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HYDRAULIC ACTUATING MEANS

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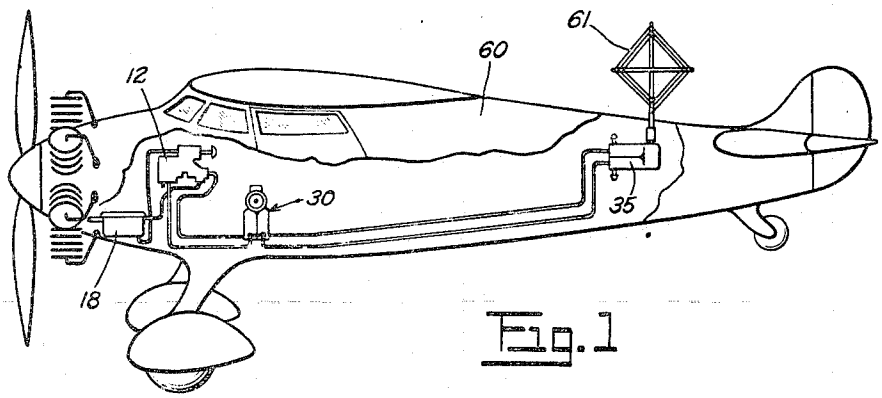

Fig. 1

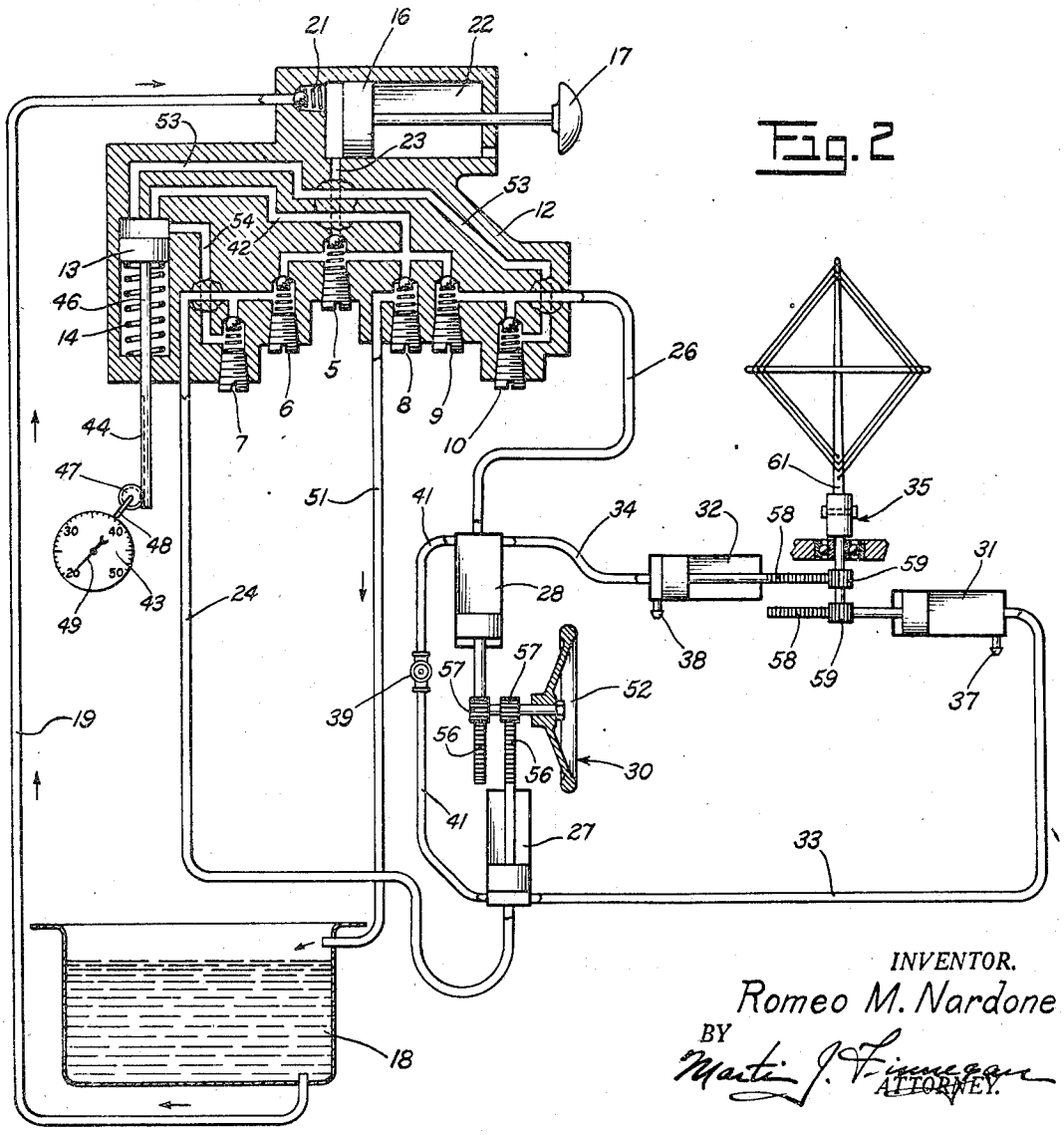

Fig. 2

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HYDRAULIC ACTUATING MEANS

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3 Claims. (Cl. 60—54.5)

This invention relates to aircraft radio, and particularly to means for controlling the position of the radio antenna during flight of the craft.

On an aircraft carrying the "rotatable loop" type of antenna, for reception of directional signals from airports in or at an angle to its path of flight, such a loop type of antenna, being exposed to the air stream, presents considerable difficulty to the operator when it is desired to turn it about its axis in order to "point" it with respect to a particular signal sending station. An object of the present invention is to alleviate such difficulty by the use of power turning means, controllable by the operator with the expenditure of a minimum of effort.

Another object is to provide instantly responsive turning means, adapted for precise control of the setting of the antenna, and free from the errors and inaccuracies to which the setting of a manually turned antenna is subject.

These and other objects of the invention will become apparent from inspection of the following specification when read with reference to the accompanying drawing wherein is illustrated the preferred embodiment of the invention. It is to be expressly understood, however, that the drawing is for the purpose of illustration only, and is not designed as a definition of the limits of the invention, reference being had to the appended claims for this purpose.

Fig. 1 is a diagrammatic view of an aircraft equipped with the antenna control of the present invention; and

Fig. 2 is a sectional view of the preferred embodiment, involving hydraulic actuating means, and mechanism for automatically maintaining the supply of actuating fluid.

