March 7, 1950 E. D. DUNNING 2,499,471

AUTOMATIC STEERING DEVICE FOR BOATS AND PLANES

Filed May 4, 1945 3 Sheets-Sheet 1

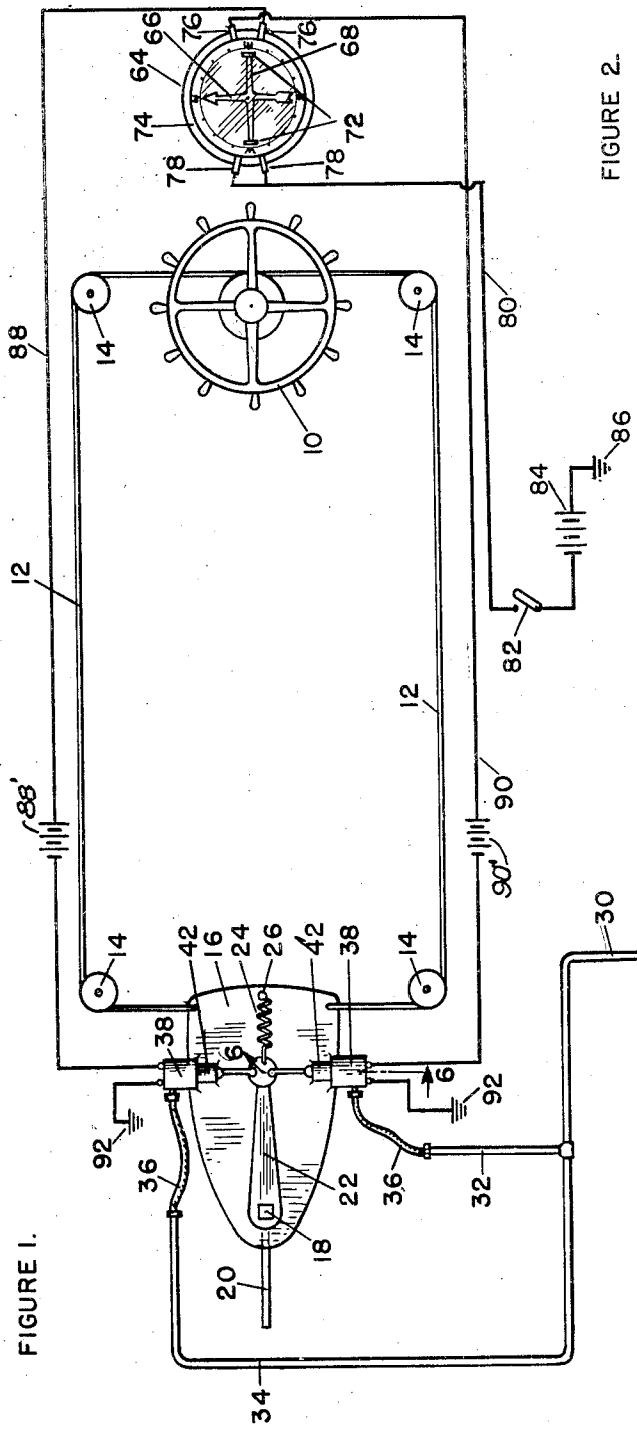
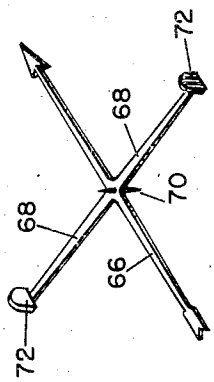


FIGURE 1.

FIGURE 2.



