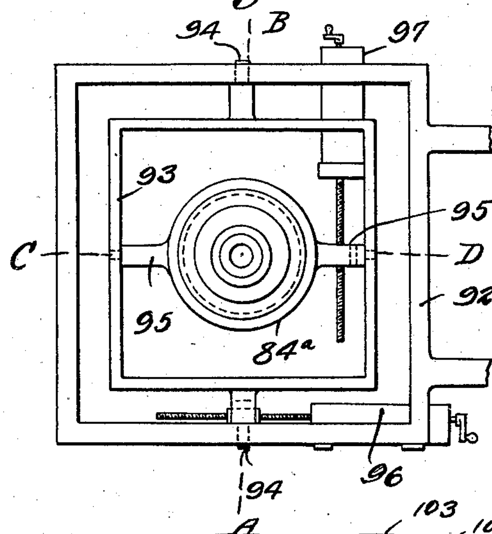

Fig. 13.

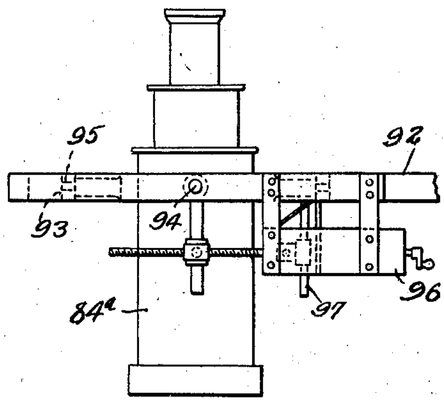

Fig. 14.

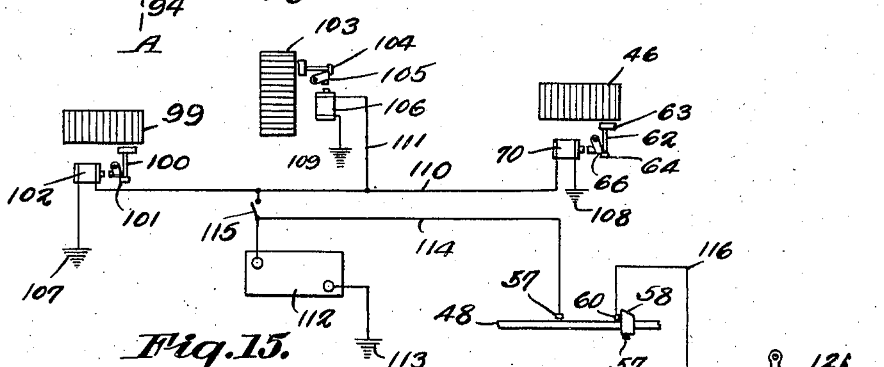

Fig. 15.

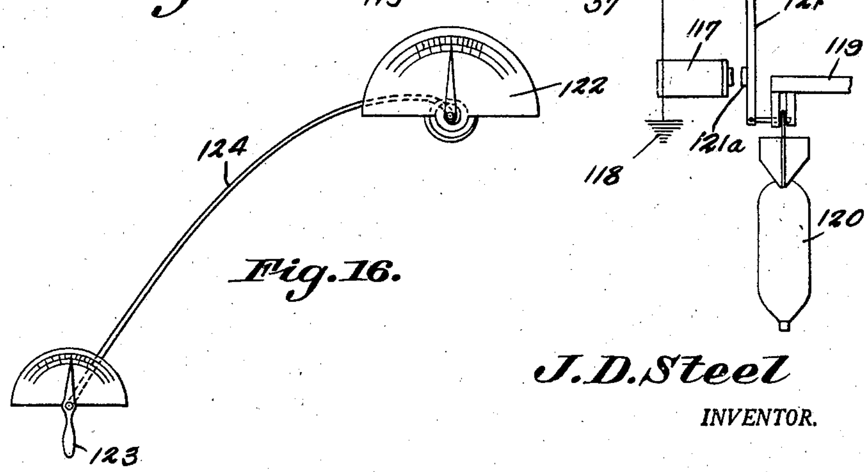

Fig. 16.

