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Clo 2
Propeller Construction

FIXED-PITCH WOODEN PROPELLERS

The construction of a fixed-pitch, wooden propeller is such that:

- its blade pitch cannot be changed after manufacture.

The choice of the blade angle is decided by:

- the normal use of the propeller on an aircraft during level flight when the engine performs in an efficient manner.

The impossibility of changing the blade pitch on the fixed-pitch propeller restricts its use to small aircraft with low horsepower engines in which maximum engine efficiency during all flight conditions is of lesser significance than in larger aircraft.

The wooden, fixed-pitch propeller is well suited for small aircraft because of its :

1, lightweight
2, rigidity
3, economy of production
4, simplicity of construction
5, ease of replacement

many small aircraft have a variety of approved propellers for installation, aircraft owners or operators have the option of selecting the:

- appropriate propeller for their operation.

The two common options are a :
1, “climb prop”
2, “cruise prop”

1, Climb propellers generally have a :

- lower pitch or shorter diameter that allows the engine to attain higher rpms

2, cruise propellers are built with:

- higher pitch angles and longer diameters and are well suited for cruise operations.

Construction of wooden propeller:

1, the type of wood and size:

A wooden propeller is not constructed from :

- solid block of wood

It's built up of a number of :

- separate layers or laminates of carefully selected and well seasoned hardwoods.

Many woods, such as

- mahogany
- cherry
- black walnut
- oak

are used to some extent

- but birch is the most widely used

The layers number that is used :

- Five to nine separate layers are typically used

The thickness:

- each about 3⁄4 inch (2 cm) thick.

Generally, the growth rings of the laminates are alternated in terms of:

- direction to minimize warping.

2, glueing

The wood laminates are glued together using a :

- waterproof, resinous glue and allowed to set

3, the first stage of the propeller shape (the blank)

After the gluing The blank is then :

- roughed out to the approximate shape and size of the finished product

The roughed out propeller is then allowed to :

- dry for approximately one week

to:

- permit the moisture content of the layers to become equalized.

This additional period of seasoning prevents:

- warping
- cracking

that might occur if it was immediately carved from a blank

4, The second stage of shaping the propeller:

Following the seasoning period:

- the propeller is carefully constructed

Templates and bench protractors are used to:

- assure the proper contour and blade angle at all stations.

5, fabric covering

After the propeller blades are finished:

- a fabric covering is cemented to the outer 12 to 15 inches (30 to 38 cm) of each finished blade.

6, tipping

A metal or composite tipping is:

- fastened to the leading edge and tip of each blade

to protect the propeller from :

- damage caused by flying particles in the air during ;

1, landing
2, taxiing
3, takeoff

The tipping also serves as an :

- erosion strip to protect the leading edge of the propeller.

Metal tipping may be of

- terneplate
- monel metal
- brass.
- Stainless steel has been used to some extent.

The metal tipping is secured to the leading edge of the blade by :

- countersunk wood screws
- rivets.

The heads of the screws are:

- soldered to the tipping to prevent loosening,
- the solder is filed to make a smooth surface

Since moisture condenses on the tipping between the metal and the wood:

- the tipping is provided with small holes near the blade tip
- to allow this moisture to drain away or be thrown out by centrifugal force.

It is important that these drain holes be kept open at all times.

When the aircraft is inactive for an extended period:

- the engine is positioned so that the wooden propeller remains in a horizontal position
- to maintain even water content between the blades

If the blades are left in a vertical position for a protracted period, water in the wood will tend to :

- migrate to the lower blade

Figure 2-3. Wooden propeller showing spinner, hub, laminates, metal tipping, fabric covering, and drain holes.

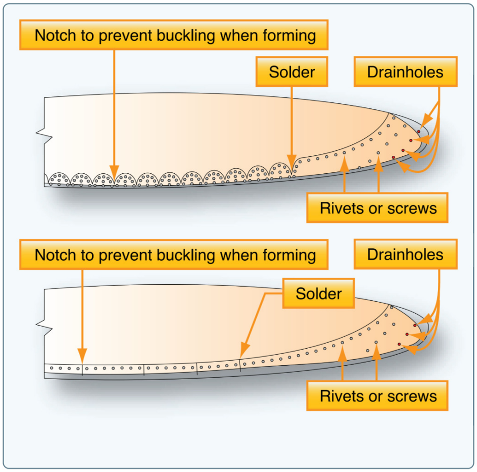


Figure 2-4. Wooden propeller tipping.