INVENTOR.
ELMER D. DUNNING

BY
Victor J. Evans & Co.
ATTORNEYS

March 7, 1950 E. D. DUNNING 2,499,471

AUTOMATIC STEERING DEVICE FOR BOATS AND PLANES

Filed May 4, 1945 3 Sheets-Sheet 2

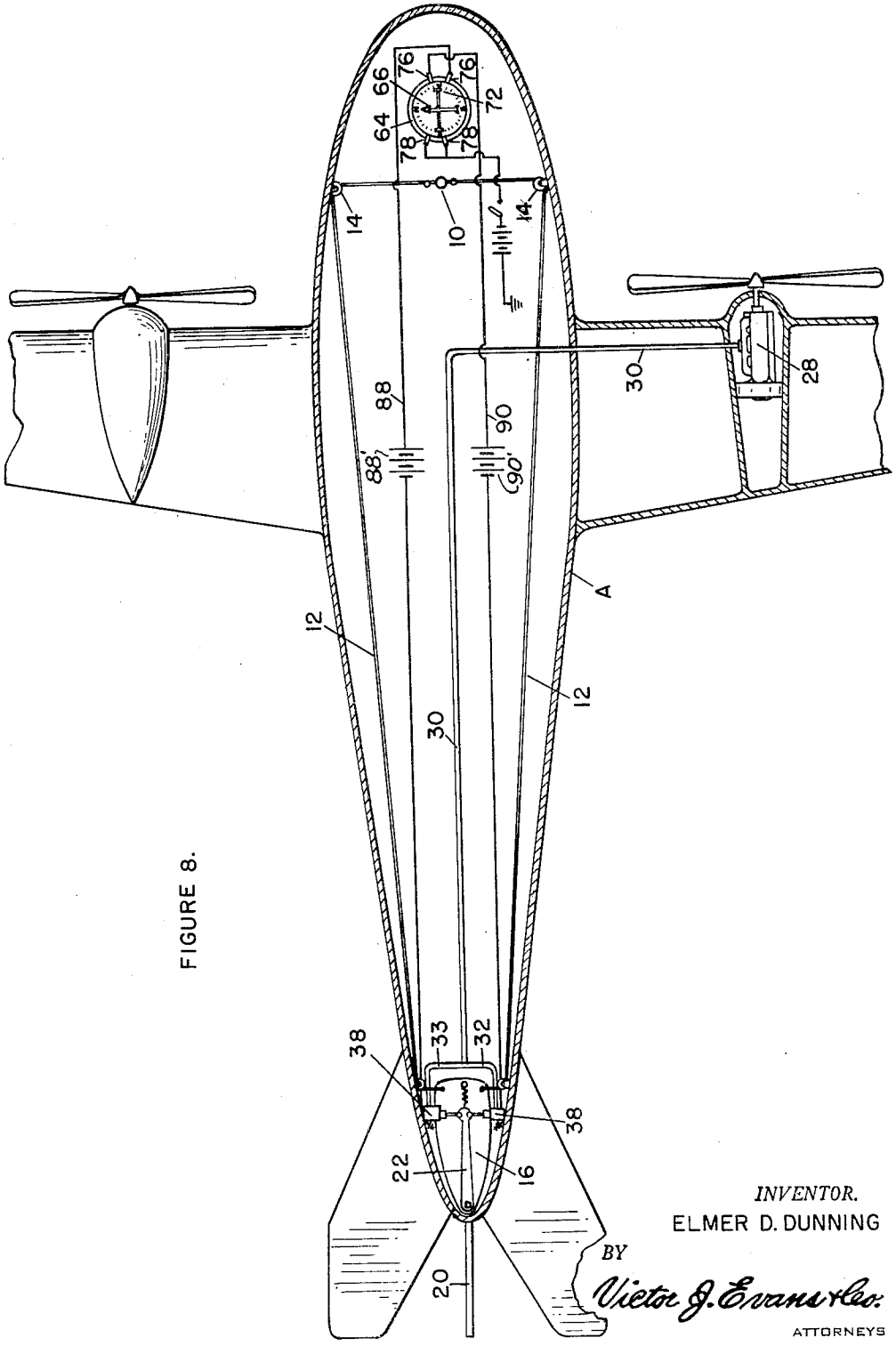


FIGURE 8.

