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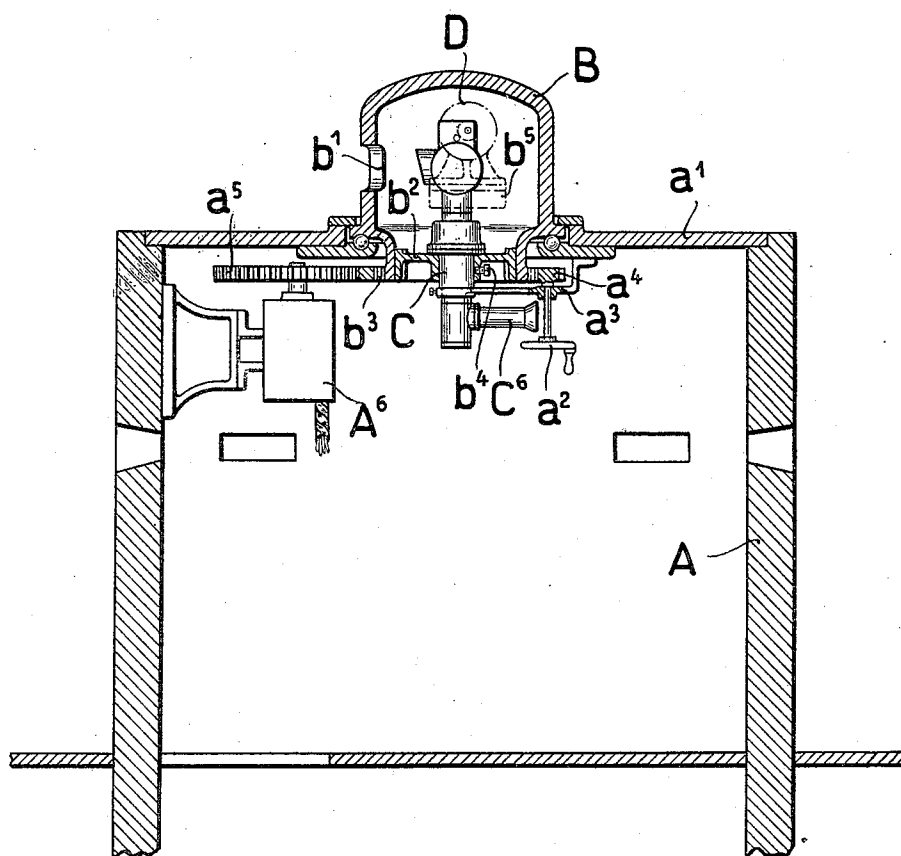
W. AKEMANN

SIGHTING DEVICE FOR NAVAL GUNS

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2 Sheets-Sheet 1

Fig. 1.



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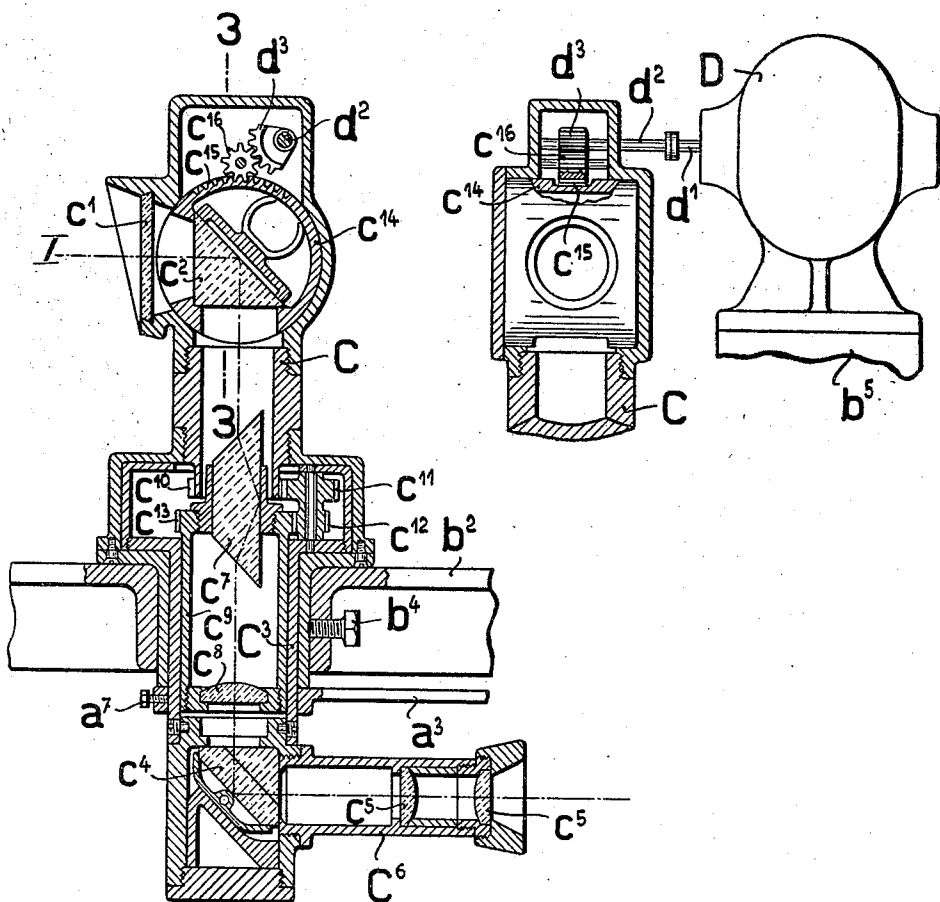
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Fig.2.