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Patented June 4, 1946 **2,401,521**

UNITED STATES PATENT OFFICE

2,401,521

BOMB SIGHT

John D. Steel, Fort Worth, Tex.

Application March 28, 1944, Serial No. 528,453

9 Claims. (Cl. 33—46.5)

1

This invention aims to provide novel means whereby operators on a test plane may make observations relatively to the dropping of a bomb, which, having been corrected and passed back to a bombing plane, or to a repository for information, will enable subsequent bombers to score an effective hit.

A further object of the invention is to supply novel means for so mounting a plurality of sighting devices on the test plane that the necessary data may be assembled readily, corrected quickly, and be available for use on a bombing plane having equipment which is a substantial duplicate of the equipment on the test plane.

A further object of the invention is to provide a device of the class described which will be simple in construction and facile in operation.

It is within the province of the disclosure to improve generally and to enhance the utility of devices of that type to which the present invention appertains.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed, may be made within the scope of what is claimed, without departing from the spirit of the invention.

In the accompanying drawings:

Fig. 1 shows, in front elevation, a device constructed in accordance with the invention;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is an elevation showing, on an enlarged scale, one of the riders and attendant parts;

Fig. 4 is a sectional view disclosing the mechanism whereby one of the telescopes is actuated;

Fig. 5 is a sectional view of the structure depicted in Fig. 4, the cutting plane being at right angles to the cutting plane in Fig. 4;

Fig. 6 is a transverse section of the mechanism shown in Figs. 4 and 5;

Fig. 7 is a fragmental view in elevation, disclosing the relation which exists between certain of the contacts;

Fig. 8 is an elevation showing the other of the telescopes and a portion of the mechanism for operating it;

Fig. 9 is an elevation at right angles to the showing of Fig. 8;

Fig. 10 is an elevation disclosing the mechanisms of Figs. 8 and 9;

Fig. 11 is an elevation looking toward the left hand side of Fig. 10;

Fig. 12 is a sectional view illustrating the structure depicted in Fig. 11;

Fig. 13 is an elevation showing a modified means for mounting one of the telescopes for compound movement;

2

Fig. 14 is a side view of the structure illustrated in Fig. 13;

Fig. 15 is a circuit diagram;

Fig. 16 is a diagrammatic showing of a signal mechanism employed to transmit information from an observer at one of the telescopes to the pilot of the aircraft on which the device is mounted.

The device forming the subject matter of this application comprises, as shown best in Figs. 1 and 2, a support 1, which is located within the fuselage of an airplane and secured, in depending position, to the upper portion 2 of the fuselage or to some accessible part of the framework of the plane. The support 1 may be of various construction, without departing from the spirit of the invention, and its longer dimension extends transversely of the longitudinal axis of the plane whereon it is used. The support 1 includes parallel, U-shaped end members 3, extended fore and aft of the plane and supplied on their lower portions with upstanding racks 4 (Fig. 2). When the plane is in horizontal flight, the end members 3 are vertically disposed, as shown in Fig. 1.

Fixed to the upper part of the support 1 are parallel, fore and aft tracks 5, whereon a carriage structure comprising carriages 6 is held at 7 for fore and aft sliding adjustment. The means for adjusting the carriage structure 6—6 fore and aft comprises a thwartship upper shaft 8, mounted to rotate in the carriage structure. Pinions 9 are secured to the shaft 8 and mesh with the racks 4. The shaft 8 may be rotated by an operator, since a hand crank 10 or its equivalent is fixed to one end of the shaft. The carriages 6 and the shaft 8 maintain the pinions 9 in mesh with the racks 4. A fore and aft adjustment of the carriage structure makes the device conveniently accessible to operators, considered relatively to the internal structure of the fuselage.

Hangers 11 are mounted to swing fore and aft on the shaft 8, in engagement with the lower parts of the carriages 6. The hangers 11 are supplied with longitudinal racks 12, and have transverse stops 14 at their lower ends.