Referring to Figs. 1 and 2, reference character 61 designates a radio antenna extending vertically above the fuselage of a craft 60 of the cabin type, having an operator's seat adjacent an antenna actuating wheel 30 and a fluid control unit 12, serving to supply the actuating units 27, 28, 31 and 32 with oil or equivalent actuating fluid from a reservoir 18, the latter being either an oil compartment of the engine crankcase or a separate oil supply. Preferably units 27 and 28 contain pistons having toothed extension rods 56 geared directly to pinions 57 on the shaft of wheel 30, while pistons of units 31 and 32 have similar racks 58 meshing with pinions 59 on the mounting shaft of the antenna 61. To indicate the pressure existing in the system a piston 13 within the control unit 12 has an extending rack 44 actuating a gear 47 on the shaft of pointer 49 of the pressure gauge 43, while a hand grip 17 on the rod of piston 16 constitutes means for raising the pressure, when necessary, as in initial "priming."

Initially, valves 5, 6, 7, 8, 9 and 10 retained in casing 12 are set to predetermined values, e. g., 5, 6, and 9 to 10 lbs., 8 to 50 lbs., and 7 and 10 to 250 lbs. Likewise pressure piston 13 is controlled by a 20 to 50 lbs. spring 14.

To bring the system into operation primer piston 16 is withdrawn (or pulled to the right as viewed in Fig. 5) by knob 17, causing oil from sump 18 to be drawn by means of pipe 19 through one-way check valve 21 into the primer chamber 22. The piston is then pushed in toward the left, as illustrated, causing the oil to be pumped through port 23, valves 5, 6 and 9, and into pipes 24 and 26, leading to piston chambers 27 and 28 respectively, of the rotator operating mechanism 30, from whence it is urged into a second set of chambers 31 and 32 through means of conduits 33 and 34, the said chambers forming in part the antenna coil rotator mechanism 35. The oil in this first operation will also flow through residual ports shown, but have no effect upon valves or pistons connected thereto because of their higher pressure setting.

