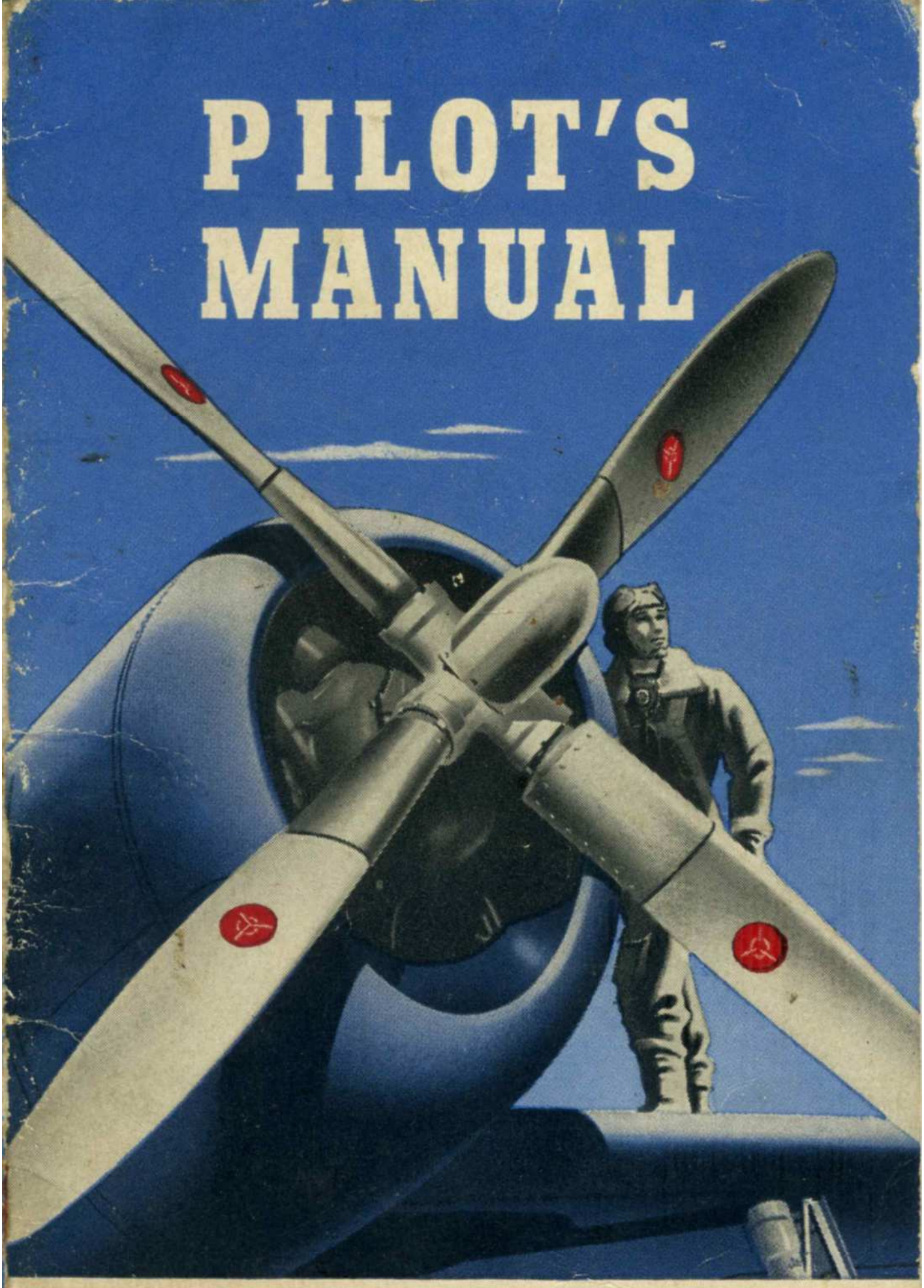
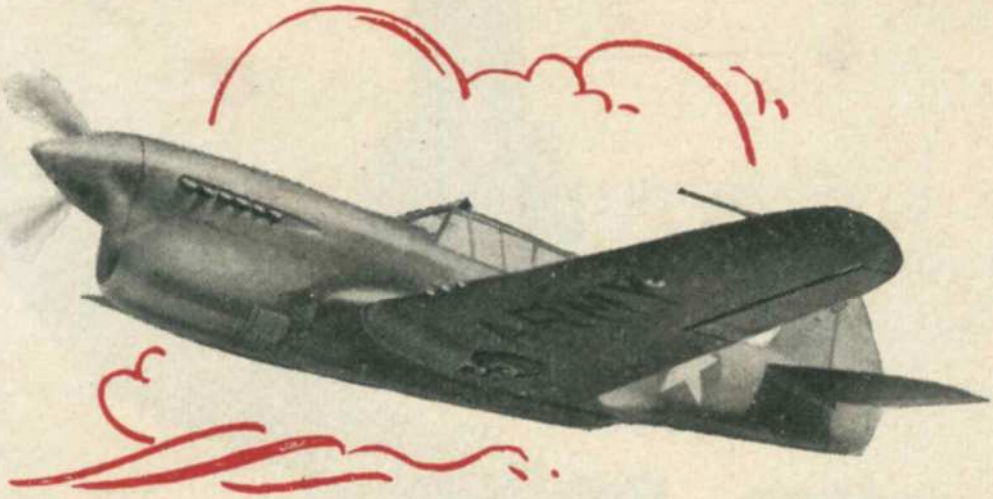
PILOT'S MANUAL