The letter S marks a sighting frame, which is a composite structure. It is sufficient for present purposes to allege that the sighting frame S includes an upper member 15, which is of inverted U-shape when seen in elevation, as in Fig. 1. In vertical transverse section, the upper member 15 is of inverted trough-shape, as Fig. 2 discloses.

A thwartship lower shaft 16 is disposed parallel to the upper shaft 8 and is mounted to rotate in the upper member 15 of the sighting frame S. At the ends of the member 15 are disposed riders 17, wherein the lower shaft 16 is journaled, as the dash line showing of Fig. 3 makes manifest. The riders 17 receive the hangers or rack bars

11, and are capable of vertical adjustment upon them.

The lower shaft 16 forms part of a mechanism for raising and lowering the sighting frame S, and, to that end, pinions 18 are secured to the lower shaft, the pinions extending into the riders 17 and meshing with the racks 12 of the hangers 11. The riders 17 extend about the hangers 11 transversely and constitute means for maintaining the pinions 18 in mesh with the racks 12 of the hangers. The stops 14 are adapted to be engaged by the riders 17 and terminate the downward movement of the riders and the sighting frame S.

Rotation may be imparted to the lower shaft 16, for the vertical adjustment of the sighting frame S, by means of a hand crank 19, or its equivalent, on that shaft. In order to avoid retrograde rotation of the shaft 16, and a consequent undesired descent of the frame S, responsive to gravity, a ratchet wheel 20 is secured to the shaft, and is engaged by a spring-pressed pawl 21, mounted on one of the riders 17, and including a button 22, by which an operator may release the pawl from the ratchet wheel, at will.

A level vial 23, or equivalent device, is mounted on the upper member 15 of the sighting frame S, and indicates the condition of the frame relatively to a horizontal line of flight. The sighting frame S has fore and aft swinging movement on the shaft 16. The sighting frame S includes pendulum arms 24, having weights 25 at their lower ends, the upper ends of the pendulum arms being pivoted at 26 to the upper member 15 of the sighting frame S, for thwartship swinging movement.

The construction as thus far described enables the sighting frame S to swing fore and aft, and the pendulums 24 can swing thwartships, the weights 25 keeping the pendulums vertical, even though the airplane may not be advancing on an even keel. The frame S may be adjusted upwardly and downwardly, relatively to the floor of the fuselage of the aircraft by operating the crank 19.

A pair of transverse, spaced links 27 are pivoted at 28 to the pendulum arms 24, for thwartship movement along with the pendulum arms. The links 27 connect the pendulum arms 24 for simultaneous swinging movement, and the links extend thwartship of the aircraft beyond one of the pendulum arms, as Fig. 1 shows. An upright 29 is connected by pivot elements 30 to the laterally projecting portions of the links 27, the axes of the pivot elements being parallel to the axes of the pivot elements 28. To the upper end of the upright 29, a table 31 is secured.

To the table 31 is secured a base plate 32 (Figs. 4, 5 and 6), having at one end a reduced extension 33. A bearing 34 is mounted on the base plate 32 in remote relation to the extension 33, a bracket 35 being mounted on the base plate, in close relation to the extension 33. A shaft 36 is mounted to rotate in the bearing 34 and in the bracket 35, the shaft carrying a hand crank 37 or the like. The shaft 36 has a threaded portion 38, located at that end of the shaft which is remote from the crank 37.

The threaded portion 38 of the shaft 36 engages a nut 39 pivotally mounted on a slide 40, the slide having reciprocation on a crank arm 41 which is secured to a shaft 42, the shaft being mounted to rotate in the extension 33 of the base plate 32. The shaft 42 carries a sighting device, such as a telescope 43, the telescope being pivotally mounted at 44 on an offset arm 45 on the base plate 32. The telescope 43 operates in a single fore and aft plane only, to wit, in a vertical plane parallel to the line of advance of the aircraft. The pendulum 24 and associated parts insure the verticality of that plane, and Figs. 4 and 5 make it evident that the telescope can swing on a single axis only, namely that represented by the shaft 42 and the pivotal mounting 44.