Figure 2-5. Tip on wooden propeller revealing soldered attachment hardware and drain holes.

7, protection of the finished propeller

Since wood is subject to:

- swelling
- shrinking
- warping

because of changes of moisture content

a protective coating is applied:

- to the finished propeller to prevent a rapid change of moisture content

The finish most commonly used is a:

- number of coats of water repellent, clear varnish

After these processes are completed:

- the propeller is mounted on a spindle and very carefully balanced.

Types of hubs

Several types of hubs are used to mount wooden propellers on the engine crankshaft

The propeller may have a :

1, forged steel hub that fits a splined crankshaft
2, may be connected to a tapered crankshaft by a tapered, forged steel hub
3, may be bolted to a steel flange forged on the crankshaft.

- In any case, several attaching parts are required to mount the propeller on the Hubs fitting

1, tapered shaft

tapered shaft are usually:

- held in place by a retaining nut that screws onto the end of the crankshaft

lengthy metal key is used to:

- align the propeller hub with the crankshaft.

Proper positioning of the propeller on the crankshaft in terms of clock angle is needed when:

- the engine is started by hand cranking or propping

snap ring is used in many hubs

The snap ring retains the crankshaft nut when the:

- propeller is removed from the engine.

Meaning:

- When the propeller is removed from the engine, the snap ring serves to retain the crankshaft nut. Essentially, the snap ring prevents the crankshaft nut from coming loose or falling off the crankshaft.

The snap ring also serves as a:

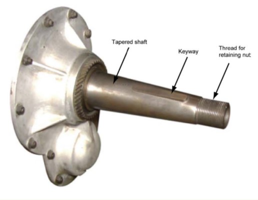
- pulling surface when breaking the hub free from the tapered crankshaft using the crankshaft nut.

meaning:

- The snap ring serves as a pulling surface, meaning it provides a point of contact or grip for a tool, such as a puller or wrench, to exert force on the hub

A loud cracking sound is emitted when the hub is:

- broken free from the tapered crankshaft



tapered Shaft

lengthy metal key

snap ring

2, splined shaft installations

On splined shaft installations:

- front and rear cones may be used to accurately center the propeller on the crankshaft or propeller shaft and seat the propeller.

1, The rear cone is a:

- one piece bronze design
- fits around the shaft and against the thrust nut (or spacer)
- seats in the rear cone recess of the hub.

2, The front cone is a:

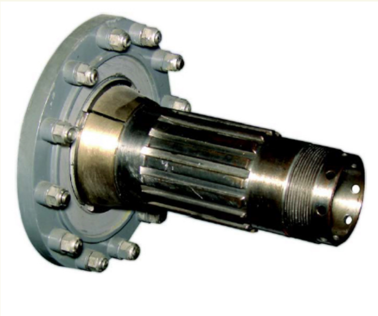
- two piece, split type steel cone
- has a groove around its inner circumference so that it can be fitted over a flange of the propeller retaining nut Then;
- the retaining nut is threaded into place and the front cone seats in the front cone hub.

snap ring is:

- fitted into a groove in the hub in front of the front cone

so that when the retaining nut is unscrewed from the propeller shaft:

- the front cone acts against the snap ring and pulls the propeller from the shaft.



splined shaft

rear cone

front cone

One type of hub incorporates a bronze bushing instead of a front cone.

When this type of hub is used:

- it may be necessary to use a puller to start the propeller from the shaft.

A rear cone spacer is sometimes provided with the splined shaft propeller assembly to prevent:

- the propeller from interfering with the engine cowling

The wide flange on the rear face of some types of hubs eliminates the use of a rear cone spacer.

3, steel fitting

One type of hub assembly for the fixed-pitch, wooden propeller is a :
- steel fitting inserted in the propeller to mount it on the propeller shaft.

It has two main parts:
1, the faceplate
2, the flange plate

1, The faceplate is a :
- steel flange with an internal bore splined to receive the propeller shaft

2, The end of the flange plate opposite the flange disk is:
- externally splined to receive the faceplate

The faceplate bore has:
- splines to match these external splines

The units used on lower horsepower engines with tapered shafts generally:
- do not have these splines.

Both faceplate and flange plates have:
- corresponding series of holes drilled on the disk surface concentric with the hub center

The bore of the flange plate has a :
- 15° cone seat on the rear end
- a 30° cone seat on the forward end to center the hub accurately on the propeller shaft.

