

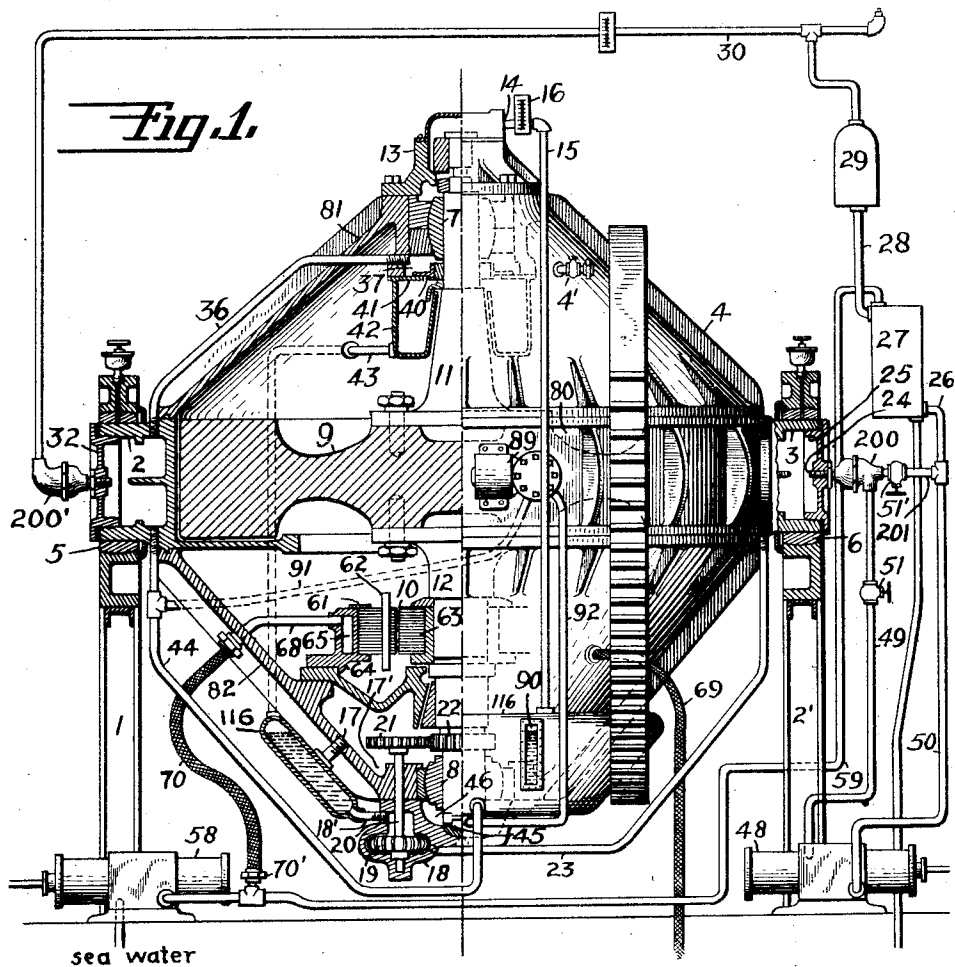
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E. A. SPERRY ET AL

COOLING MEANS FOR GYROMOTORS

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UNITED STATES PATENT OFFICE.

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COOLING MEANS FOR GYROMOTORS.

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September 9, 1920. Serial No. 409,190.

To all whom it may concern:

Be it known that we, ELMER A. SPERRY and EDWARD G. SPERRY, citizens of the United States of America, residing at 1505 Albemarle Road, Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Cooling Means for Gyromotors, of which the following is a specification.

This invention relates to electrically driven gyroscopes of the type employed for stabilizing ships or for other heavy duty. In such gyroscopes it is found highly desirable to rotate the rotor in vacuo, thereby greatly reducing the windage losses. When such is done, however, the cooling of the driving motor, which is generally built on the rotor shaft, becomes a serious matter since with the air pumped out the cooling effect of the same is also eliminated.

The purpose of this invention is to devise a means for effectively cooling such a gyro driving motor.

The drawing represents an elevation, partly in section, of a typical gyroscopic stabilizer for ships, the drawing being the same as Fig. 1 of our copending application, Serial No. 254,342, filed September 16, 1918, now matured into U. S. Patent 1,387,018 dated August 9th, 1921, of which the present application is a division.

The gyroscope is shown as mounted on heavy brackets 1 and 2'. Large hollow trunnions 2 and 3 extend from opposite sides of the casing 4 of the gyroscope and are journaled on bearings 5 and 6 in said brackets. The casing 4 supports the bearings 7 and 8 for the rotor and also serves to enclose completely the rotor 9, the motor 10 for driving the same, and all other rotating parts of the gyroscope. A valve and coupling 4' are shown on the casing for the purpose of connecting an exhaust pump to evacuate the casing. The casing is shown as built up of a plurality of sections comprising a central annulus 80 carrying the trunnions 2 and 3 and a pair of conical end portions 81 and 82. The rotor 9 is shown as securely bolted at each side to stub shafts 11 and 12. Shaft 11 is journaled adjacent its upper end in the bearing 7. A cap 13 may be provided for the bearing, said cap being provided with an oil

outlet 14 from which a pipe 15 leads. Said pipe is preferably provided with a peep-sight 16 so that the operator may ascertain whether or not oil is flowing through the pipe. The pipe 15 is shown as leading downwardly into a reservoir 116 adjacent the bottom of the gyroscope. Similarly, the lower bearing 8 is provided with an outlet or overflow opening 17 which leads into the reservoir 116. From the reservoir 116 the oil passes to an oil pump 18 through pipe 18'. The pump is shown in the form of a centrifugal pump having a turbine wheel 19 mounted on the same shaft 20 with a gear 21. Said gear meshes with a gear 22 on the shaft 12 of the gyroscope so that the pump is continuously driven. From the pump the oil is led through a pipe 23 into the hollow trunnion 3 of the gyroscope. From thence the oil passes out through a pipe 24 secured to the cap 25 rigidly fixed to trunnion 3 from whence the oil normally passes through a swivel joint 200, through pipes 201, 26 into and through the oil cooler 27 hereinafter described. A peep-sight 90 may also be provided for reservoir 116. A valve 51' is preferably provided in pipe 201.

