

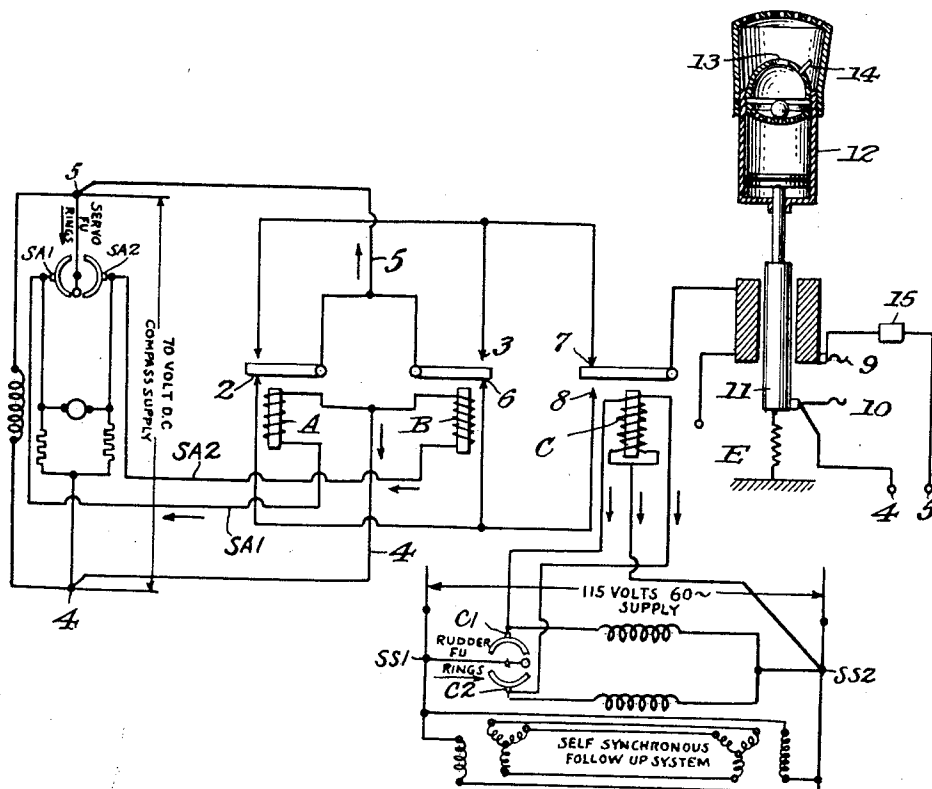
July 27, 1954

C. N. COLYVAS

2,685,081

FAILURE ALARM FOR SPERRY GYRO PILOTS

Filed Jan. 23, 1952



INVENTOR.
C. N. Colyvas,
BY Wendert, Lind & Ponack

ATTYS.

UNITED STATES PATENT OFFICE

2,685,081

FAILURE ALARM FOR SPERRY GYRO
PILOTS

Constantine N. Colyvas, Fort Lee, N. J.

Application January 23, 1952, Serial No. 267,744

8 Claims. (Cl. 340-268)

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This invention relates to the Sperry gyro pilot, placed on board ships for automatic steering, and is actually intended to be an attachment of it.

The drawing illustrates a simplified wiring diagram of my alarm system as it is attached to a gyro pilot repeater and steering engine control system.

This device consists of two units, the relays and the delayed action switch mechanism with the alarm bell.

The A and B relays in the drawing, are 70 volts D. C. The C relay is a 115 volts A. C. with two windings. One end of the one winding is connected to the lead C1. The one end of the other winding is connected to lead C2. The other ends of both windings are connected to lead SS2. Each one of the windings, when energized, is able to pull the arm of the relay C.

The relays are connected electrically as shown in the drawing. Leads marked 4, 5, SA1, SA2, C1, C2, SS2 are to be electrically connected to leads in the Sperry gyro pilot's electrical panel, bearing the same markings.

The delayed action switch mechanism consists of the unit of a 70 volts D. C. single stroke bell. We remove the bell and connect in the end of the striking hammer 11 the piston rod of a small cylinder 12. The head of the cylinder consists of three parts. In the threaded inside surface, is screwed a hollow plate, which is full of holes, permitting the air to pass freely through it. Over that is screwed a cone shaped head, which has a big opening on top. Inside these two plates is placed a rubber ball, which acts as valve for the escape of the air, closing the big opening. There is another small adjustable opening on the cone head of the cylinder through which the pressed air escapes, when the big hole is closed by the rubber valve. In the outside threaded surface of the cylinder is screwed a guard head for protection. Two contacts 9 and 10, one on the base of the unit and the other on the moving hammer, act as switch, for the alarm bell 15.