The invention includes a micrometer mechanism, comprising a cylinder 46 secured to the shaft 36 in the vicinity of the crank 37. The cylinder 46 has micrometer calibrations 47. A straight track bar 48 is fixed on the plate 32 in parallel relation to the axis of rotation of the shaft 36. A micrometer screw 50 is secured to the shaft 36 at the inner end of the cylinder 46. The screws 38 and 50 and the cylinder 46 may be considered as parts of the shaft 36.

Pedestals 51 are secured to the plate 32. Parallel guide rails 52 are mounted in the pedestals 51 and in the bracket 35.

An inverted, U-shaped cursor 53 (Fig. 6) is mounted for reciprocation on the guide rails 52. A nut 54 forms part of the cursor 53, the screw 50 being threaded into the nut. The nut portion 54 of the cursor 53 carries a pointer 55, extended parallel to the axis of rotation of the shaft 36, and adapted to cooperate with the calibrations 47 on the cylinder 46.

The cursor 53 has an offset 56 (Figs. 4 and 7), carrying an electrical contact 57. A slide 58 is adjustable along the track bar 48 and is held lightly in adjusted positions by a set screw 59 or the like. The slide 58 is supplied with an electrical contact 60. The electrical contact 60 is adapted to be engaged by the electrical contact 57 on the offset 56 of the cursor 53.

A small frame 61 (Fig. 6) is mounted on the plate 32. A brake plunger 62 (Figs. 4 and 15) is mounted for reciprocation in the frame 61, in a direction at right angles to the axis of rotation of the cylinder 46. At its inner end, the brake plunger 62 is provided with a shoe 63, adapted to engage the cylinder 46. At its outer end, the brake plunger 62 has a head 64. A compression spring 65 cooperates with the plunger 62 and with the frame 61, to cause the shoe 63 to engage the cylinder 46, unless the shoe is constrained to spaced relation with respect to the cylinder, as disclosed in Fig. 4.

In order to maintain the brake plunger 62 and the shoe 63 in the retracted position of Fig. 4, a latch 66 is pivotally carried at 67 on the frame 61. A retractile spring 68 is connected to the latch 66 and to the frame 61, the spring causing the latch to engage the head 64 of the plunger 62, thereby holding the shoe 63 spaced from the cylinder 46. The latch 66 carries an armature 69, responsive to an electro-magnet 70 fixed on the base plate 32.

If desired, the micrometer mechanism hereinbefore described may be housed within a casing 71, having a transparent inspection plate 172, protection thus being afforded for somewhat delicate parts. Similar casings, likewise indicated by the numeral 72, may be used in connection with micrometer parts to be described hereinafter.

Passing to Figs. 8 to 12, on the table 31 is mounted a plate 72, carrying a bracket 73 (Fig. 11), to which a frame 74 is pivoted at 75 for swinging adjustment. The frame 74 has an offset arm 76 (Fig. 10), like the arm 45 of Fig. 5. The frame 74 carries a micrometer mechanism 77, like the micrometer mechanism shown in Fig. 4 and hereinbefore described in detail.

Instead of being operated by such a part as the hand crank 37 of Fig. 4, the shaft of the micrometer mechanism 77 is actuated by a flexible shaft 78 (Fig. 10), connected to a rigid shaft 79, journaled in a bearing 80 on the plate 72, and rotated by a hand crank 81.

A shaft 82, corresponding to the shaft 42 of Fig. 4, is mounted to rotate in the frame 74.

The screw 83 of the micrometer mechanism 77 corresponds to the screw 38 of Fig. 4 and is operatively connected with the shaft 82, which carries a telescope or sighting device 84, by such a mechanism as the crank arm 41 of Fig. 4, the slide 40 and the nut 39. The telescope 84 is pivotally mounted in the arm 76 and has swinging movement with respect to the frame 74, in a thwartship plane. The telescope 84 is adjusted in the aforesaid plane, through the instrumentality of the crank 81 of Fig. 10.

A micrometer mechanism 85 is mounted on the plate 72 and operates in a direction at right angles to that in which the micrometer mechanism 77 operates. The micrometer mechanism 85 is substantially like the micrometer mechanism shown in Fig. 4, aside from the fact that the cursor offset 56 of Fig. 4, the contact 57, the slide 58 and the contact 60 are omitted.