INVENTOR.
ELMER D. DUNNING

BY
Victor J. Evans & Co.
ATTORNEYS

March 7, 1950 E. D. DUNNING 2,499,471

AUTOMATIC STEERING DEVICE FOR BOATS AND PLANES

Filed May 4, 1945 3 Sheets-Sheet 3

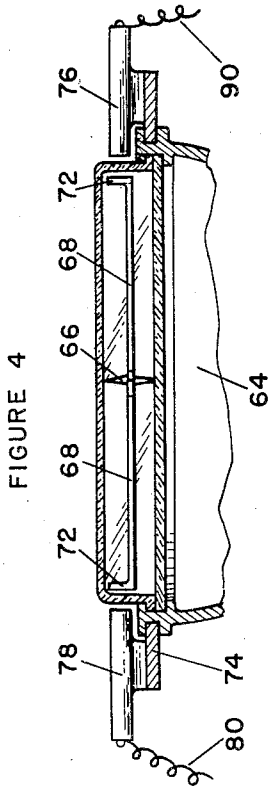


FIGURE 4

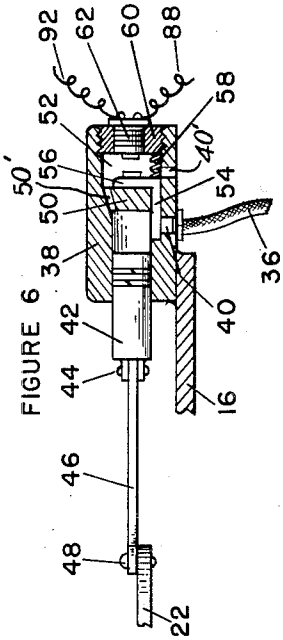


FIGURE 6

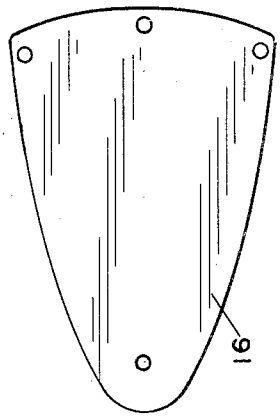


FIGURE 7

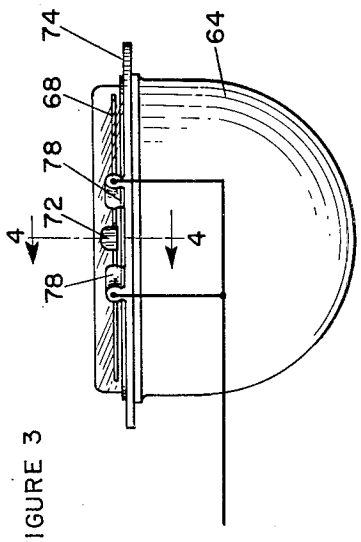


FIGURE 3

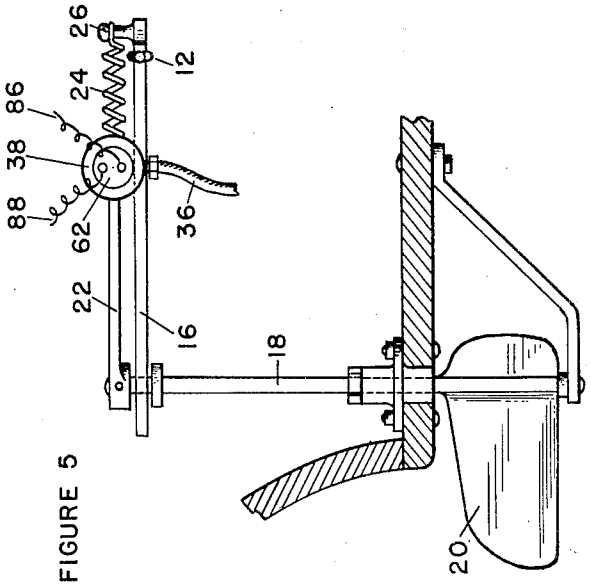


FIGURE 5

INVENTOR.
ELMER D. DUNNING

BY

Victor J. Evans & Co.