Fig.3.



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UNITED STATES PATENT OFFICE.

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SIGHTING DEVICE FOR NAVAL GUNS.

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(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, WALTHER AKEMANN, residing at Essen, Germany, a citizen of the German Republic, have invented a certain new and useful Improvement in Sighting Devices for Naval Guns, for which I have filed applications for patents as follows: Germany, Dec. 15, 1916; France, Dec. 3, 1920; Great Britain, Dec. 7, 1920; Japan, Dec. 29, 1920; and of which the following is a specification.

This invention relates to a sighting device having a stabilizing gyroscope and intended for use with naval guns and provided with a telescope having a bent optical axis and in the case of which a gyroscope of only comparatively slight capacity is required even when a large size telescope is being made use of.

The invention will be described with reference to the accompanying drawing which illustrates, as an embodiment of the subject matter of the invention, a sighting device located in the conning turret of a vessel and connected to the transmitter of a long-distance controlling apparatus for the guns and having a telescope formed by a periscope.

In this drawing—

Fig. 1 is a side view of the sighting device with the pertinent parts of the conning turret disclosed in vertical section.

Fig. 2 is a longitudinal mid-section through the periscope shown in Fig. 1 and forming a part of the sighting device, along with the immediately contiguous parts of the conning turret, and

Fig. 3 is a detail view, partly in section on line 3—3 in Fig. 2.

Referring to these drawings, A denotes the fixed conning turret of a man-of-war, B an armoured cupola of circular cross section mounted to rotate on ball bearings within the roof a^1 of the turret, a sight opening b^1 being formed in the side wall of the said cupola. The lower end of the armoured cupola B, which projects through an appropriate opening into the interior of the turret, is closed by a bottom b^2 adapted

to prevent fragments of shells or the like, which may have entered through the sight opening b^1 into the cupola B, from dropping into the interior of the turret A.

A hand wheel a^2 (Fig. 1) serves to rotate the cupola B; the said wheel is mounted to rotate within a support a^3 fixed to the roof a^1 , while its shaft carries a pinion a^4 meshing with a toothed wheel b^3 arranged at the lower end of the cupola B. This toothed wheel b^3 gears further with a second toothed wheel a^5 rigidly fixed to the rotor shaft of a transmitter A⁶ belonging to a long-distance controlling device for the traversing gear of a gun. The transmitter A⁶ is mounted on the side wall of the turret A in the manner illustrated in Fig. 1. By the above-mentioned connection between the armoured cupola B and the transmitter A⁶ of a long-distance controlling device for the traversing gear of a gun the object is obtained that when the cupola B executes a rotary motion, the revoluble part of the transmitter A⁶ will rotate about an angle proportional to this motion, and that the said part of the transmitter A⁶ will transmit its rotation upon the traversing gear of the gun in such a manner, that this latter, too, will be obliged to turn about an angle equal to the angle of rotation of the cupola B.