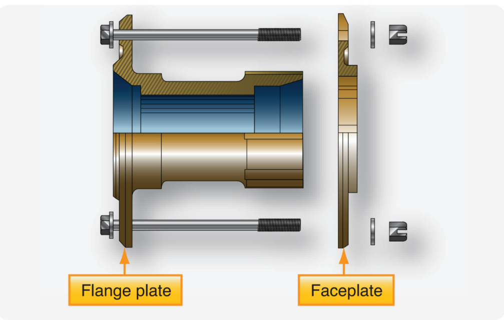


Figure 2-6. Wooden propeller hub adapter.

TORQUING WOODEN PROPELLERS

The installation of a wooden propeller must adhere to:

- strict torquing procedures

The torque placed on a wooden propeller must be:

- enough to apply a compressive force to the hub without crushing the wood

Before installing the propeller, or checking the torque, ensure that:

- the magneto switch(es) are in the OFF position and that the aircraft is chocked or tied-down

Removing a spark plug from each cylinder will further

- enhance safety and will make it easier to rotate the engine for torquing purposes and for checking propeller track

Always use an:

- accurate torque wrench that fulfills calibration requirements

The propeller bolts should be tightened using a:

- star pattern.

Increase the tightness of the bolts using:

- small incremental increases of torque

Keep shifting from one bolt to the next using the star pattern:

- Continue the process until the prescribed torque value is attained.

If self-locking nuts are used to retain the propeller:

- add the resistance of the friction of the self-locking mechanism to the published torque value

The reason that the technician should use small incremental:

- increases in torque to arrive at the desired tightness is that applying large quantities of torque at one time to the bolts may cause the wood to crush and the blade track to shift.

The torque of the propeller bolts should be:

- re-checked after the initial flight and following the first 25 hours of operation.

Thereafter:

- check the bolt torque every 50 hours of operation.

The torque should also be checked when the:

- ambient environment changes in a substantial manner (e.g., winter to summer

To check the torque of the propeller bolts:

- remove safety wire, if applicable, and rotate the torque wrench in a tightening direction until the fastener begins to turn.

1, If the amount of torque required to rotate the fastener is very low:

- approximately half to two-thirds of the prescribed torque
- remove the propeller and inspect the hub area for defects (elongated holes and/or cracks)

Such damage must be repaired by the:

- manufacturer

or

- an appropriately rated repair facility.

2, If the torque is somewhat low (three quarters the specified torque), carefully:

- increase the torque to the proper level

3, If the torque is with in the specified range:

- no action is required

4, if the torque exceeds the prescribed range:

- loosen the bolts and torque to the correct limit

At the conclusion of the torque check:

- verify that the propeller track is within limits and resafety the hardware, as necessary

METAL FIXED-PITCH PROPELLERS

Metal fixed-pitch propellers are similar in general appearance to a :

- wooden propeller

except that the:

- sections are usually thinner

The metal fixed-pitch propeller is widely used on many models of light aircraft

metal propellers were manufactured in :

- one piece of forged Duralumin

Metal propeller Compared to wooden propellers:

- lighter in weight because of elimination of blade clamping devices
- offered a lower maintenance cost because they were made in one piece
- provided more efficient cooling because of the effective pitch nearer the hub and, because there was no joint between the blades and the hub
- propeller pitch could be changed, within limits by; by twisting the blade slightly by a propeller repair station

Generally, metal propellers are ;

- heavier than their wooden counterparts

X

Propellers of this type are now manufactured as ;

- one piece anodized aluminum alloy.

They are identified by :

- stamping the propeller hub
- with the serial number, model number, type certificate number, production certificate number, and the number of times the propeller has been reconditioned.

The complete model number of the propeller is a:

- combination of the :

1, basic model number
2, suffix numbers to indicate the propeller diameter
3, pitch