ATTORNEYS

Patented Mar. 7, 1950

2,499,471

UNITED STATES PATENT OFFICE

2,499,471

AUTOMATIC STEERING DEVICE FOR BOATS AND PLANES

Elmer D. Dunning, Roselle, N. J.

Application May 4, 1945, Serial No. 591,890

2 Claims. (Cl. 114—144)

1

This invention appertains to navigation apparatus generally, and more particularly to a manual-automatic type thereof for the steering of air and water craft.

One of the several objects of the invention is to provide an apparatus or mechanism of this character, wherein the rudder of an airplane or a water craft can be either manually or automatically controlled at the will of the pilot or navigator, the automatic control, when employed, being initially set manually to a predetermined compass course of craft travel.

Another object of the invention has to do with the provision of a novel form of electro-pneumatic means of rudder control, with the navigating compass of the craft modified to control an electric circuit which, in turn, controls the operation of the pneumatic means through the medium of which the rudder is automatically shifted correspondingly with off-course movements of the compass needle from a pre-determined setting.

A further object of the invention lies in the provision of a navigation control of the kind specified, which is comparatively simple and inexpensive to manufacture, inasmuch as but few of its accessories and parts are of special design and construction; highly efficient in operation; and capable of being installed on either an air or a water craft, without any undue modification of the structure thereof.

With these and other objects and advantages in view, the invention resides in the certain new and useful combination, construction, and arrangement of instrumentalities, parts, and circuits, as will be hereinafter more fully described, set forth in the appended claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a diagrammatical view of a layout of the apparatus, in accordance with the invention;

Figure 2 is a perspective view of the modified form of compass needle;

Figure 3 is a side elevation of the compass unit and showing certain of the electric control devices mounted thereon for cooperation with the modified needle thereof;

Figure 4 is an enlarged, fragmentary, vertical section, taken through the line 4—4 of Figure 3;

Figure 5 is a side elevation, partly in section, of a rudder installation and showing certain of the controls associated therewith;

Figure 6 is an enlarged sectional detail, taken through the line 6—6 of Figure 1;

Figure 7 is a plan view of the tiller, through

2

the medium of which the rudder is manually actuated; and

Figure 8 is a plan view, partly in section, showing the manner of installation of the apparatus on a conventional type of airplane.

Referring to the drawings, wherein like characters of reference denote corresponding parts in the several views, and more particularly to Figures 1, 5, 7 and 8, the numeral 10 designates a helm, which may take the form of the steering wheel (Figure 1), or the joy stick (Figure 8), and 12 a pair of cables or ropes leading aft for connection with a tiller 16 that is mounted on the upper end of the stem 18 of a rudder 20, each cable or rope being trained about guide pulleys 14, at one side of a fuselage or hull A, as in Figure 8. This arrangement constitutes the manual control of the rudder 20 and is more or less conventional, except as to the shape of the tiller 16, which preferably is made in the form of a metal plate that is substantially triangular in plan, as shown. This tiller plate 16, however, is loose on the rudder stem 18, beneath a tiller arm 22, which is secured to the stem to transmit directional motions to the rudder 20 from the steering controls. A yielding connection, preferably in the form of a coiled retractile spring 24, is extended between the free end of the tiller arm 22 and an upstanding pin 26, carried medially of the forwardly directed edge of the tiller plate 18, so as to sustain the helm, tiller elements and the rudder, in true amidships position and, at the same time, permit of a limited relative movement between the tiller elements.

The automatic control of the rudder 20 is generally comprised in compass controlled electrical circuits, which, in turn, effect the directional operation of rudder actuating devices that are cooperatively associated with the tiller elements 18 and 22; the compass, indicated at 64, being of regulation type, located in its usual position at the station of the pilot or navigator, as the case may be, but modified in proper manner, necessary for the performance of its control functions.