From the cooler the oil passes through pipe 28 into and through a strainer 29. From thence the oil is shown as passing through a pipe 30 through the swivel joint 200' into the hollow trunnion 2 through the fixed cap 32. By leading the oil from the stationary parts to the gyroscope through the trunnions in this manner a ready means is provided for introducing a continuous supply of oil or other liquid to the gyroscope without the use of flexible connections. From the interior of trunnion 2 a portion of the oil is led through a pipe 36 into a chamber 37 under the upper bearing 7. Since the oil is under pressure it flows up through the said bearing along the shaft and out at the opening 14 and pipe 15. The sight 16 will show at a glance whether the bearing is immersed in oil or not. The shaft 11 is provided with a disc 40 which closely fits and slides over a plate 41 on the gyroscope casing so that little, if any, oil escapes into the gyroscope. What little oil does trickle through is caught by the annular basin 42 from whence it is carried through

the pipe 43 to the reservoir 116. Oil is supplied to the lower bearing from trunnion 2 through pipe 44. The thrust bearing 45 which supports the gyro rotor is supplied with oil under much higher pressure from an electrically driven pump 89 shown as mounted on the gyro casing 4. Said pump is fed from trunnion 2, being shown connected to pipe 44 through a branch pipe 91. From the pump, the oil is led into the thrust bearing through pipe 92. The oil is preferably under sufficient pressure to entirely support the shaft 12 and all parts secured thereto thus furnishing an oil thrust bearing for the shaft. From the said bearing the oil escapes into a chamber 46 from whence it is forced up along the shaft 12 together with the oil from pipe 44 through the bearing 8 and into the space 17.

In order to secure a complete circulation of the oil at the time the gyroscope is started, we prefer to provide an auxiliary oil pump 48 which is connected to the system through pipes 49 and 50. When the pump 48 is operating the valve 51 may be closed and valve 51 opened.

The motor is shown in the form of an induction motor having a stator 61 secured to the casing and provided with windings 62. The rotor 63 is preferably without windings and is shown as mounted directly upon the shaft 12. In order to cool the stator and its windings we prefer to provide the metallic frame 64 supporting the same with a channel 65, which preferably extends circumferentially around the frame. Cooling fluid is introduced into the said channel through a pipe 68 extending through the airtight casing 4, where it is coupled to flexible hose 70. Said fluid is led outwardly from the gyroscope through similar piping (not shown) and the flexible pipe or hose 69, so that a continuous circulation of water from without the gyroscope casing may be produced. The pump 58 may be used to supply sea water for cooling the motor; said pump being shown as connected to flexible hose 70 at 70'.

The operation of our invention is as follows: Before or at the time the gyroscope is started up the oil pumps 48 and 89 are started to cause a circulation of the oil through all of the bearings. The operator by observing the peep-sights 16 and 90 may readily determine when the oil has completely flooded the bearings. As the gyroscope comes up to speed the pump 18 will exert more and more pressure until the pump 48 may be entirely shut off and valve

51 closed if desired. Auxiliary pump 89 is kept running.

Before or at the time the pump 48 is started the water pump 58 is also set in operation to supply cooling water to both the oil cooler 27 through pipe 59 and the motor 10 within the casing.

While, as shown, only the oil is carried into the gyroscope through the hollow trunnions, it will be understood that the described method may be employed for other purposes, if desired.

Having described our invention, what we claim and desire to secure by Letters Patent is:

1. The combination with a gyroscope having a rotor, a casing enclosing the same and adapted to be evacuated, an electric motor within said casing for driving the gyro rotor, a channel adjacent the windings of said motor, a connection from said channel to the exterior of said casing, and means for circulating a cooling medium therethrough.

2. The combination with a gyroscope having a rotor, a casing enclosing the same and adapted to be evacuated, means for mounting the same for oscillation about an axis, an induction motor having a wound stator and a rotor within said casing for driving the gyro rotor, a channel adjacent windings of said stator, a connection from said channel to the exterior of said casing, means for circulating a cooling medium therethrough and a flexible connection between said circulating means and said casing.

3. The combination with a gyroscope having a rotor, a journal frame and bearings for the same, motive means for driving the same, a circulating path for the lubricant for said bearings, cooling means for said lubricant in said path, cooling means for said motive means, and means for circulating cooling fluid through both said cooling means.

4. The combination with a gyroscope having a rotor, a journal frame and bearings for the same, motive means for driving the same, a circulating path for the lubricant for said bearings, cooling means for said lubricant in said path, cooling means for said motive means, and a common means for circulating liquid through both of said cooling means.

In testimony whereof we have affixed our signatures.

ELMER A. SPERRY.
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