HARTZELL PROPELLER, INC.
PIQUA, OHIO

MANUAL NO. 131

HARTZELL REVERSIBLE PROPELLER MODEL HC-H3YF-3LF

October 20, 1976

HARTZELL REVERSIBLE PROPELLER
Model HC-H3YF-3LF

OPERATION

The propeller utilizes oil pressure from the governor to move the pitch into low pitch and on into full reverse. Counter-weights attached to the blades, air pressure in the cylinder and a spring oppose the action of the oil pressure and move the pitch out of reverse toward high pitch when the governor drains oil from the propeller. The spring is effective only between low pitch and full reverse. The governor supplies oil to the propeller when the RPM is below the prescribed value and drains oil from the propeller when the RPM is above the prescribed value.

A hydraulic low pitch stop is provided in the form of a Beta valve, which has a valve spool linked to the propeller piston. This Beta valve is located between the governor and the propeller and acts to shut off the supply of governor oil when the pitch is moved to the low pitch position. The Beta Valve is slightly open when the pitch is in the low-to-high pitch range. The pitch is moved into the reverse range by manually readjusting the linkage connecting the Beta valve spool to the piston, so that the low stop becomes the reverse pitch stop.

The pitch can only be reversed when the RPM is below the governor setting, because only then does the governor supply oil to the propeller. Thus the propeller cannot be put into reverse pitch during level flight because the governor is not pumping oil to the propeller, except during momentary periods in order to maintain constant RPM. Nor can the propeller be reversed at airspeeds above a certain airspeed because the propeller will windmill at governing speed.

The propeller can be reversed during power-off descent after the airspeed has reduced below the speed where the propeller windmills below the governor speed setting.

Engine power can be applied during descent with the pitch set at some low value, in order to increase drag. The power must be limited, however, to avoid the RPM reaching the governor setting. If this occurs, the governor will take charge and move the pitch out of the reverse pitch range since it calls for draining oil out of the propeller to correct the overspeed condition.

After the aircraft has touched down, the pitch can be moved to full reverse, after which the power can be applied to increase the braking action of the propeller. Again, it is vitally important that the pitch be in full reverse and the RPM kept below the governor setting, else the governor will take charge and move the pitch out of reverse. This would cause the engine to overspeed when the pitch went through flat pitch, unless the power was reduced very quickly.

The pitch must be moved to the low pitch value before the engine is shut off; otherwise the linkage may be damaged when the springs and air pressure move the propeller toward the high pitch position.

Taxiing the aircraft is facilitated by controlling the thrust with the Beta system, since it is possible to go from positive to negative thrust. The engine power is adjusted for normal taxiing power.

INSTALLATION INSTRUCTIONS

Installation of Propeller on Engine

The "F" flange has six ½ inch studs on a 4 inch bolt circle, plus two ½ inch dowel pins.

1. Install the spinner bulkhead on the propeller hub using long bolts, one on each side of each blade, which assist other bolts in clamping the two hub halves together. In most cases, extra long bolts are furnished with the spinner, together with the proper spacers. Torque these 3/8-24 nuts to 22 ft. lb.

2. Clean the engine shaft and hub flange.

3. Insert the PRP-909-6 "O" ring into the groove located inside the hub at the flange mounting.

4. Install propeller on the engine shaft. Torque the ½ inch nuts to 60 to 70 ft. lb. except Continental IO-520 which is 70 to 80 ft. lb. torque.

5. Install spinner.

Installation of Beta Valve

A Beta Valve Adapter is installed between the governor and the engine pad. In order to provide for this added thickness, longer studs are installed in the engine. The Beta Valve Adapter is installed first, using a gasket between the adapter and engine pad.

A drive coupling is installed on the engine governor drive shaft.

The governor is mounted over the Adapter using another gasket.

The Beta Valve is installed on a bracket which is attached to the engine near the rear of the propeller.

Two hydraulic lines are installed between the Beta Valve and Beta Valve Adapter for governor oil and propeller oil. A third hydraulic line is installed between the Beta Valve and a drain return on the engine.

If the engine governor pad is located at the front of the engine rather than in some remote location, an integral Beta Valve and Adapter may be installed under the governor in the same manner as described for the Beta Valve Adapter.

Installation of the Reverse Pitch Push-Pull Control

The push-pull control is installed in the aircraft, and the one end is connected to the Beta Valve linkage as shown in the assembly drawing.