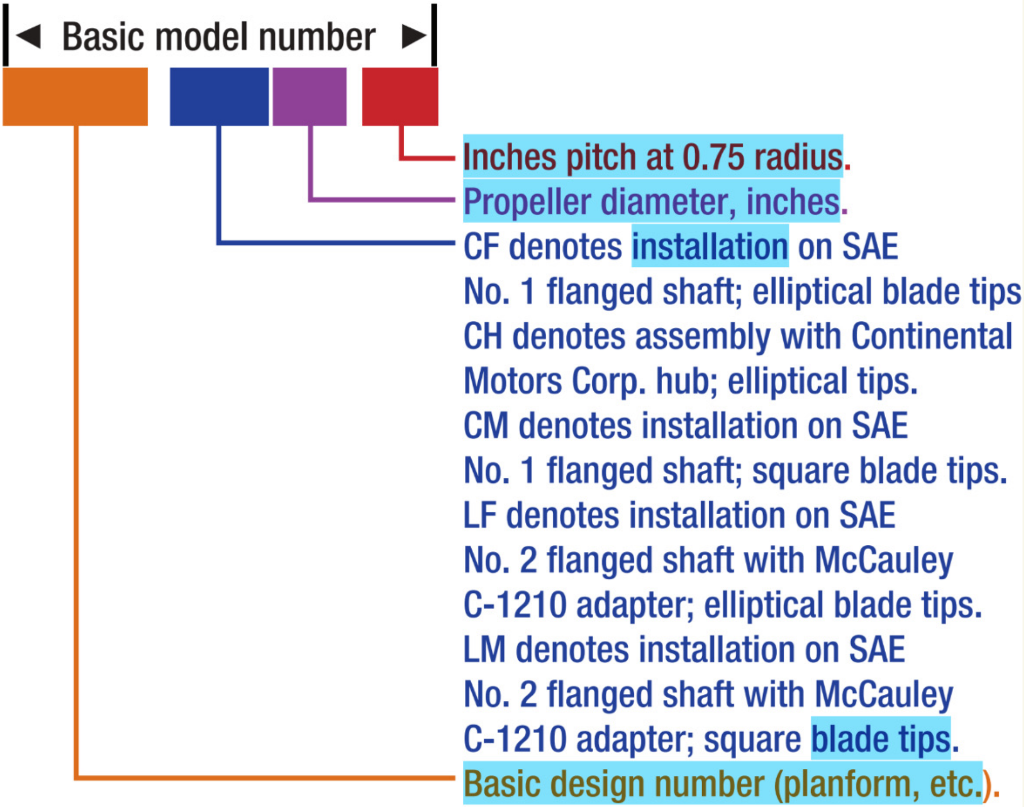


Figure 2-7. Propeller data information.

STEEL PROPELLER BLADES

Steel propeller blades are typically:

- hollow to keep weight to a minimum

By comparison to blades made from other materials:

- steel propeller blades possess more heft

Heavier

Figure 2-8. Cross section of steel propeller blade.

COMPOSITE PROPELLERS

They offer numerous advantages, especially for:

- higher speed turboprop aircraft.

- The strength offered by composite blades

in conjunction with :

- lightweight and reduced sound levels have proven useful attributes.

two essential components are utilized to produce the blades:

- the matrix
- the fiber material

The former is similar to an:

- epoxy and is used to keep the strands of the fiber in position

The fibers possess considerable :

- tensile strength and provide vigor in terms of blade resiliency.

number of propellers flown in aerobatics are composite because of their:

- lightweight,
- low inertia,
- durability,
- affordability

Composite blades typically begin at the:

- blade root where they are formed around the metal blade shank

Numerous layers of carbon fiber laminates are :

- wound around a core.

An attached erosion strip, when included:

- An attached erosion strip, when included

BLADE STATIONS

Propeller blades are rotating airfoils that have a relatively complex shape when compared to wings

The main reason for the intricate shape is related to :

- airspeed

Near the propeller hub the :

- relative velocity between the blade section and air is comparatively slow

By contrast, the propeller tip experiences a :

- high velocity with the air.

To accommodate the difference in airspeed a typical propeller blade will have a :

- high blade angle near the hub
- shallow blade angle at the tip

An examination of a propeller blade reveals that the blade angle gradually:

- decreases from the hub or shank area of the blade to the tip.

The length of the chord of the propeller blade may also change:

- moving from the hub to the tip.

The structural need of the propeller blade near the hub may require a shape that lacks aerodynamic qualities but

- provides ample strength to combat the various forces placed on the propeller assembly

Propeller stations are often provided in :

- six inch increments (15 cm).

PROPELLER HUB, SHANK, BACK, AND FACE

1, Hub:

The propeller hub is designed to withstand:
- all the forces experienced by the propeller during operation

On fixed-pitched units, the opposing blades connect at the hub, which is a:
- thick, heavily built member

On controllable-pitch propellers:
- the hub accommodates the pitch change mechanisms by

1, bearings
2, passageways
3, necessary lubricant(s)

In addition to retaining the blades and internal members of the pitch control mechanism:
- the propel ler hub is attached to the crankshaft or propeller shaft.