CURTISS *Electric* PROPELLER

PREFACE



THE information presented in this manual was prompted by our desire to provide all flight personnel with a convenient reference containing pertinent propeller operating data.

The text includes a brief description of the construction and function of the electrically controllable propeller, and a compilation of facts and data dealing with operating procedures, operating recommendations, and Tips, which we hope will prove helpful in familiarizing you with the fundamentals of Curtiss Electric Propeller operation.

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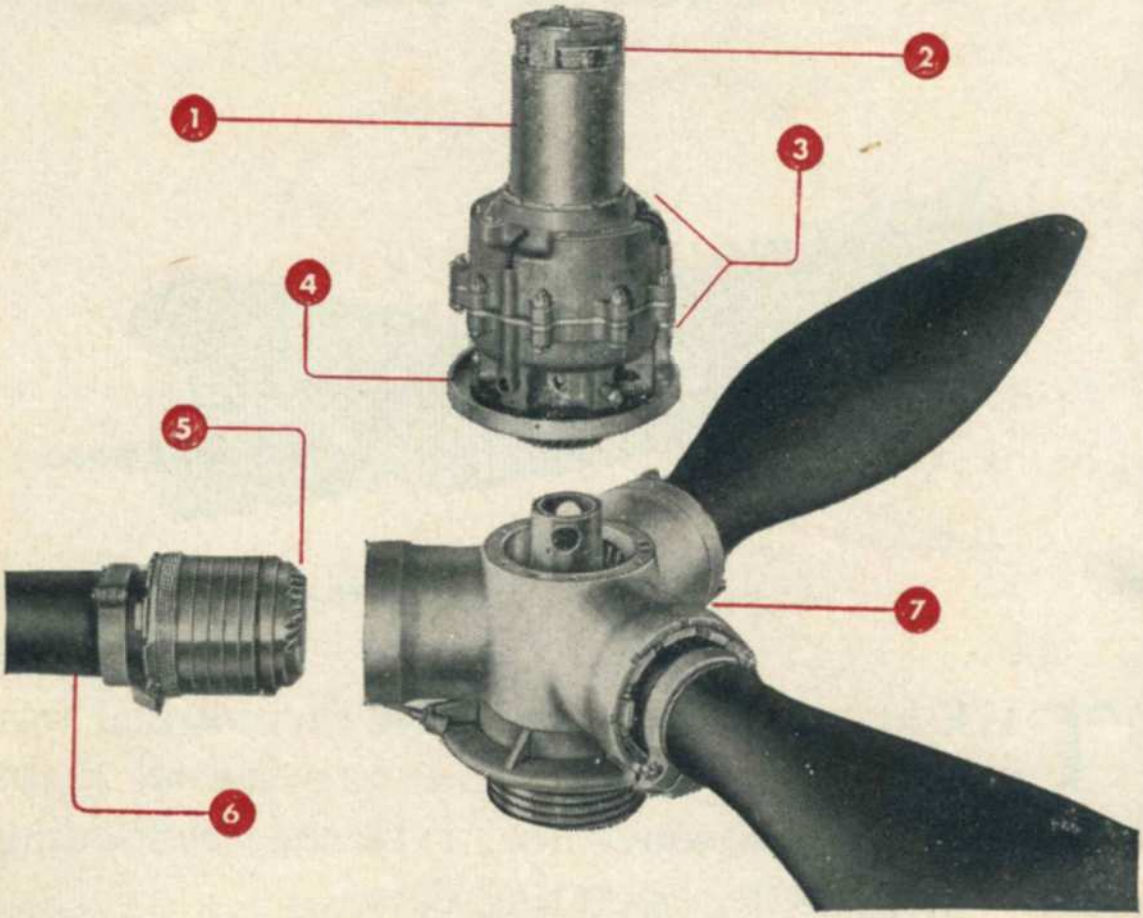
Note: *The contents of this Pilot's Manual are published for information only, and are not intended to supplement, supersede or modify any Technical Order or manufacturer's publication.*

CURTISS ELECTRIC PROPELLER



The propeller illustrated here is typical of the unit type construction of the Curtiss Electric Propeller. The major assemblies shown are . . .