The screw 86 of the micrometer mechanism 85 is connected to the frame 74 by an arm, slide and nut structure 87, shown in Figs. 12 and 11, and of the kind hereinbefore described at length in connection with that part of the mechanism which is depicted in Fig. 4. The shaft of the micrometer mechanism 85 (represented by the screw 86), corresponds to the shaft 36 of Fig. 4, and is operated by a flexible shaft 88, connected to a rigid shaft 89, operated by a hand crank 90 or the like, the shaft 89 being journaled in a bearing 91 on the plate 72. By means of the crank 90 and associated parts, the frame 74 may be swung on the pivotal mounting 75 of Figs. 11 and 12, the telescope 84 receiving thwartship swinging movement.

The structure hereinbefore described and best shown in Figs. 10, 11 and 12, whereby the telescope 84 is mounted for swinging movement in two planes at right angles to each other, may be varied without departing from the spirit of the invention; and in that connection, attention is directed to Figs. 13 and 14, wherein the telescope 84*a*, which has a compound swinging movement, is designated by the reference character 84*a*.

The plate 72 of Fig. 10 is supplanted by an outer frame 92 (Fig. 13), within which is located an inner frame 93. Opposed portions of the frame 93 are pivoted at 94 to corresponding portions of the frame 92, the inner frame having movement transversely of an axis A—B. The telescope 84*a* is pivoted at 95 to the frame 92 for movement upon an axis C—D, at right angles to the axis A—B. The structure amounts to a gimbal mounting for the telescope 84*a*.

The frame 93 receives movement with respect to the axis A—B from a micrometer mechanism 96 on the frame 92 and the telescope receives movement with respect to the axis C—D, from a micrometer mechanism 97 on the frame 93. The micrometer mechanisms 96 and 97 are of the construction hereinbefore set forth in connection with the micrometer mechanisms 77 and 85 of Fig. 10.

Referring to Fig. 15, the numeral 46 designates the calibrated cylinder (Fig. 4) which is part of the mechanism for operating the telescope 43 fore and aft, the brake plunger being shown at 62, the latch at 66, and the electro-magnet at 70. As to the telescope 84, the calibrated cylinder which forms part of the mechanism for swinging that telescope fore and aft is marked by the numeral 99, the brake plunger being shown at 100, the latch at 101, and the electro-magnet at 102. As to the thwartship movement of the telescope 84, the calibrated cylinder is shown at 103, the brake plunger at 104, the latch at 105, and the electro-magnet at 106. The electro-magnet 102 is grounded as indicated at 107. The electro-magnet 70 is grounded as shown at 108, and the electro-magnet 106 is grounded at 109.

The electro-magnets 102 and 70 are joined by a conductor 110. Branched off from the conductor 110 is a conductor 111 joined to the electro-magnet 106. The numeral 112 indicates a source of electrical energy of any preferred sort, grounded at one side, as shown at 113. From the opposite side of the source 112, a conductor 114 leads to the contact 57 on the cursor 53 of Fig. 4.

A normally open switch 115, under the control of an operator, connects the conductors 110 and 114. The switch 115 appears as to superficial structure in Figs. 9 and 10. A conductor 116 extends between the contact 60 (Figs. 4 and 7) on the slide 58 (which is adjustable along the track bar 48) and an electro-magnet 117 on the aircraft, the electro-magnet being grounded at 118. Any appropriate portion of the aircraft supports a release for a bomb 120. The release may include a pivotally mounted radius arm 121, having an armature 121*a* which is responsive to the electro-magnet 117. The bomb release may be of any desired nature.

Assuming that the switch 115 of Figs. 9, 10 and 15 is open, it will be understood that when the contact 57 of the cursor 53 engages the contact 60 on the adjustable slide 58, the electro-magnet 117 will be energized and will attract the radius arm 121, the bomb 120 being released.