The operation of this unit is simple. When the coil is energized by flow of current, the striking hammer 11 pulls upward, pressing air in the cylinder 12. The pressure of the air pushes the rubber valve and closes the big opening 13. The air then escapes slowly through the small adjustable opening 14. The speed of the movement of the striking hammer can be fixed through the adjustable air escape opening, consequently the time that elapses between the time that the coil was energized and the time that the circuit of

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the alarm bell closes through contacts 9 and 10, can be equally adjusted. When the flow of the current in the coil stops, the piston is pulled back by a spring E fastened to the other end of the striking hammer, the rubber valve opens the big opening, air flows freely inside the cylinder and the unit returns immediately to its starting position.

A simplified schematic wiring diagram of a Sperry gyro-pilot is shown in the drawing having the present invention connected thereto. The operation of the gyro-pilot is as follows:

The master gyro-compass establishes a reference line with respect to the earth's surface so accurate and so stable that even the slightest yawing of the ship is indicated simultaneously by a relative movement of the repeaters. The function of the gyro-pilot in automatic steering is to pick up this relative movement and convert it into corrective application of the rudder. The drawing shows the electrical connections schematically, with the follow-up ring assemblies in simplified form for clarity.

Signal circuit.—The repeater motor within the gyro-pilot control unit initiates the signal for corrective rudder. The operating cycle of the signal circuit is as follows: when the ship is on its course the actuating trolleys of the contact ring assembly are in a neutral position, making contact with both of the energized segments SA1 and SA2 of the contact rings, shorting the armature and locking the servomotor due to dynamic braking action.

Suppose the ship yaws slightly to the right of the course: the angular motion is instantly picked up by the repeater motor, and the trolley assembly rotates counterclockwise, causing the lower of the two rollers to move to the right a fraction of a degree, so that it no longer touches segment SA1 of the contact ring assembly. The armature of the servomotor, instead of being shorted out, is now energized through circuit SA2. The servomotor starts instantly and through the differential causes the outer member or contact rings of the control ring assembly to rotate in a clockwise direction. The energized segment C1 therefore, makes contact with the inner member or trolley SS1, closing the circuit to the pilot relay A. The operation of the pilot relay closes the drive-motor control relay A. Relay A closes contacts No. 1 and No. 2 by means of one of two clapper switches and energizes the drive-motor, causing it to turn in the direction to give left rudder.

The movement of the drive-motor rack and

pinion operates the self-synchronous transmitter in the power unit which causes corresponding rotation of the self-synchronous receiver in the control unit binnacle. The receiver causes the trolleys SS1 to follow the movement of the contact rings and open the circuit to the drive-motor. The opening of the clapper switch energizes the down contacts and stops the drive-motor through dynamic braking action.

The servomotor, in addition to driving the outer member of the control ring assembly through a differential, drives the outer member of the signal ring assembly, through the rudder adjustment, causing the outer member to follow the movement of the signal trolley assembly until the lower of the two trolleys again rests upon segment SA1. This short-circuits the armature of the servomotor and stops the motor. The signal circuit sequence described in this paragraph functions independently of the control circuit to start and stop the servomotor. Whenever the servomotor is running, however, it actuates the control circuit and therefore operates the drive motor. It will be understood from the foregoing that the function of the signal circuit, including the starting and stopping of the servomotor, is to provide a sensitive and accurate means of energizing the control circuit—the function of the control circuit to provide positive control of the drive-motor.

If the ship yaws to the left instead of to the right, the repeater motor turns in the opposite direction and the upper roller of the signal trolley moves to the right, energizing the servomotor armature circuit through SA1. The servomotor now runs in the opposite direction, control circuit C2 and pilot relay B are energized and right rudder is applied. Again the outer member of the signal ring assembly overtakes the inner member, the signal is cut off, and the servomotor is stopped. When the servomotor stops, the outer member of the control ring assembly stops also, and its trolleys, driven by the self-synchronous receiver, cross the gap between the segments and open the circuits to the drive motor.

Because of the space required to describe fully the sequence between the original signal and the movement of the drive-motor, the time factor might appear to be considerable. The functions are entirely electrical, however, and therefore the several steps take place practically simultaneously. There is no discernible interval between the initial signal and the response of the drive-motor.

From the foregoing taken together with the remainder of the disclosure and the drawing, the operation of the failure alarm will be clear. This alarm will be actuated upon any failure in the system with the exception of repeater failure which has heretofore been the only failure which would actuate the alarm.

The material relating to the action of the gyro-pilot and the accompanying sketch is to be found in a publication of Sperry Gyroscope Company entitled Gyro-Compass and Gyro-Pilot Manual, Pub. No. 17-1615C, 2½ M. September, 1948.