The thrust generated by the propeller is transmitted to the:
- engine and ultimately to the airframe through the propeller hub

Some propeller models attach the spinner bulkhead, or spinner backplate, to the:
- Hub

2, Shank

The portion of the blade inserted into the hub of a controllable pitch propeller is known as the:

- blade butt

or

- blade root.

The propeller blade shank :

- connects the blade root or butt to the airfoil section of the propeller blade.

The shape of the shank ranges from :

- circular
- oval
- cambered form

The shank must be capable of :

- absorbing the loads placed upon the propeller and transmitting the thrust to the hub

Overshoes or boots associated with de-icing and anti-icing systems are:

- attached to the shank of the propeller blades and extend down a measure of the blade.

2,blade back

The surface of the propeller blade known as the back is the :

- side of the blade containing the camber or curvature

The propeller back is similar to the:

- upper surface of a wing in that it generates a lower pneumatic pressure as the blade rotates.

3, blade face

The face of the propeller blade is the:

- surface that is relatively flat.

As the propeller rotates:

- the face strikes the air.

Pilots who fly single engine airplanes equipped with tractor propellers look at, or face:

- the face of the propeller as they operate the aircraft

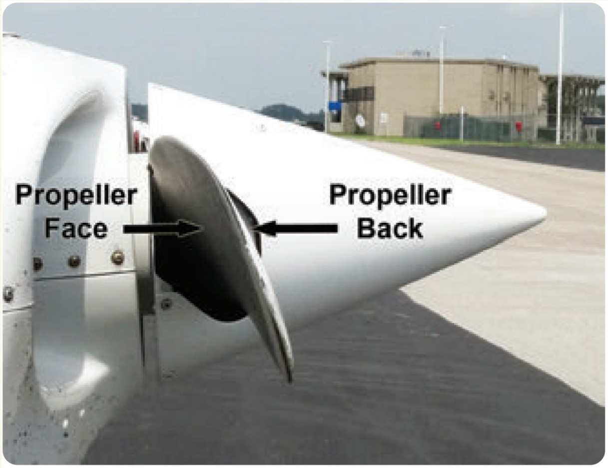


Figure 2-11. Propeller face and back.

TYPES OF PROPELLERS

the simplest of which are the or the 2 basic types of propellers:

- fixed-pitch
- ground adjustable propellers.

The complexity of propeller systems increases from these simpler forms to:

- controllable-pitch
- complex constant speed systems (automatic systems

The types that we will be speaking about

1, TEST CLUB PROPELLER
2, FIXED-PITCH PROPELLER
3, GROUND-ADJUSTABLE PROPELLER
4, CONSTANT-SPEED PROPELLERS
5, FEATHERING PROPELLERS
6, REVERSE-PITCH PROPELLERS

1, TEST CLUB PROPELLER

A test club is used to :

- test and break in reciprocating engines.

They are made to provide the:

- correct amount of load on the engine during the testing and breaking in period and not intended for flight

The multi blade design also provides:

- extra cooling airflow during operation.

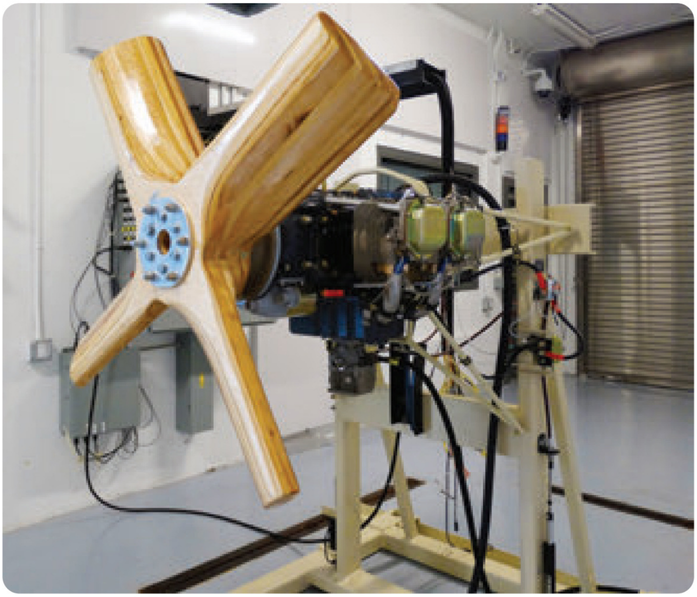


Figure 2-12. Club propeller used in test cell.