When an operator stationed at the telescopes 84 closes the switch 115, the electro-magnets 70, 106 and 102 will be energized, thereby retracting the latches 66, 105 and 101, the brake plungers 62, 104 and 100 of Fig. 15 being advanced by the spring 65 of Fig. 4, and similar springs, so that the brake plungers engage, respectively, the cylinders 46, 103 and 99, the rotation of the shaft 36 of Fig. 4 and the fore and aft movement of the telescope 43 terminating, the rotation of the cylinders 103 and 99 being terminated in a similar way, and the compound movement of the telescope 84, both fore and aft, and thwartship, coming to an end. It is assumed of course, that the operator will not turn the crank 37 of Fig. 4, or the cranks 90 and 81 of Fig. 10, after the brake pressure is felt; although the brake mechanism might be strong enough to resist actuation by the cranks under any reasonable effort that the operator might expend upon them.

In Fig. 16 there is shown a signal 122, which is disposed in a position convenient for the pilot of the aircraft. The numeral 123 indicates an operating means located adjacent to the telescope 43. There is an operative connection 124 between the mechanism shown at 123 and the signal 122. The showing of Fig. 16 is purely diagrammatic, the actual construction of the signalling mechanism being no more than a job for a mechanic or an electrician. By means of the device indicated in Fig. 16, the observer at the telescope **43** may transmit instructions to the pilot.

At this point the function and the mechanical operation of various groups of parts will be considered, and then the solution of a specific problem will be discussed.

Referring to Figs. 1 and 2, it will be noted that the frame S and the hangers **11** are suspended from the thwartship shaft **8**, and the frame will maintain a vertical position even though the aircraft is not advancing on a horizontal line of flight. Thus there is assured a vertical line which serves as a datum to which angles measured thwartship, or fore and aft, that is, in a vertical plane including the line of advance, may be referred.

Passing to Figs. 4, 5, 6 and 7, the operator sets the slide **58** on the bar **48** in accordance with his judgment. When the shaft **36** is rotated by means of the crank **37**, a fore and aft swinging movement is imparted to the telescope **43**, through the instrumentality of the screw **38** which forms part of the shaft **36**, the crank arm **41** and attendant parts, and the shaft **42**.

The cursor **53** is actuated by the screw **50** on the shaft **36** and, ultimately, the contact **57** on the cursor comes into engagement with the contact **60**. Referring to Fig. 15, the circuit which includes the conductor **114**, the conductor **116** and associated parts is energized, and the electro-magnet **117**, attracting the radius arm **121**, brings about a dropping of the bomb **120**. A reading may be taken at any time by means of the micrometer mechanism which includes the calibrations **47** on the cylinder **46**.

Referring to Figs. 10 to 12, the telescope **84** is swung fore and aft when the crank **81** is actuated, and is swung thwartships, when the crank **90** is actuated.

In the practical operation of the device, a plane (which may be referred to conveniently as a test plane) equipped with the structure hereinbefore described, is flown toward a target, or objective to be bombed. The test plane drops a test bomb, which as to physical characteristics, is a duplicate of the bomb which is dropped later, by another plane, in order to consummate the work of destruction, the plane which drops the potent bomb being referred to as the "bombing plane."

The test plane accumulates data which are radioed, or transmitted otherwise, back to a following bombing plane. In the data sent back, errors in the work of the test plane are corrected, and the bombing plane, therefore, is in possession of information which will enable it to drop an explosive bomb with reasonable certainty that the bomb will strike the target, or at least land close enough thereto to fulfill its mission, practically considered.

It is presupposed that the following bombing plane operates under the same conditions that the test plane has encountered, reference being had to such quantities as speed, elevation and weather conditions.

If it is offered as an objection that the operation of the bombing plane, under conditions duplicating those that attended the operation of the test plane, results in increase of risk to the bomber and crew from anti-aircraft fire, it should be noted that such a risk is no more than a hazard of warfare. Moreover, anti-aircraft fire may not be available immediately, as the disaster at Pearl Harbor makes manifest.

The operator at the telescope **43** sets the slide **58** in a position on the graduated track bar **48** dictated by his judgment. The operator at the telescope **43**, which swings fore and aft only, points his instrument on the target. If the pilot of the aircraft permits it to get off its course, laterally considered, the operator at the telescope **43** notifies the pilot by means of the signal mechanism shown in Fig. 16, and the pilot can rectify his course.