For the purposes of the present invention, a vacuum system of operation of the rudder actuating devices aforesaid, and the system is comprised in a conduit 30, leading from the intake manifold of an internal combustion engine 28, of the air or water craft on which the apparatus may be installed, having branches 32 and 34 extending from it and terminating at either side of the tiller elements. Each of the rudder actuating devices is comprised in a cylinder 38, which is fixedly mounted on the top side of the tiller

plate 16, to one side of the free end of the tiller arm 22, and a piston 42 movable in the open end of the bore, at the inner end of the cylinder, and connected to the tiller arm by a rod 46; the rod 46 being pivoted, as at 44, to the piston, and, as at 48, to the tiller arm, as is best shown in Figure 6.

Each of the cylinders 38 is provided with side ports 40 and 40', opening into the bore thereof behind the piston 42. Each port 40 is coupled, by a flexible connection 36, to a respective end of the branch conduits 32, 34 while each side port 40' is opened to the atmosphere. As is best shown in Figure 6, each of the cylinders 38 has its bore divided by a partition wall 50, located immediately to the outer side of the port 40, to provide a chamber 52 which opens through the outer end of the cylinder. The wall 50 is provided with a passage 50' for placing the chamber 52 in communication with the piston 42 for a purpose to appear. Mounted within the chamber 52, is an angular slide valve, that has a horizontal portion 54 extending through a slot, formed in the partition wall 50, for cooperation with the spaced ports 40 and 40'. The vertical portion 56, of the slide valve, constituting an armature for an electromagnet 62, which is supported in a bushing 60, that is screw threaded into the open end of the chamber 52; the electromagnet and the bushing, in assembly, closing the chamber to atmosphere. A coiled expansion spring 58 is interposed between the armature portion 56 and the bushing 60, within the chamber, to move the slide valve to a position to close port 40 and uncover port 40', upon deenergization of the electromagnet 62.

The operation of the rudder actuating devices, as thus constructed and arranged, is controlled from the compass 64 and, to such end, the needle 66 thereof is provided with a pair of oppositely right angled arms 68, extending in the same plane therewith and in line with its point of pivot 70, which carry flat members or discs 72, at their outer ends. These members 72 constitute shutters that are opaque in character and, under offcourse movements of compass 64, act to blackout one or the other of a pair of photo-cells 76; which are secured in spaced relation on an annular turntable or ring 74, that is mounted on the compass casing, about the dial thereof. Also mounted on the turntable or ring 74, diametrically opposite the photo-cells 76, is a pair of similarly spaced light ray tubes 78, which, together with the photo-cells 76, are converging'y arranged for the accurate impinging of the latter by the crossing ray beams projected diagonally from the tubes 78, as long as the shutters 72 are positioned in the clear therebetween.

The circuit connections of the apparatus, as shown in Figures 1 and 8, are as follows: The tubes 78 are commonly connected by a conductor 80, through a main control switch 82, to one side of a current source, i. e., the battery 84, which has its other side grounded, as at 86; while the right and left of the photo-cells 76 are respectively connected, by conductors 88 and 90, through independent sources of current 88' and 90', respectively, to one terminal each of the left and right of the electromagnets 62, the other terminals of which are grounded, as at 92. Thus, the electromagnets 62 are normally energized and therefore hold the slide valves 54 in each cylinder 38 against the action of its respective spring 58 in a position to open port 40 and close port 40'.

In operation, manual steering of a craft A (Figure 8) is to be performed in the usual manner from the helm 10, through the cables 12, and the tiller elements 16 and 22, while the automatic steering first requires that the craft be manually brought on its straightaway course manually and the helm 10 thereafter be secured at neutral position. Following this, the turntable or ring 74 will be rotated to position the photo-cells 76; and the tubes 78, centered to either side of respective of the shutters 72 and the main control switch 82 closed on the current source 84, when current will pass by way of the switch 82 to the tubes 78, the photo-cells 76, the conductors 88 and 90, the electromagnets 62, to the grounds 92 and 86. Thus, the electromagnets 62 are energized and attract the armatures 56 to move the slide valves 54 to open the ports 40 and close ports 40', in the cylinders 38, when the pistons 42 will be balanced by the action of the contractile spring 24 to hold the tiller elements 16 and 22, and the rudder 20, at amidships position. Upon any off-course movement of the craft A, and, consequently, of the compass 64 likewise relatively to the needle 66, the photo-cells 76, and the tubes 78, will be correspondingly shifted relatively to the shutters 72, which will immediately blackout one or the other of the photo-cells 76 and open the circuit to its respective electromagnet 62. With the deenergizing of an electromagnet 62, a respective slide valve 54 is forced to close the port 40 of the cylinder 38 and open port 40', by the expansion action of the coiled spring 58, thus cutting communication between the cylinder and the engine or motor 28 and opening bore of the cylinder 38 to the atmosphere. With the closing of the port 40 and opening of the port 40' of one cylinder 38'', the piston 42 of the opposing cylinder 38'' acts to shift the tiller arm 22 and the rudder 20, to correct the steering direction of the craft back on its predetermined course.