The bottom b^2 of the cupola B serves at the same time as the seat for an upright periscope (see in particular Fig. 2). The said periscope consists in the customary manner of a top portion C containing the admission lens c^1 and the refracting prism c^2 , a central portion C³ revoluble relatively to the portion C and serving as a support for a tube c^3 containing the erecting prism c^7 and the object lens c^8 as also the pinions c^{11} and c^{12} of the erecting prism c^7 and finally a bottom portion C⁶ containing the roof-shaped inverting prism c^4 and the eyepiece c^5 . The top portion C supporting the admission lens c^1 and the refracting prism c^2 , is rigidly connected in the manner shown in Figs. 1 and 2 by means of a set screw b^4 with the bottom b^2 of the cupola B, so

that it is forced to participate in every rotary motion executed by the cupola B and this in the like sense and with the like angular velocity, whereas the central portion C³ supporting the pinions c¹¹ and c¹² of the erecting prism c⁷ is rigidly connected by means of a set screw a⁷ with the support a³ fixed to the roof a¹ of the turret A, so that the angular position of this portion C³ will not be changed by a rotation of the cupola B. The arrangement devised is such that the bottom portion C⁶ of the periscope, containing the eyepiece c⁵, is located underneath the bottom b² and therefore within the interior of the turret A, while the top portion C, which is intended to be focused on the object to be fired at, projects into the cupola B and is disposed with its admission lens c¹ opposite the sight opening b¹. The top portion C is connected to the tube c⁹, disposed to rotate within the central portion C³ and carrying the erecting prism c⁷ and the object lens c⁸, by means of a toothed gear c¹⁰ c¹¹ c¹² c¹³ in such wise that in the course of a rotation of the top portion C which participates in a rotation of the cupola B, the tube c⁹ will revolve relatively to the central portion C³, which is fixed in its position by the support a³, in the like direction but with half the angular velocity of the top portion C. The bottom portion C⁶ carrying the eyepiece c⁵ is loosely revoluble relatively to the central portion C³.

The refracting prism c² is mounted to rock about a horizontal axis within the top portion C by intervention of a mounting c¹⁴ shaped to form a fulcrum; the said axis being disposed transversely to the rays entering through the admission lens c¹. The mounting c¹⁴ is provided at a portion of its shell surface with a series of teeth c¹⁵ which the teeth of an intermediate wheel (c¹⁶), lodged in the top portion C, are adapted to engage. A toothed sector d³ gears with the intermediate wheel c¹⁶; the said sector being likewise disposed to rock within the top portion C by means of a shaft d², for its part arranged in parallel to the axis of rotation of the mounting c¹⁴. One end of the shaft d² extends beyond the top portion C of the periscope and is rigidly connected with the coaxially disposed outer Cardan shaft d¹ of a stabilizing gyroscope mounted by means of a Cardan suspension within a casing D (Figs. 1 and 3). The Cardan shaft d¹ forms the material axis stabilized by the gyroscope. The casing D is rigidly mounted on a pedestal b⁵ fixed to the inner wall of the armoured cupola B. The arrangement and the ratio of transmission of the toothed gear d³ c¹⁶ c¹⁵ interposed between the Cardan shaft d¹ and the refracting prism c² is so determined that, in the case of relative movements executed by the

Cardan shaft d¹ fixed in the space by the gyroscope, the angle of rotation of the refracting prism c² with respect to the top section C will only be about one half of the angle of rotation of the Cardan shaft d¹ with respect to the casing D and that this first-named angle has the same direction as this latter angle of rotation.

The manner of operation of the device is as follows:

The man stationed in the turret and appointed to sight the object places one eye against the eyepiece of the bottom portion C⁶ and by rotating the hand wheel a² causes the cupola B to be revolved until the object to be sighted is visible within the reticule of the periscope so that, as a result, this latter will be laterally focused upon the object. At the same time the aforesaid rotation of the hand wheel a² causes by intervention of the gear a⁴ b³ a⁵ such a rotation of the adjustable part of the transmitter A⁶ of the long-distance controlling device that likewise the gun to be pointed will be laterally trained upon the object. Now in the event of the vessel executing a rolling motion so that, for example, the ship's deck will swing for an angle α relatively to the horizontal position, then, on the one hand, the periscope will, as an entirety, be likewise revolved for the angle α relatively to its upright position disclosed in the drawing; while, on the other hand, in view of the fact that the Cardan shaft d¹ retains its position in the space by the action of the gyroscope while at the same time executing a relative motion for the angle α relatively to the gyroscope casing D, the refracting prism c² will be caused to revolve by intervention of the gear d³ c¹⁶ c¹⁵ relatively to the top portion C in the same direction of rotation for the angle $\frac{\alpha}{2}$. The aforesaid rotation of the periscope as an entirety and of the refracting prism c² relatively to the top portion C results, in accordance with the well-known law concerning the refraction of rays of light on a reflecting surface, in that the ray of light I (Fig. 2) remains parallel to itself during a rolling motion of the vessel and that it therefore retains the position into which it has been focused upon the object.