Through the operation of the crank **37** of Fig. 4, and attendant parts, the person at the telescope **43**, swings that telescope in a vertical plane and keeps it on the target, the pilot taking advantage of the information which he receives from the operator at the telescope **43** and seeing to it that the craft does not sag laterally off her course.

When the person at the telescope **43** operates the crank **37**, he causes the contact on the cursor **53** to approach and finally touch the contact **60** of the slide **58** on the track bar **48**. Then the circuit which includes the conductors **114** and **116** of Fig. 15 is closed, the electro-magnet **117** is energized, and the trial bomb **120** is dropped. Whatever the system of forming the calibrations **47** on the cylinder **46** may be, the reading, in substance, is an angular reading, or in arc, although it need not be expressed in degrees and fractions thereof.

The observer at the telescope **43** continues to hold on the target, to the end that he my act in the capacity of course-adviser to the pilot. In this connection it should be noted that the slide **58** of Fig. 4 does not serve as an impeding stop for the cursor **53**, since the slide is held but lightly on the track bar **48**.

Suppose that the observer at the telescope **43** has set the slide **58** at a reading of 1286 on the graduated track bar **48** and he continues to keep the telescope **43** on the target. The operator at the telescope **84** has set his micrometers **77** and **85** at zero. When the bomb is dropped by engagement between the contacts **57** and **60** of Fig. 4, the observer at the telescope **84** follows the bomb fore and aft, by the micrometer mechanism **77** of Fig. 10, and laterally by the micrometer mechanism **85** of that figure. When the bomb explodes, the observer at the telescope **84** stops the operation of all three micrometers by operating the switch **115** of Figs. 10 and 15, the brake members **62**, **104** and **100** of Fig. 15 being applied.

Suppose that the observer at the telescope **84** has obtained a fore and aft reading of 1424 and a thwartship reading of 110 as the bomb strikes. Suppose, also, that at the time the bomb strikes and explodes, the observer at the telescope **43** has a target reading of 1200. Comparing the figures 1424 and 1200, it appears that the observer at the telescope **43** has made a fore and aft error of 224 in the setting of his slide **58**. Due to conditions beyond his control, he has made a thwartship error of 110, shown on the micrometer **85**.

The correction 224 is applied to the reading 1286, and the test plane has a corrected course reading which may be passed back to the bombing plane. The slide **58** and the micrometer mechanism **85** of the bombing plane then may be set properly, and the active bomb will be so dropped as to hit the target. The bombing plane preferably does not have the fore and aft telescope **43** and attendant parts, since that telescope is useful chiefly to collect data and to keep the test plane on its course whilst the data are being collected.

The sighting frame S may be referred to as a carrier, and the carrier is so mounted on the upper portion 2 of the aircraft that the carrier will define a vertical line of reference. The telescope **43** is a first sighting device. The telescope **84** is a second sighting device. Various micrometer mechanisms, such as that shown in Fig. 4, constitute actuating means. In Fig. 15, a bomb release is shown at **121** and the electrical connections constitute means for operating the release. The operating means, as above described, comprises normally inactive parts, such as the contacts **57** and **60** of Fig. 4. Such parts are incorporated in the actuating mechanism for the first sighting device **43**, that is, the mechanism shown in Fig. 4, and they are incorporated, in duplicate, in the mechanism shown at **77** in Fig. 10, whereby fore and aft swinging movement is imparted to the telescope **84**. The aforesaid parts **57** and **60** coact under the impulse of the actuating mechanism, for instance, that shown in Fig. 4, to bring about bomb release.

What is claimed is:

1. A bombsight comprising a carrier, means for pivotally mounting the upper portion of the carrier on an aircraft whereby the carrier will define a vertical line of reference, a sighting device, means for mounting the sighting device on the carrier for swinging movement in a vertical, fore and aft plane, and in a vertical, thwartship plane, an actuating mechanism operatively connected to the sighting device, to swing it in a fore and aft plane, and an actuating mechanism operatively connected to the device, to swing it in a thwartship plane and means for mounting the carrier for raising and lowering with respect to the aircraft whereon it is mounted.