. . . the power unit which consists of a reversible electric motor (1), a brake (2), and a speed reducer (3), containing a train of planetary gears;

. . . the power gear assembly (4), which includes the master bevel gear that meshes with the blade gear (5) attached to the shank of each blade (6); and . . .

. . . the hub assembly (7), having blade sockets and a splined center bore to engage with the propeller shaft.

PRINCIPLE OF OPERATION

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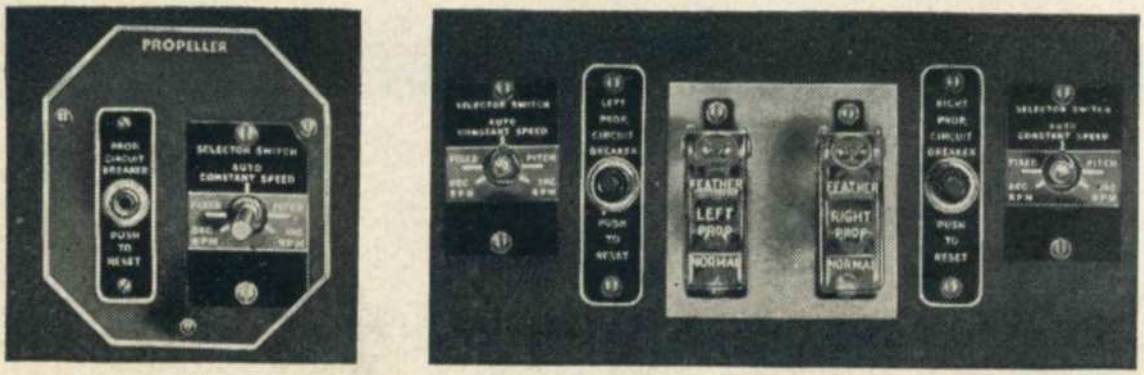
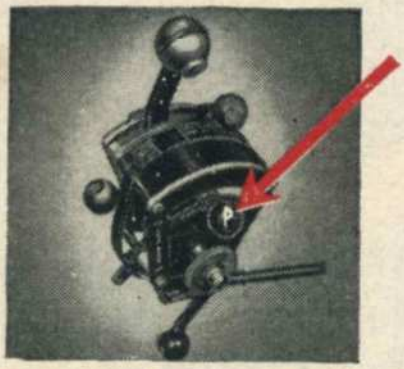
The Curtiss Electric Propeller is a type in which the angle of the blades is controlled while in flight in order to provide maximum efficiency and maintain constant engine speed under various operating conditions.

The electrical energy for operating the blade-angle-change motor comes from the electrical power supply of the airplane to the control system of the propeller through switches located in the cockpit. From this point, the current passes through brushes mounted in a housing fixed to the engine nose, to slip rings attached to the rear of the propeller hub, and from there through connector rods to the cam-operated limit switches located in the power unit . . . and then to the blade-angle-change motor.

The function of the speed reducer is to convert the high rotational speed of the electric motor into a slower but more powerful turning force which is transmitted to the blades through the power gear. The angle of the blades is increased or decreased, as required, depending upon the direction of rotation of the electric motor. Whenever the current is cut off, the brake stops the motor armature, and locks the blades in a fixed position.



Single Engine and Twin Engine Switches



Propeller Control Lever

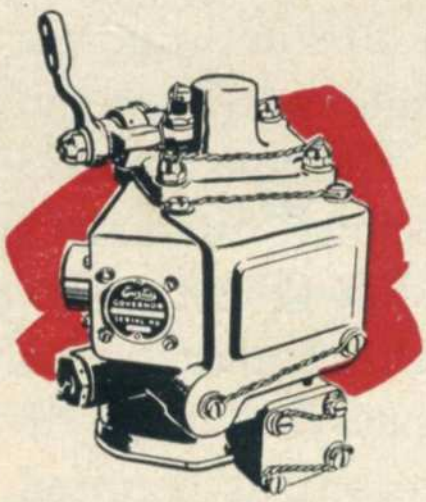
COCKPIT CONTROLS

The Control System* — consisting of a governor, a relay, and cockpit controls—does the switching of the electrical current to the propeller motor.

Typical arrangements of the cockpit propeller controls are shown above. . . .

. . . for the single engine installation—a Circuit Breaker, a Selector Switch, and a Propeller Control Lever . . .