To insure having equal quantities of oil filling all four chambers 27, 28, 31 and 32, the latter two are equipped with normally closed "bleeders" 37 and 38 respectively, while the former two are connected by an equalizing conduit 41 containing a valve 39, also normally closed. By opening these during the initial positioning operation, all pistons can be brought into proper working relationship, thus overcoming the possibility of an oil lock preventing effective manipulation of the units.

Following proper positioning of the pistons in the manner just indicated, continued pumping of the primer 16 will increase the oil pressure already in port 42 (referred to hereinbefore as one of the residual ports) to cause piston 13 to be lifted at 20 lbs. whereby an indicator reading will begin on dial 43, due to its connection to the piston 13 through means of rack 44, formed on piston shaft 46, pinion 47, shaft 48 and pointer 49.

Further pumping will merely increase the dial pressure reading until 50 lbs. is reached which is more than enough for operating purposes. At the same moment pressure valve 8 will blow off and the excess oil will return to the sump through pipe 51.

In the event of too sudden a jerk on the handwheel 52 of unit 30, or too much manual force exerted thereon, an excessive momentary pressure might be set up in the system. To relieve this, valve 10 (or valve 7, as case may be) will "pop" at the limit point of, say, 250 lbs., by reason of the high pressure created on one of the pistons 27, 28. At the same time the vacuum created in the mating cylinder will draw open valve 6 or 9 (as the case may be) whereupon the liquid, after opening valve 10, will pass through ports 53 and 42, valve 46 (or 9), line 24 (or 26) and into the evacuated cylinder 27 (or 28). Thus, no liquid in the system will be lost. Any unequal balance of pressure in the system, due to climatic changes in temperature, as when the plane rises or descends, will cause expansion or contraction of the fluid in the lines, as the case may be. To take care of the former condition, both valves 10 and 7 will pop, allowing the oil to pass through ports 53 and 54 to cylinder 13 and thence through port 42, valve 8, and line 51 to the sump 18. To take care of contraction, (falling pressure) valves 6 and 9 will open to replenish the cylinders 27, 28.

Otherwise, in normal operation, with the system at about 35 lbs. pressure, turning handwheel 52 will cause the oil in pistons 28 and 27 to be displaced because of the positive drive through racks 56 and pinions 57, simultaneously causing the oil in pistons 32 and 31 to be displaced and this movement to be transmitted also through racks 58 and pinions 59 to the antenna shaft or loop 61, which has approximately 460 degrees orientation.

What is claimed is:

1. Hydraulic actuating means comprising a set of driving pistons and a set of driven pistons, a cylinder for each piston, fluid connection means from the cylinders housing said driving pistons to the cylinders housing said driven pistons, whereby the motion of the former is transmitted to said driven pistons, and means distinct from said first named fluid connection means for establishing flow from one of said driving piston containing cylinders to the other in response to a sudden or jerky movement of said driving pistons.

2. Hydraulic actuating means comprising a set of driving pistons and a set of driven pistons, a cylinder for each piston, fluid connection means from the cylinders housing said driving pistons to the cylinders housing said driven pistons, whereby the motion of the former is transmitted to said driven pistons, and means distinct from said first named fluid connection means for establishing flow from one of said driving piston containing cylinders to the other in response to a sudden or jerky movement of said driving pistons, said last named means including a by-pass path wholly independent of the above recited fluid connection means, and a valve in said by-pass line for regulation of the flow thereto.

3. In combination with a piston and a cylinder enclosing said piston, a second cylinder remote from the first, but in communication therewith, a piston in said second cylinder, manually operable means for causing movement of said second piston, a fluid reservoir and means for replenishing the supply of fluid, including a pump to draw fluid from said reservoir into said cylinders, pressure indicating means cooperating with said pump, said pressure indicating means including an index element, a third piston movable by the pressure developed by said pump to cause rotation of said index element, a third cylinder housing said third piston and constituting an auxiliary reservoir distinct from said first-named reservoir, and means independent of said first-named reservoir for by-passing fluid from said second cylinder to said third cylinder concurrently with flow of fluid from said second cylinder to said first cylinder, said by-passing means being effective only during abnormal pressure conditions in said second cylinder.

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