2. A bombsight comprising a sighting frame, means for suspending the sighting frame from an aircraft for fore and aft swinging movement, the sighting frame including a pendulum having thwartship swinging movement, a sighting device, means for mounting the device on the frame for swinging movement in a vertical fore and aft plane, and in a vertical, thwartship plane, mechanism operatively connected to the sighting device, to swing it in a fore and aft plane, and mechanism operatively connected to the sighting device, to swing it in a thwartship plane.

3. A bombsight constructed as set forth in claim 1, in combination with means for imparting fore and aft adjustment to the carrier, at the will of an operator.

4. A bombsight constructed as set forth in claim 1, in combination with means for mounting the carrier for raising and lowering with respect to the aircraft whereon it is mounted, and means for mounting the carrier for fore and aft movement.

5. A bombsight comprising a support, means for mounting the support in elevated position on an aircraft, the support having a fore and aft rack, a carriage structure, means for mounting the carriage structure for fore and aft sliding movement on the support, a first shaft journaled in the carriage structure, a pinion carried by the first shaft and meshing with the rack, means for rotating the first shaft, hangers suspended from the first shaft for fore and aft swinging movement and provided with substantially vertical racks, riders mounted for vertical sliding movement on the hangers, a second shaft disposed parallel to the first shaft and journaled in the riders, means for rotating the second shaft, a member mounted to swing fore and aft on the second shaft, pendulums suspended from said member for thwartship swinging movement, a link pivoted to the hangers, and sighting means mounted on the link.

6. A bombsight comprising a support, means for mounting the support in elevated position on an aircraft, a carriage structure, means for mounting the carriage structure for fore and aft sliding movement on the support, means under the control of an operator for imparting fore and aft sliding movement to the carriage structure, depending hangers, substantially vertical racks on the hangers, means for mounting the hangers on the carriage structure for fore and aft swinging movement, riders mounted for vertical sliding movement on the hangers, a thwartship shaft journaled in the riders, pinions on the shaft and meshing with the racks, means for rotating the shaft, a member mounted to swing fore and aft on the shaft, pendulums suspended from said member for thwartship swinging movement, a link pivoted to the hangers, and sighting means mounted on the link.

7. A bombsight comprising a support, means for mounting the support in elevated position on an aircraft, the support having a fore and aft rack, a carriage structure, means for mounting the carriage structure for fore and aft sliding movement on the support, a shaft journaled on the carriage structure, a pinion carried by the first shaft and meshing with the rack, means for rotating the shaft, hangers suspended from the shaft for fore and aft swinging movement, riders mounted for vertical sliding movement on the hangers, means under the control of an operator for imparting vertical sliding movement to the riders, a member mounted on said means for fore and aft swinging movement, pendulums suspended from said member for thwartship swinging movement, a link pivoted to the hangers, and sighting means mounted on the link.

8. A bombsight comprising a support, means for mounting the support in elevated position on an aircraft, a carriage structure, means for mounting the carriage structure for fore and aft sliding movement on the support, means under the control of an operator for imparting fore and aft sliding movement to the carriage structure, depending hangers, means for mounting the hangers on the carriage structure for fore and aft swinging movement, riders mounted for vertical sliding movement on the hangers, means under the control of an operator for imparting vertical sliding movement to the riders, a member mounted on said means for fore and aft swinging movement, pendulums suspended from said members for thwartship swinging movement, a link pivoted to the hangers, and sighting means mounted on the link.

9. A bombsight comprising depending hangers, means for mounting the upper portions of the hangers on an aircraft for fore and aft swinging movement, a frame, means for mounting the frame on the hangers for vertical adjustment at the will of an operator, the frame including pendulums having thwartship swinging movement, parallel links pivoted to the pendulums and disposed transversely thereof, an upright pivotally connected to the links and maintained thereby in parallel relation to the pendulums, and sighting means carried by the upright.

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