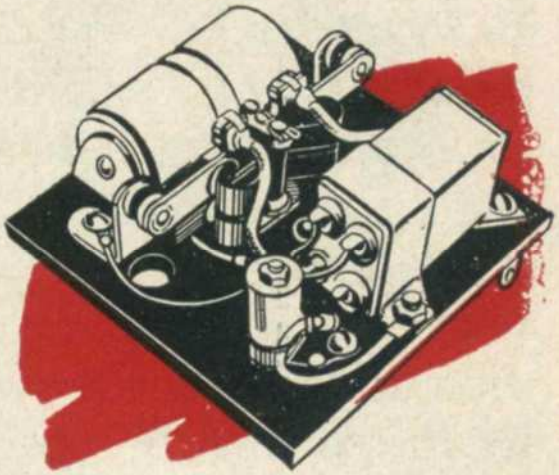
. . . for the multi-engine installation—a Feather Switch is added, and duplicate controls are provided for each propeller.



The Governor — driven by the engine — is the

**The Governor Control System is the type usually installed. On some multi-engine installations an automatic synchronizer system is used. Consult special operating instructions on this type of control for the particular aircraft concerned.*

mechanism that automatically switches the electrical energy through the relay to the propeller motor, thereby maintaining constant engine speed by controlling the angle of the blades.

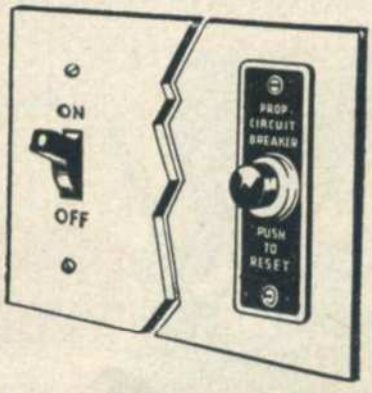


The Relay—when energized by the governor—closes the circuits to the propeller motor during automatic operation.

The Circuit Breaker serves to protect the propeller circuits against electrical overload. Two types may be found in use—the "Toggle Switch" type, which snaps to the "OFF" position when opened due to an electrical overload; and the "Push-Button" type which snaps outward, exposing a luminous band on the button. To reset—move "Toggle Switch" to "ON"; or press button of the "Push-Button" type in until band is no longer visible.

The Selector Switch has four positions — AUTOMATIC CONSTANT SPEED—FIXED PITCH (OFF)—INCREASE RPM—and DECREASE RPM.

Selector Switch



"Toggle" "Push Button"
Types of Circuit Breakers

In AUTOMATIC CONSTANT SPEED—the setting of the propeller blade angle is automatically controlled by the governor with the aid of the relay.

In FIXED PITCH—the electrical circuits of the propeller are open and the propeller operates as a fixed pitch propeller. When required, the blade angle setting can be changed by momentarily holding the Selector Switch lever either in the INCREASE RPM or DECREASE RPM position. As soon as released, the switch lever will spring back to FIXED PITCH, opening the electrical circuit. When this happens, the blades remain "fixed" at the established angle setting, and the propeller will again operate as a fixed pitch propeller.

The Feather Switch employed in the multi-engine installation closes the feathering circuit when placed in the FEATHER position. A voltage booster is used in most installations to provide rapid blade angle change during the feathering operation.

OPERATING INSTRUCTIONS

4 points to be REMEMBERED!

1 The Circuit Breaker protects the propeller circuits against electrical overloads and it should be "ON" at all times.

2 AUTOMATIC CONSTANT SPEED OR SELECTIVE FIXED PITCH control is selected by the pilot through the operation of the Selector Switch.

3 In AUTOMATIC CONSTANT SPEED, the control of the blade angles for maintaining constant engine speed is accomplished by the governor and the relay. Engine speeds are selected with the Propeller Control Lever.

4 In SELECTIVE FIXED PITCH the propeller operates as a fixed pitch propeller. The blade angles are adjusted by holding the Selector Switch in either INCREASE RPM or DECREASE RPM, as required.

OPERATING INSTRUCTIONS (Cont.)

PRE-FLIGHT CHECK

First thing to do upon entering the airplane—MAKE SURE THAT THE PROPELLER CIRCUIT BREAKER IS IN THE "ON" POSITION.

Second—Place the Selector Switch in AUTOMATIC and the Propeller Control Lever in the FORWARD or TAKE-OFF position.

Third—Start and warm up the engine.

Fourth—Turn generator **"ON"** and make sure it is operating.

• • •

The following check of the propeller automatic operation should be made when the engine has reached proper operating temperature.

With the Selector Switch in AUTOMATIC and the Propeller Control Lever in the TAKE-OFF position . . .