Having thus fully described my invention, it is to be understood that any and all changes in the construction and arrangement of parts and circuits, to which the invention is susceptible, may be resorted to, without departing from the spirit thereof, or its scope as claimed.

What is claimed is:

1. In a steering device for a craft, the combination of a steering stem mounted on the craft, a plate rotatably mounted on said steering stem, opposed cylinders secured to said plate, an arm secured to said steering stem and extending between said cylinders, a fluid-pressure means, conduit means connecting said cylinders to said fluid-pressure means, pistons in said cylinders, means connecting said pistons to said arm, spring means anchored to said arm and plate, manual means for shifting said plate to a predetermined direction whereby said arm and steering stem are moved through said spring means to said direction, valve means in each cylinder for controlling the flow of fluid from said conduit means to said cylinders, electromagnetic means in each cylinder for actuating said valve means, a compass on the craft and having a compass needle, an annulus rotatably mounted on said compass and adjustable about the same, a pair of spaced light sources mounted on said annulus, a pair of spaced photo-cell units mounted on said annulus diametrically opposite to said light sources, respectively, whereby light beams emanating from said light sources will impinge upon said photocell units, respectively, diametrically-opposed light-blocking screens on said compass needle whereby relative movement between the same

and said annulus will interpose said screens into the path of the light beams from either light source, and electrical means connecting said photo-cell units with said electromagnetic means, respectively, whereby the movement of said light-blocking screens into the path of either light beam will cause said respective photo-cell units to control the actuation of its respective electro-magnetic means and thereby cause operation of the respective valve means.

2. In a steering device for a craft, the combination of opposed cylinders on the craft, an arm attached to the steering device of the craft, a fluid-pressure means, conduit means connecting said cylinders to said fluid-pressure means, pistons in said cylinders, means connecting said pistons to said arm, spring means anchored to said arm and plate, valve means in each cylinder for controlling the flow of fluid from said conduit means to said cylinders, electromagnetic means in said cylinder for actuating said valve means, a compass on the craft and having a compass needle, an annulus mounted for movement relative to said compass, a pair of spaced light sources mounted on said annulus, a pair of spaced photo-cell units mounted on said annulus diametrically opposite to said light sources, respectively, whereby light beams emanating from said light sources will impinge upon said photo-cell units, respectively, diametrically-opposed light-blocking screens on said compass needle whereby relative

movement between the same and said annulus will interpose said screens into the path of the light beams from either light source, and electrical means connecting said photo-cell units with said electromagnetic means, respectively, whereby the movement of said light-blocking screens into the path of either light beam will cause said respective photo-cell units to control the actuation of its respective electro-magnetic means and thereby cause operation of the respective valve means.

ELMER D. DUNNING.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,702,404	Holmes	Feb. 19, 1929
1,930,945	Sjostrand	Oct. 17, 1933
1,993,549	Holmes	Mar. 5, 1935
2,112,504	Mirfield	Mar. 29, 1938
2,182,717	Chance	Dec. 5, 1939
2,200,431	Rateau	May 14, 1940
2,337,589	Chance	Dec. 28, 1943

FOREIGN PATENTS

Number	Country	Date
350,935	Great Britain	June 12, 1931
507,277	Germany	Sept. 16, 1930