The device forming the subject matter of the invention makes it possible to keep even when employed in combination with a periscope (the particular utility of which latter for war purposes has been generally acknowledged), the line of sight parallel to itself when the ship is rolling, and this by means of a stabilizing gyroscope of comparatively slight capacity. This advantage is based upon the fact that with the sighting device according to the invention the mass, formed by the refracting prism c² and its

driving gear, and which is to be rotated by the gyroscope when the vessel is rolling, is comparatively very small relatively to the mass of the entire periscope, so that, consequently, a stabilizing gyroscope of but only slight capacity will develop a sufficiently large directive force.

A further advantage of the described sighting device is that the man sighting the object to be fired at is enabled to press his eye against the eyepiece of the bottom portion C^o of the periscope without any liability of the pressure thus brought to bear on the periscope causing any undesirable displacement of the gyroscope.

But beyond this, a most important advantage of the form of execution of the sighting device hereinbefore explained will be found to consist in the possibility created of restricting to a minimum the dimensions of the armoured cupola B serving to lodge the periscope and the gyroscope and consequently also the power required to rotate the cupola and further of the general arrangement being devised in such a manner that the man appointed to sight the object will be able to remain within a splinter-proof compartment and will therefore be enabled to observe the object undisturbed and without being obliged to change his position.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:

1. In an arrangement of the class described, a sectional telescope, a reflecting means in one end section of said telescope, means for rigidly supporting the center section of said telescope, said sections being rotatable relatively to each other, a stabilizing device connected to said reflecting means for stabilizing the same, said stabilizing device being rotatable with the end section carrying said reflecting means.

2. In a sighting device of the class described a telescope having a bent optical axis, said telescope being formed in relatively rotatable sections, a reflecting means supported within the upper section, the central section being fixed, a stabilizing gyroscope, means operatively connecting said gyroscope to said reflecting means to cause said reflecting means to rotate relatively to the section of the telescope supporting it, when the vessel is rolling at half the angular velocity and in the same direction as the stabilizing device, and means for supporting said stabilizing device for rotation with the section of telescope containing said reflecting means.

3. An arrangement of the class described comprising a conning turret, a cupola revolvably mounted on said turret, a telescope supported by said cupola, said telescope be-

ing formed in sections, the top section thereof rotating with said cupola, a reflecting means supported in the upper section of said telescope, means for rotating said cupola and means for stabilizing said reflecting means.

4. A sighting device of the class described comprising a conning turret, a cupola rotatably mounted on said turret, means for rotating said cupola, a telescope supported in said cupola, said telescope being formed in sections, the top section thereof being fixed to the cupola for rotation therewith, means rigidly securing the central section of the telescope to the turret, a reflecting means carried by the top section of the telescope, an erecting prism carried by the central portion of said telescope, and a gyroscope carried by said cupola for automatically stabilizing said reflecting means.

5. A sighting device of the class described comprising a conning turret, a cupola rotatably mounted on said turret, means for rotating said cupola, a telescope supported in said cupola, said telescope being formed in sections, the top section thereof being fixed to the cupola for rotation therewith, a reflecting means carried by the top section, means rigidly securing the central section of the telescope to the turret, a tubular member rotatably mounted in said central section, an erecting prism and object lens carried by the tubular member, means connecting the tube to the top section of the telescope to cause it to rotate in a like direction but with half the angular velocity of the top section, and a gyroscope carried by said cupola for automatically stabilizing said reflecting means.

6. An arrangement of the class described comprising a conning turret, an armored cupola rotatably mounted on said turret, means for rotating said cupola, a periscope supported in said cupola, so positioned that the lower portion thereof projects into said turret, a reflecting means carried by the upper portion of said periscope, a gyroscope operatively connected to said reflecting means, for stabilizing the same, said gyroscope being supported in said cupola, substantially as described.

7. An arrangement of the class described comprising a conning turret, an armored cupola revolvably supported on said turret, a bottom for said cupola, means for rotating said cupola, a transmitter forming part of a long distance controlling device operatively connected to said cupola, a sighting telescope supported by the bottom of said cupola and projecting into said cupola and into said turret, said sighting telescope being formed in sections, the upper section thereof being fixed to rotate with said cupola, means rigidly securing the central section of said telescope to said turret, the

lower section of said telescope being freely rotatable, a stabilizable reflecting means carried by the upper section of said telescope, means for stabilizing said means, said stabilizing means being supported in said cupola.

Essen, Germany, this 21st day of October, 1920.

DR. WALTHER AKEMANN.

In presence of—

HANS GOTTSMANN,
JOHANN DECKERS.

The foregoing specification signed at