1. Open throttle until engine turns approximately 70% of its take-off RPM . . . and

2. Pull the Propeller Control Lever back until a reduction of not more than 200 RPM is noted. **At this setting the propeller should hold the engine at a steady speed without surges or other irregularities.**

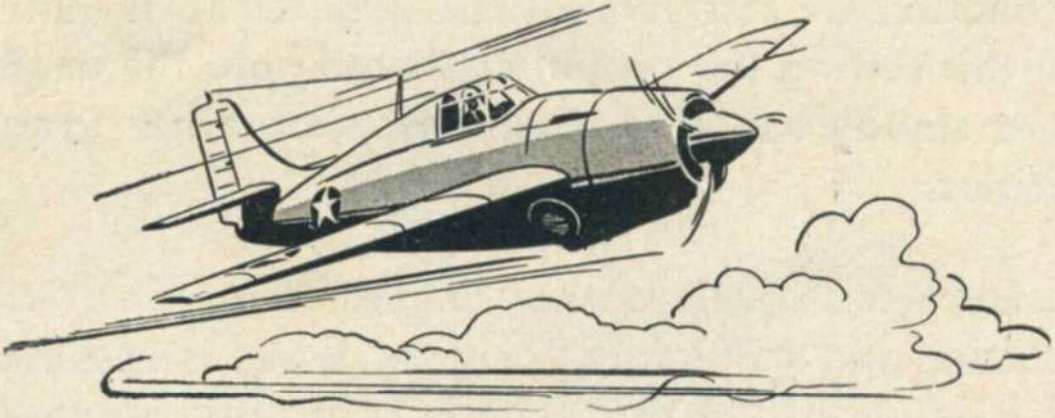
3. Return Propeller Control Lever to the TAKE-OFF position and see that the original RPM is resumed. If it is—then the propeller is operating normally, and is ready for flight.
In the case of a multi-engine installation—the same pre-flight check should be made on each propeller.

Pilots should always make the above operating check just prior to all take-offs as this will eliminate the possibility of taking-off with an inoperative propeller which may be caused by an incorrect switch setting or possible mechanical difficulty.

TAKE-OFF

Take-offs should be made with the propeller set for automatic operation—Circuit Breaker "ON" . . . Selector Switch in AUTOMATIC . . . and Propeller Control Lever in TAKE-OFF position.

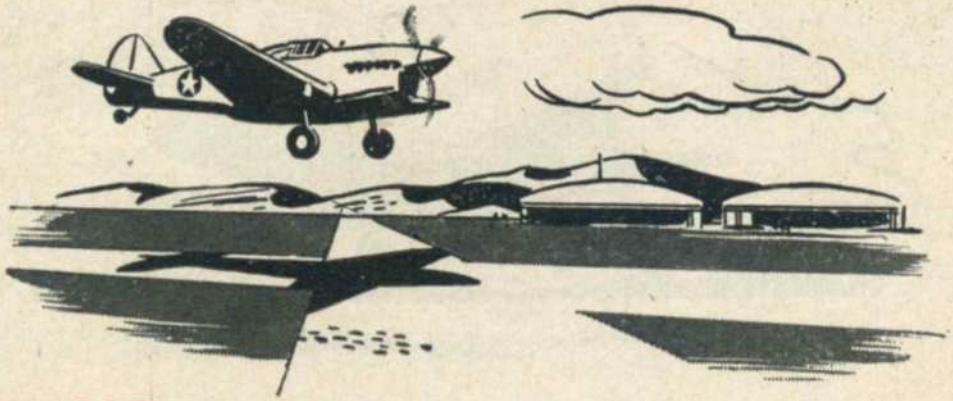
OPERATING INSTRUCTIONS (Cont.)



CLIMB · · · CRUISE · · · MANEUVER

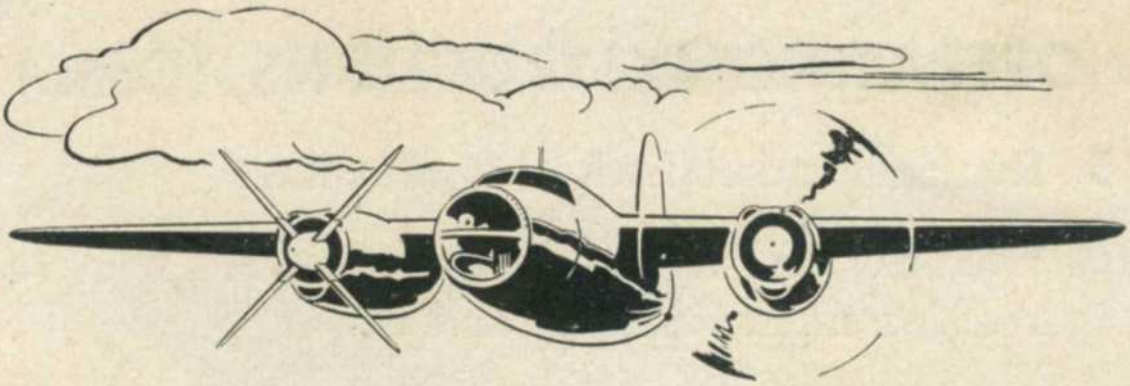
In climbs, cruising and during maneuvers, the propeller should continue to be operated in AUTOMATIC, and the engine speed regulated by adjusting the Propeller Control Lever.