Suppose now that there is some trouble and the gyro-pilot does not operate properly. The ship turns slightly to the right of the course: the angular motion is instantly picked up by the repeater motor and the trolley assembly rotates counterclockwise, causing the lower of the two rollers to move to the right, so that it no longer touches segment SA1 of the contact ring assembly. Through connection SA2 current flows en-

energizing only relay A. The circuit now in the alarm system is through lead 5, arm of B relay, contact 3, contact 1 arm of C relay, closing the circuit to the delayed action switch which will start to operate. Now, because of the trouble the drive-motor will not operate, and through self-synchronous transmitter and receiver will not drive the outer member of the contact ring assembly, so the trolleys will remain on segment SA2 energizing only relay A of the alarm system, through connection SA2. Current will be flowing to the delayed action switch for more than the preset time, the leads 9 and 10 will make contact and the alarm will sound.

Now, if we have trouble in the steering engine itself, suppose steam failure. The movement of the drive-motor rack and pinion operates the self-synchronous transmitter in the power unit which causes corresponding rotation of the self-synchronous receiver in the control unit binnacle. The receiver causes the trolleys SA1 and SA2 to follow the movement of the contact rings and open the circuit to the drive-motor. If the steering engine does not operate (steam failure) the drive-motor rack and pinion will not operate, the self-synchronous transmitter and receiver will not operate to cause the trolleys to follow the movement of the contact rings, the trolleys will remain on segment SA2, through connection SA2 will be energizing only relay A of the alarm system and the alarm will sound as related above.

I claim:

1. In combination, a gyro pilot, a steering engine actuated by said gyro pilot, an alarm system connected to said gyro pilot and steering engine comprising a first element responsive to the movement of the gyro pilot, a second element responsive to the output of the steering engine and connected to said first element, alarm means connected to said first and second elements responsive to the interaction of said elements, whereby when the gyro pilot moves, the said first element responsive to the movement responds to actuate the alarm means through the said second element responsive to the steering engine output on failure of the gyro pilot to transmit said movement to the steering engine or on failure of the steering engine to operate in response to the transmission of the movement of the gyro pilot and actuate the said second element responsive to the steering engine output.

2. A combination as claimed in claim 1 in which the gyro pilot is provided with repeater means, the steering engine being responsive to said repeater means, and the first element responsive to the movement of the repeater means, whereby when the repeater means is moved by the gyro pilot, the said first element responsive to the movement of the repeater means actuates the alarm through the second element responsive to the steering engine output on failure of the repeater means to transmit said movement to the steering engine or on failure of the steering engine to operate in response to the transmission of the movement of said repeater means and actuate the second element responsive to the steering engine output.

3. A combination as claimed in claim 1 in which the alarm means is comprised of a delayed action switch mechanism and an alarm bell operated through said delay action switch.

4. A combination as claimed in claim 2 in which the alarm means is comprised of a delayed action switch mechanism and an alarm bell operated through said delayed action switch.

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5. An alarm system for use with a gyro pilot and a steering engine actuated by a movement of said gyro pilot, comprising a first element responsive to the movement of the gyro pilot, a second element responsive to the output of the steering engine and connected to said first element, alarm means connected to said elements and responsive to the interaction of said elements, whereby when the gyro pilot is moved, the said first element responsive to the movement responds to actuate the alarm means through the second element responsive to the steering engine output on failure of the gyro pilot to transmit said movement to the steering engine or on failure of the steering engine to operate in response to the transmission of said movement and actuate the second element responsive to the steering engine output.

6. An alarm system for use with a gyro pilot, a gyro repeater responsive to movements of said gyro pilot and a steering engine actuated by said gyro repeater, comprising a first element responsive to the movement of the gyro repeater, and a second element responsive to the output of the steering engine and connected to said first element, alarm means connected to said elements and responsive through the interaction of said elements, whereby when the gyro repeater is moved by the gyro pilot, the first element responsive to said movement responds to actuate the alarm through the second element responsive to the steering engine output on failure of the gyro repeater to transmit said movement of said gyro repeater to the steering engine or on failure of the steering engine to move in response to the transmission of said movement of the gyro repeater and actuate the second element responsive to the steering engine output.

7. An alarm system as claimed in claim 6 in which the elements responsive to the actions of

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the gyro pilot and the steering engine are electrically operated.

8. An alarm system for use with a gyro pilot, a gyro repeater moved in response to said gyro pilot and a steering engine actuated by said gyro repeater, comprising an electrically operated relay actuated by movement in one direction of said gyro repeater, a second electric relay actuated in response to movement of the gyro repeater in the opposite direction, a third electric relay actuated by movement of the steering engine in either direction and connected to said first and second relays, alarm means comprising a delayed action switch mechanism and an alarm bell operated through said delayed action switch mechanism, said relays being interconnected in such a manner that movement of the gyro repeater will cause either the first or the second of said relays to close a circuit to actuate said alarm means, and on failure of the gyro repeater to transmit its motion to the steering engine or on failure of the steering engine to operate in response to the transmission of said movement, the third said relay will not break the circuit to the alarm means made by either of the first two of said relays, thereby causing the alarm bells to sound through said delayed action switch, but on the response of said steering engine to the movement of said gyro repeater, the third said relay will be actuated to break the circuit to the alarm means.

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