

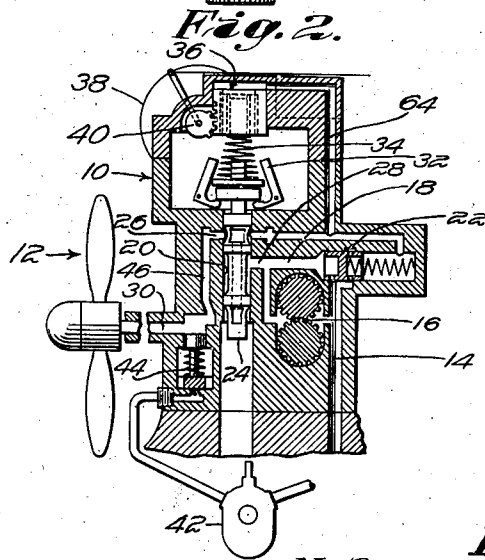
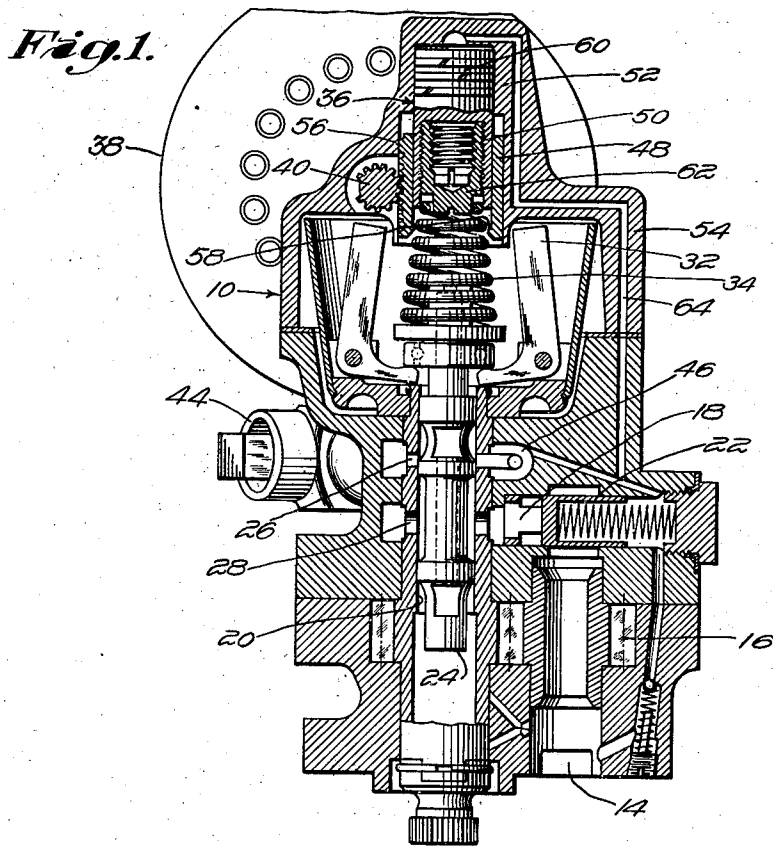
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AUTOMATIC RESETTING DEVICE FOR GOVERNORS

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AUTOMATIC RESETTING DEVICE FOR GOVERNORS

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4 Claims. (Cl. 264—3)

This invention relates to improvements in governing devices and has particular reference to an improved governor control for a controllable-pitch propeller.

An object of the invention resides in the provision of an improved governor control of the character indicated having a manually actuatable setting device and an automatic setting device for resetting the governor for operating conditions under which the manual setting device does not provide adequate control and for returning the governor to the manual setting when such special operating conditions terminate.

A somewhat more specific object resides in the provision in a governor for a controllable-pitch propeller of means for automatically resetting the governor for propeller speeds below a predetermined minimum to prevent the propeller from attaining a speed materially above the speed for which the governor is normally set as the speed of the propeller is increased.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent as the description proceeds.

In the accompanying drawing, in which like reference numerals are used to designate similar parts throughout, there is illustrated a suitable mechanical embodiment for the purpose of disclosing the invention. The drawing, however, is for the purpose of illustration only and is not to be taken as limiting or restricting the invention since it will be apparent to those skilled in the art that various changes in the illustrated construction may be resorted to without in any way exceeding the scope of the invention, as defined by the claims.

In the drawing, Fig. 1 is a longitudinal sectional view through a governor constructed according to the invention, and

Fig. 2 is a schematic sectional view showing the governor applied to control the pitch of a controllable-pitch propeller.

Referring to the drawing in detail, the numeral 10 generally indicates the speed governor and the numeral 12 generally indicates a controllable-pitch propeller the pitch of which is regulated by the action of the governor 10. In the illustrated arrangement the governor actuates a valve for controlling the pitch of a hydro-controllable feathering-type propeller one illustrative form of which is clearly illustrated and described in United States Patent No. 2,174,717, issued October 3, 1939, to Frank W. Caldwell et al., for Multiposition controllable pitch propeller.