During automatic operation, the correct blade angle setting for obtaining constant engine speed is made automatically with no attention on the part of the pilot.



LANDING

Landings should be made with the propeller set for automatic operation, and the Propeller Control Lever set for the maximum cruising RPM.



EMERGENCY FEATHERING

1. Place Feather Switch to FEATHER. The blades will then assume the feather setting without further attention.

2. Close throttle.

3. Move mixture control to IDLE CUT-OFF.

4. Shut off fuel supply to inoperative engine only.

5. Turn off engine ignition switch after propeller stops turning.

It is important that the above instructions be followed in the sequence given.

UNFEATHERING (in Flight)

1. Turn on the ignition switch.

2. Move Propeller Control Lever to the Low RPM position.

3. Turn on fuel supply.

4. Set throttle and mixture control to their normal starting positions.

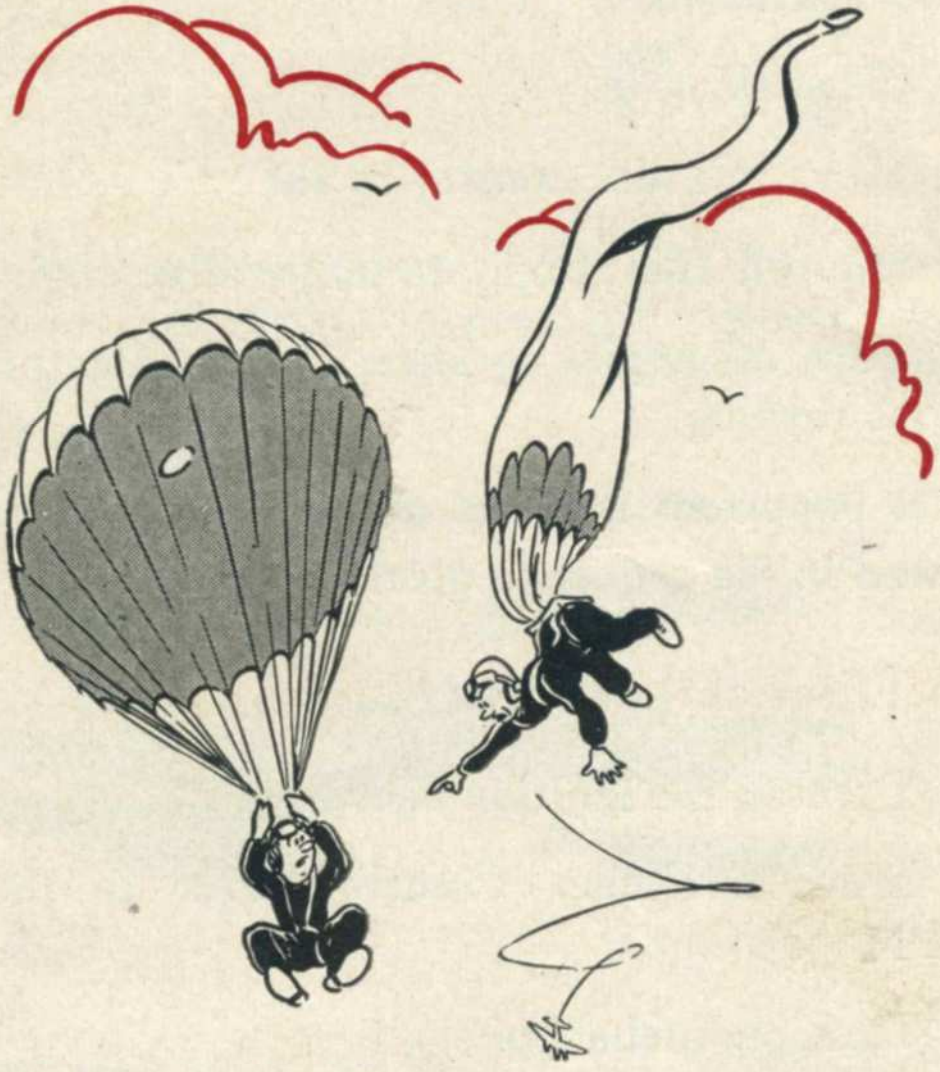
OPERATING INSTRUCTIONS (Cont.)

5. Return Feather Switch to NORMAL.

6. Hold Selector Switch to INCREASE RPM as required for engine starting and warm up.

7. After engine has resumed normal operating temperature—place Selector Switch in AUTOMATIC . . . and

8. Set Propeller Control Lever and throttle for normal operation.



"You musta feathered the prop on your good engine!"

OPERATING RECOMMENDATIONS

1. Automatic constant speed control should be used for all types of operation—take-off, climbing, cruising, maneuvering, and landing.

2. Selective fixed pitch control is an auxiliary form of control that may be used when fixed pitch propeller operation is desired, or in the event the automatic constant speed control becomes inoperative.