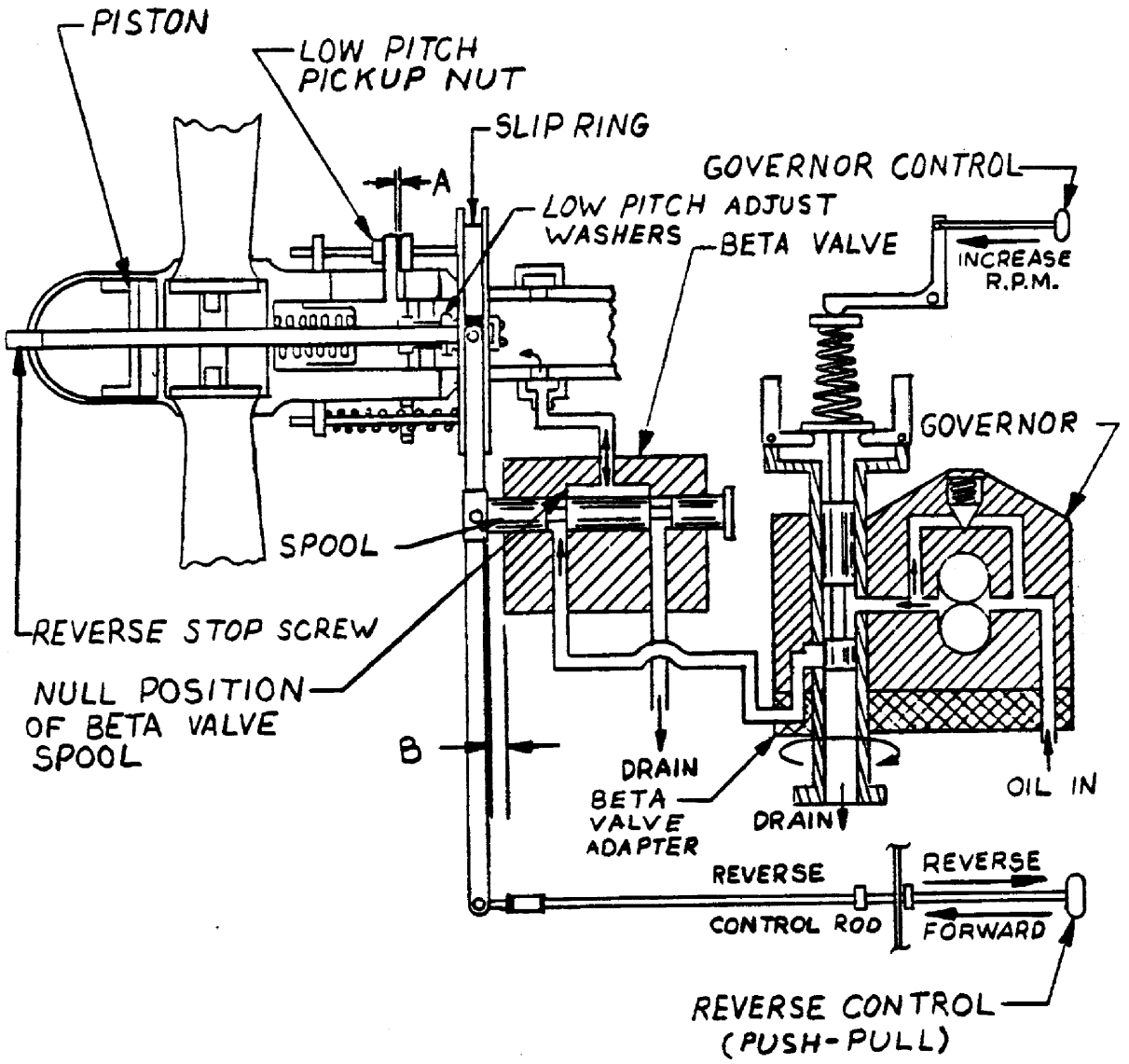

FIGURE 1 DIAGRAM OF PROPELLER--GOVERNOR CONTROL SYSTEM

PROCEDURE FOR ADJUSTING PROPELLER CONTROL

(See Diagram)

1) Set reverse control in FORWARD position.

2) Adjust reverse control rod to position Beta Valve approximately 1/16-3/32 in open position. "B" = approximately 1/16-3/32. "A" =0.

3) Check travel of push-pull control when in reverse pitch. Use blade bar to move pitch into full reverse. Move push-pull control into reverse. Beta valve should be in Null position. "B" = 1/8-5/32.

4) Run up engine to check low pitch RPM. Set governor for maximum RPM. Adjust low pitch adjustment washers to provide maximum rated prop RPM less approximately 100. If RPM can not be reached, remove the propeller from the engine and then remove one or more low pitch adjustment washers. Remove one 1/32 inch washer to increase RPM setting by 75, or vice versa.

5) Check reverse pitch RPM. Set pitch in full reverse. Set governor maximum RPM. Run up engine full throttle. Maximum RPM should be at least 100 less than maximum rated RPM to provide a safety factor.

6) If RPM is too high, increase reverse pitch by adjusting the reverse stop screw in the nose of the propeller. Increase reverse pitch blade angle ½ turn per 100 RPM, or vice versa.

> CAUTION: Before adjusting the reverse stop screw on the Reversing Propeller, the air pressure should be dropped to zero. Unless this is done, it is possible to unscrew the reverse stop far enough to disengage the threads, allowing the pressure to blow the reverse stop screw out with great force. There should be at least four threads engaged during normal operation.

7) Check runout of slip ring. Total runout within .010 static. Observe wobble of slip ring when engine is running during low pitch and reverse pitch operation. If slip ring does not run true, recheck runout.

8) Flight test.

OPERATING INSTRUCTIONS

1) Reverse pitch ONLY when throttle is CLOSED.

2) Propeller can only be reversed when pitch is in low. This means airspeed must be below a certain value, and throttle is closed. Governor control must always be in maximum RPM position-forward.

3) Be sure pitch is either in LOW or FULL REVERSE before throttle is opened up. Otherwise engine will overspeed. The reverse pitch control provides a means to feel the position of the pitch.

4) Do not shut off engine with pitch in reverse. This would cause damage to control mechanism because propeller springs and air pressure will return pitch toward high pitch after engine is shut down. There is not enough "Beta" valve travel to allow for this change in pitch unless reverse control is moved to low position.

TROUBLESHOOTING

Variations in Low Pitch Static RPM

The linkage may have too much backlash in the joints.

Pitch Goes to Full High During Idle - Governor Ineffective

The Beta Valve is shut off and drain opened up allowing piston to move full into high.

Correction: Adjust the reverse push-pull control to reduce "B", so Beta valve is open to governor by at least 1/16 inch. Beta valve spool is in Null position when centered approximately between stops.