It is well known to operate a controllable-pitch propeller under governor control to establish a substantially constant engine speed by changing the propeller pitch to vary the load on the engine whenever the engine tends to speed up or slow down. It is also well known to manually adjust the governor setting so that the propeller will maintain the engine speed substantially constant at a selected rate.

In the hydro-controllable propeller and control system illustrated in Fig. 2, hydraulic fluid, such as engine lubricating oil at lubricating oil pressure, is supplied through the channel 14 to the intake of a booster pump 16. The outlet of the pump is connected with a pressure chamber 18 one end of which leads into a valve bore 20 and the other end of which leads to a pressure relief valve 22 which is operative to maintain a predetermined fluid pressure in the chamber 18 or to maintain the fluid pressure in the chamber 18 a predetermined amount above the fluid pressure required to operate the propeller. A valve plunger 24 is slidable in the bore 20 and controls the ports 26 and 28 in such a manner that the propeller line 30 may be connected with the pressure chamber 18 or may be vented to drain through the hollow plunger 24 and the lower end of the bore 20. At its upper end the plunger 24 is operatively connected to a speed governor having centrifugally actuated flyballs 32 opposed by a speeder spring 34. The upper end of the speeder spring rests against the lower end of a movable abutment 36 which is adjustable to various positions by the manually actuatable mechanism including the pulley 38 and pinion 40 the teeth of which mesh with rack teeth provided on one side of the movable abutment. By rotating the pulley 38 the lowermost operative position of the abutment 36 and the load on the speeder spring 34 can be changed to change the speed setting of the governor. If desired the propeller 12 may be of the feathering type and the unfeathering operations may be controlled by the high pressure pump 42 connected to the propeller line 30 through the pressure operated cut-off valve 44 which acts to cut-off the connection 46 between the governor operated valve and the propeller whenever the high pressure pump 42 is operated and simultaneously connect the outlet of the high pressure pump directly with the propeller line 30.

The governor setting mechanism may be adjusted for a selected engine speed and will then maintain the engine at or near the selected speed by varying the propeller pitch as long as

the engine develops sufficient power to rotate the propeller at the selected speed. If, however, the engine is brought to an idling condition for some particular maneuver, such as a dive or a landing glide, it will not develop sufficient power to maintain the speed for which the governor is set. The governor will then change the propeller pitch setting in an attempt to reduce the engine load sufficiently to maintain the selected speed and will maintain the propeller in this flat pitch condition as long as the engine power remains insufficient to rotate the propeller at the selected speed. If, with the engine at reduced power and the propeller in its flat pitch condition, the engine power is increased, the propeller pitch will not be changed until the engine speed begins to exceed the speed for which the governor is set. As soon as the selected speed is reached the governor will immediately begin to function to increase the propeller pitch and increase the load on the engine to maintain the selected speed. However, as an appreciable time interval is required for the governor to change the propeller pitch from the flat or extreme low pitch condition to a pitch angle sufficient to slow down the engine, during this interval the engine speed may go considerably beyond the speed for which the governor is set and, if the engine power is increased rapidly, this overshooting or overspeeding of the propeller may reach dangerous proportions before the governor control can increase the propeller pitch a sufficient amount to slow down the engine. It is among the objects of the present invention to incorporate into a propeller speed control device of the character indicated suitable means for preventing this overspeeding of the propeller incident to a rapid increase in engine power from a power value below that necessary to drive the propeller at the speed for which the speed controlling governor is set and one illustrative form of such a device is particularly shown in Fig. 1.

The abutment 36 is formed in two parts, as indicated at 48 and 50. Of these the outer part 48 is in the form of a sleeve slidable in the bore of the cylinder 52 formed on the governor cap 54 immediately over the upper end of the spring 34. This sleeve has rack teeth 56 along one side thereof meshing with the teeth of the adjusting pinion 40 and is provided at its lower end with a stop in the form of an internal flange or inset 58. A piston 60 is slidable in the sleeve 48 and in the upper reduced portion of the bore of the cylinder 52 and carries in its lower end an adjustable spring seat 62. With the propeller under the control of the governor the lower end of piston 60 rests against the internal flange 58. A fluid connection 54 leads from the propeller connected oil chamber 46 to the space at the closed end of the cylinder 52 on top of the piston 60 so that oil at propeller oil pressure is supplied to the cylinder to urge the piston 60 downwardly relative to the sleeve 48 against the stop 58.