3. Feathering may be used at any time without restrictions on the propeller as to the number of consecutive feathering and unfeathering operations. However, it should be borne in mind that practice feathering in flight should not be attempted unless you have been properly "checked-out" and are thoroughly familiar with the correct procedure for stopping and starting an engine during flight, as well as with the flight characteristics of the airplane operating with an inactive engine.

TIPS

Circuit Breaker

Don't forget that the Circuit Breaker should be "ON" at all times.

Selector Switch

The normal position for the Selector Switch is AUTOMATIC CONSTANT SPEED. Continuous automatic operation of the propeller removes the possibility of inadvertently operating with a fixed pitch propeller.

Feathering with Selector Switch

Feathering may also be accomplished at the normal rate of pitch change by holding the Selector Switch to DECREASE RPM. During this operation, of course, the Feather Switch must remain in the NORMAL position.

Over Speeding

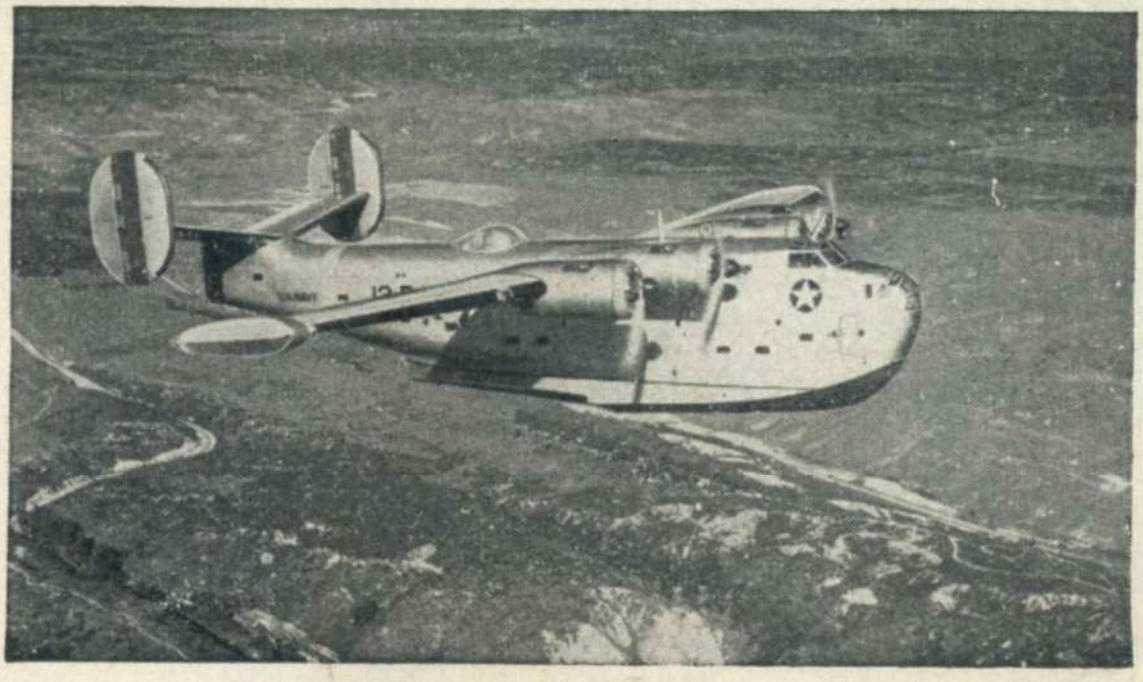
An increase in airplane speed, such as occurs during take-off or dives, requires an increase in propeller blade angle to absorb engine power and prevent overspeeding. The propeller will not increase the angle of the blades if

Over Speeding

the propeller switches are incorrectly set or if the battery is low. Check for proper switch settings and note that the generator is operating. The use of the DECREASE RPM position of the Selector Switch affords an alternate means of correcting overspeeding.

Power Source

Remember—the battery and the generator are your source of electrical power. Hence, should the generator fail to operate while in flight, the electrical energy can be conserved by placing the Selector Switch in FIXED PITCH (OFF). However, before landing, make sure the Selector Switch lever is returned to AUTOMATIC CONSTANT SPEED, so that automatic operation is available in the event of a deferred landing.



