

NEW AUTOMATIC STEERING CONTROL SYSTEM

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A new automatic steering control system for ships which directs a vessel to a new course without any overshooting, and which holds a selected course precisely despite disturbing forces, was first demonstrated to representatives of the marine industry here on 2nd October, 1952. This new Gyro-Pilot, developed by Sperry Gyroscope Company, is a modern, electronic version of « Metal Mike », the steering robot known to mariners the world over.

A special adaptation of this new system is being installed aboard the United States Lines' superliner *S.S. United States*, which will have three specially built steering stands supplied by Sperry.

The new, commercial Gyro-Pilot has added « rate » control to the « displacement » type of steering afforded by « Metal Mike. » In displacement steering, the automatic pilot applied rudder only in exact proportion to the ship's deviation from a desired heading. The pilot did not return the rudder amidships until the vessel actually reached the desired heading. This resulted in overshooting the course, due to the turning momentum of the hull, before the ship settled out on course.

Addition of electronic rate control can now direct a vessel automatically to its proper heading — from the smallest deviation or largest course change alike — rapidly, positively, and with no overshoot whatsoever. In short, the new Gyro-Pilot takes care of such variables as speed, ship's turning momentum, wind and sea conditions, and calls for just the right amount of rudder to meet these forces.

In simplest terms, the rate signal in the new Gyro-Pilot functions so that the faster the vessel is forced from the heading, the greater the rudder angle required to hold her. Conversely, the faster the vessel is turning into the desired heading, the greater the opposite or « meeting » rudder required to stop the turn.

Setting a new course through the new Gyro-Pilot is a simple operation. In the steering stand, there is a gyro-compass repeater on which a course-setting pointer is superimposed. When the ship is in automatic steering, the helmsman can select a new course by moving the steering wheel to set the pointer on the exact heading desired. Smoothly the ship turns automatically to the course.

The Sperry Gyro-Pilot mixes both rate and displacement signals to attain its precise steering control. Rate control is applied as a direct current voltage — proportional to the rate or speed of turning of the vessel — and is obtained from a generator geared to the Sperry Gyro-Compass. These signals are correctly mixed with displacement signals to obtain optimum rudder control. To adapt this steering control system to the highly variable characteristics of different hulls, the proportion between the two signals is changed to suit a particular vessel. Once the proportion is established by trial, it will suffice for all speeds, turns and sea conditions.

(1) T.M. Reg. U.S. Pat. Off.

Further improvement in the quality of steering control afforded by the electronic « Metal Mike » has been made possible through the use of a hydraulic rather than an electric power unit for controlling a vessel's steering engines. Located in the steering gear room, the power unit is a hydraulic cylinder with associated pump and valving mechanism which receives steering intelligence in the form of electric signals from the Gyro-Pilot. The resulting linear piston motion is used to stroke the valves of the main steering gear which moves the ship's rudder. These hydraulic cylinders avoid high inertia of moving parts and make possible more exact rudder movements.

Sperry Gyroscope Company has placed the new Gyro-Pilot into production and has scheduled deliveries for early spring sufficient to meet industry demand.

ADDITIONAL BACKGROUND NOTES FOR MARINE TRADE JOURNALS

1. As with the « two-unit » Gyro-Pilot, which had remained virtually unchanged for the past 15 years, hand-electric steering control may be instantly obtained by throwing a control lever from the « gyro » to the « hand » position. In this condition, the rate signals and gyro-compass repeater input is disconnected from the Gyro-Pilot so that the rudder will respond only to the steering wheel movement. In hand-electric steering, the weather and rudder adjustments used in « automatic » are also disconnected so that a fixed ratio between steering wheel turns and rudder angle is maintained at all times.

2. Designers of the Gyro-Pilot forecast longer service life and less maintenance for the new « Metal Mike ». For example, there is the elimination of contacts which require frequent cleaning. Other design features have reduced requirements for frequent maintenance attention.

3. A noteworthy safety feature has been incorporated in the new Gyro-Pilot — the automatic synchronizing switch. This synchronizing switch holds the power supply to the pilot open, unless the course selector pointer is set within a few degrees of the ship's heading. This device provides protection against the application of large rudder angles when transferring from telemotor to Gyro-Pilot in cases where the course selector pointer has not been properly centered beforehand.

4. As a further advance in the design of automatic steering control, the Gyro-Pilot has two sets of limit switches. One set, the « outside » limits, act in the normal manner to stop the rudder just short of its own mechanical stops. The other, the « inside » limits, continually confine the rudder within a pre-selected angle either side of amidships when in pilot control. For large vessels this rudder angle may be in the region of 8 to 10 degrees which is the practical limit of helm at high operating speeds. Thus the operator may call for large course changes and be assured that the ship will only respond within an appropriate turning radius. However, should the helmsman wish to exceed these inside limits, he needs only to select « hand » steering and turn the steering wheel for any amount of desired rudder.

In automatic steering in rough weather these inside limits prevent excessive rudder action and consequent wear on the steering system. Experience has shown that rudder movement may be limited in these conditions without sacrificing overall course-keeping performance.