When the plunger 24 is in position to connect the ports 28 and 26 the oil pressure in the chamber 46 will be the same as that in the pump outlet chamber 18 and when the plunger 24 is in position to vent the port 26 through the hollow plunger 24 the pressure in the chamber 46 will be the pressure exerted on the oil in the propeller line by the centrifugal action of the propeller blades tending to turn towards their low pitch position. It is only when the propeller blades are against the low pitch limit stop that

no fluid pressure will be present in the chamber 46 and under these circumstances the piston 60 may rise to relieve the load on the governor speeder spring 34.

Assuming that the engine power has been reduced so that the engine is no longer able to rotate the propeller at the speed for which the governor is manually set and that, in its effort to relieve the engine load and maintain the selected speed, the governor has maintained the plunger 24 in a position to vent the propeller line through the port 26 until no pressure is left in the propeller line and the chamber 46, the piston 60 will then rise in the cylinder 52 and leave the stop 58 at the same time relieving the load on the speeder spring 34 and setting the governor for a much lower speed than that for which it was set by the manual control. For instance we might assume that the manual adjustment is set for 2,000 revolutions per minute and when the piston 60 is at the closed end of the cylinder 52 the setting is for 1,000 revolutions per minute. If now the engine power is increased and the engine and propeller begins to speed up, the pump 16 will begin to force oil into the outlet chamber 18 and as soon as the speed has reached 1,000 R. P. M. the governor will act to connect the ports 28 and 26 to admit oil to the propeller pitch changing mechanism through passages 46 and 30 to start increasing the propeller pitch. As the oil pressure in the propeller line 30 builds up, this pressure will be transmitted through conduit 54 to the top of the piston 60 and will begin to change the governor setting. We will thus have a condition in which the propeller pitch is being increased to retard the engine speed and the governor setting is being changed toward a higher speed setting at the same time. With properly proportioned parts and fluid connections the piston will reach the stop 58 at somewhere near the same time that the engine speed reaches the speed at which the governor is set. Since the propeller mechanism is full of oil at this time and the propeller pitch has already been increased to bring the engine and propeller speeds under control of the governor at the gradually increasing speed setting, when the engine and propeller speed reaches the speed for which the governor is set the governor will already be in control of the propeller pitch and the speed will be quickly brought to the speed for which the governor is set with substantially no overspeeding of the propeller at this period. As long as the power developed by the engine is sufficient to drive the propeller at the speed for which the governor is set there will be sufficient oil pressure on top of the piston 60 to maintain the piston in contact with the stop 58 and the speed setting of the governor will remain that at which the governor is set by the manual adjusting mechanism.

While a particular mechanical arrangement has been hereinabove described and illustrated in the accompanying drawing for the purpose of disclosing the invention, it is to be understood that the invention is not limited to the particular construction so illustrated and described, but that such changes in the size, shape and arrangement of the various parts may be resorted to as come within the scope of the sub-joined claims.

Having now described the invention so that others skilled in the art may clearly understand the same, what it is desired to secure by Letters Patent is as follows:

1. In a governor having a speeder spring and having a valve for admitting hydraulic fluid to an

apparatus to be governed, a two part spring abutment for adjusting the speeder spring, mechanically actuated means for operating one part of said abutment, and hydraulically actuated means for operating the other part of said abutment, the adjustment of said first part determining the limit of movement of said other part, said hydraulically actuated means being connected with the supply line between said valve and said apparatus so that when said valve is moved to admit fluid to said apparatus, fluid is admitted to said hydraulic means.

2. In a governor for controlling a mechanism by controlling the application of hydraulic fluid under pressure to said mechanism and having a speeder spring, speeder spring setting means having a low speed position and a high speed position, said means including hydraulically actuated means movable by the pressure of hydraulic fluid to compress said spring and move said setting means to high speed position, said setting means being movable to said low speed position by said governor speeder spring upon failure of the hydraulic pressure in said hydraulically actuated means, an abutment against which said setting means is movable by said hydraulic fluid and constituting a stop for determining the high speed position of said setting means and manual means for adjusting said abutment.

3. A governor speeder spring adjusting means comprising a governor valve movable by said spring and controlling fluid under pressure, means for conducting fluid controlled by said valve from said valve to mechanism to be governed, a fluid operated device for compressing said spring and a mechanically actuated device for limiting the extent of compression of said spring by said fluid operated device, a fluid conduit connecting said fluid operated device and said valve to conduct a portion of said controlled fluid to said fluid operated device to operate said fluid operated device and compress said spring.

4. In a speed governor in combination means for setting said governor to maintain selected speeds comprising means for adjusting a stop, means for adjusting the governor speed setting, means for holding said speed setting adjusting means against said stop to determine a selected speed setting, means rendered operative by a sustained governor speed below said selected speed to disable said holding means and change the governor speed setting to a lower speed value, and means, including means responsive to governor speed, for energizing said holding means and restoring said selected speed setting when the governor speed exceeds said lower speed value.

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