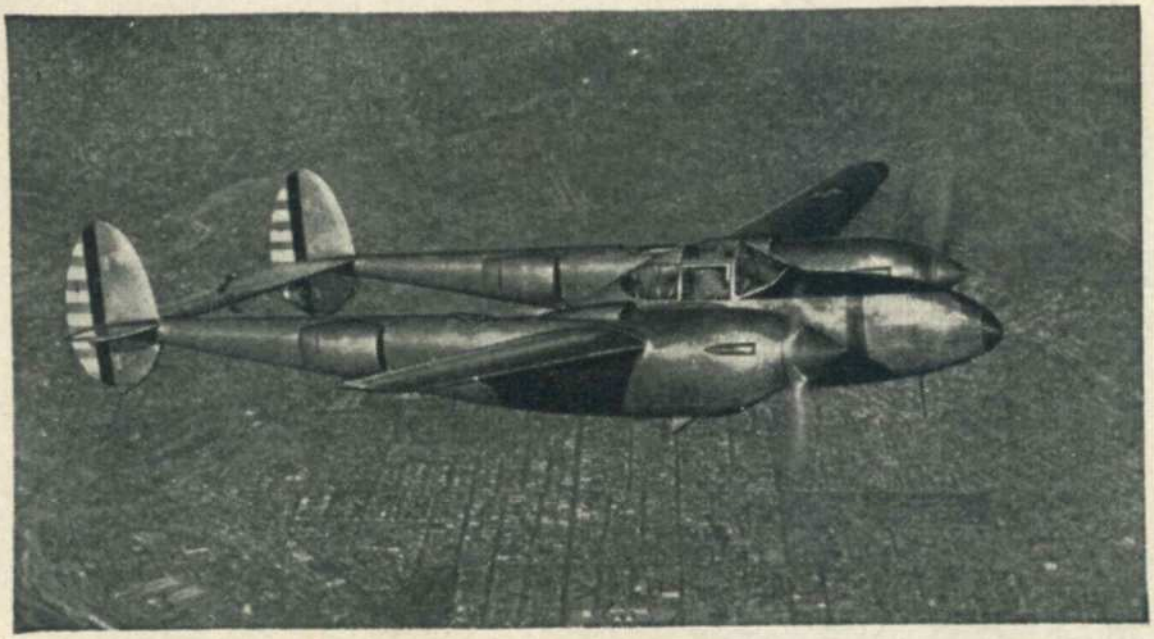
TIPS (CONT.)

Selective Fixed Pitch Operation

Should selective Fixed Pitch operation be desired or should the constant speed control become inoperative, move the Selector Switch lever to FIXED PITCH (OFF). The desired RPM setting can then be obtained by momentarily holding the switch lever to INCREASE RPM or DECREASE RPM, as required.

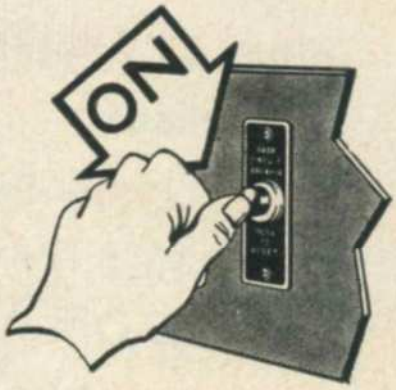
Unequal Thrust

Remember—unequal propeller thrust may result when opening throttles of a twin-engine airplane during take-off or landing if one of the propellers is set for fixed pitch and the other for automatic operation.



Reset Circuit Breaker

Remember—when the Circuit Breaker opens because of an overload on the propeller circuit the propeller blades remain at a fixed angle setting. Therefore, it is essential that the Circuit Breaker be reset to the "ON" position.



The "Push-Button" type of Circuit Breaker is designed to carry extremely high loads when ***holding*** the button ***"full in"***. Careful use of this feature may prove valuable in obtaining a satisfactory blade angle setting when a continuous overload exists in the propeller circuit.

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PILOT'S CHECK-OFF LIST

CIRCUIT BREAKER —To be "ON" at all times.

TAKE-OFF—Selector Switch to AUTOMATIC. Propeller control lever in TAKE-OFF position.

CRUISING—Selector Switch to AUTOMATIC. Select desired engine RPM with propeller control lever.

SELECTIVE FIXED PITCH CONTROL—Selector Switch to FIXED PITCH. Adjust propeller blade angle by holding to INCREASE RPM or DECREASE RPM as required.

LANDING—Selector Switch to AUTOMATIC. Propeller control lever to maximum cruising RPM.

RESET CIRCUIT BREAKER — Return to the "ON" position.

FEATHER—Feather Switch to FEATHER.

UNFEATHER—Feather Switch to NORMAL. Selector Switch to INCREASE RPM as required.

IN CONCLUSION . . .

. . . you should remember that the Curtiss Electric Propeller needs electricity to operate . . . that the generator must be turned "ON" and operating . . . and that the Circuit Breaker must be "ON" at all times. You should also remember that AUTOMATIC CONSTANT SPEED is the proper setting for all flying operations, and that SELECTIVE FIXED PITCH is mainly an auxiliary form of control.

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We believe the operating procedures and recommendations described in this manual will prove helpful in obtaining satisfactory propeller operation.

THE CURTISS-WRIGHT CORPORATION

PROPELLER DIVISION

CALDWELL, N. J.


Curtiss
ELECTRIC PROPELLERS