2, FIXED-PITCH PROPELLER

The blade angle:
- cannot be changed after the propeller is built.

Generally, this type of propeller is :
- one piece and is constructed of wood or aluminum alloy.

Fixed-pitch propellers are designed for:
- best efficiency at one rotational and forward speed

The fixed-pitch propeller is used on:
- airplanes of low power speed, range, or altitude

Many single engine aircraft use:
- fixed-pitch propellers

the advantages to this type of:
- less expense
- their simple operation.

This type of propeller does not require any:
- control inputs from the pilot in flight

Fixed-pitch propellers are available in:
- tractor
- pusher designs

Figure 2-13. Fixed-pitch tractor propeller.

3, GROUND-ADJUSTABLE PROPELLER

The ground-adjustable propeller operates as a:

- fixed-pitch propeller.

The pitch, or blade angle, can be changed only when the propeller is not:

- turning

This is done by :

- loosening the clamping mechanism that holds the blades in place, and setting the desired pitch

After the clamping mechanism has been tightened:

- the pitch of the blades cannot be changed in flight to meet variable flight requirements.

The ground-adjustable propeller is:

- not often used on present day airplanes.

4, CONTROLLABLE-PITCH PROPELLER

The controllable-pitch propeller permits a:

- change of blade pitch, or angle, while the propeller is rotating

This allows the propeller to assume a blade angle that gives:

- the best performance for particular flight conditions.

The number of pitch positions may be:

- limited

The use of controllable-pitch propellers also makes it possible to:

- attain the desired engine rpm for a particular flight condition.

This type of propeller is not to be:

- confused with a constant-speed propeller

With the controllable-pitch type:

- the blade angle can be changed in flight, but the pilot must change the propeller blade angle directly

The blade angle will not change again until the:

- pilot changes it.

5, CONSTANT-SPEED PROPELLERS

The propeller has a natural tendency to:
- slow down as the aircraft climbs

speed up as the aircraft:
- dives because the load on the engine varies

To provide an efficient propeller:
- the speed is kept as constant as possible.

By using propeller governors to:
- increase or decrease propeller pitch

the engine speed is held constant.

When the airplane goes into a climb:
- angle of the propeller decreases

just enough to prevent:
- the engine speed from decreasing

The engine can maintain its power output if the:
- throttle setting is not changed.

When the airplane goes into a dive:
- the blade angle increases sufficiently
- to prevent overspeeding
- and, with the same throttle setting, the power output remains unchanged.

If the throttle setting is changed:
- instead of changing the speed of the airplane by climbing or diving,
- the blade angle increases or decreases as required to maintain a constant engine rpm

The power output (not the rpm) changes in accordance with:
- changes in the throttle setting

The governor controlled:
- constant-speed propeller changes the blade angle automatically, keeping engine rpm constant

One type of pitch changing mechanism is operated by :
- oil pressure (hydraulically) and uses a piston and cylinder arrangement.

- The piston may move in the cylinder

or
- the cylinder may move over a stationary piston

The mechanical connection between the piston/cylinder and propeller blades may be:
- through gears or linkages

The pitch changing mechanism rotates:
- the butt of each blade

The propeller blades are mounted with:
- bearings that allow them to rotate to change pitch

In most cases, the oil pressure for operating the different types of hydraulic pitch changing mechanisms comes directly from the :
- engine lubricating system

When the engine lubricating system is used:
- the engine oil pressure is usually boosted by a pump that is integral with the governor to operate the propeller

The higher oil pressure:
- provides a quicker blade angle change

A valve within the governor:
- directs the pressurized oil for operation of the hydraulic pitch changing mechanism

The governors used to:
- control hydraulic pitch changing mechanisms are geared to the engine crankshaft and are sensitive to changes in rpm

When rpm increases above the value for which a governor is set:
- the governor causes the propeller pitch changing mechanism to turn the blades to a higher angle

The higher pitch increases the:
- load on the engine, and rpm decreases until it returns to the on speed rpm.

When rpm decreases below the value for which a governor is set:
- the governor causes the pitch changing mechanism to turn the blades to a lower angle
- The load on the engine is decreased and rpm increases until it reaches the on speed rpm

a propeller governor tends to keep engine rpm constant

In constant speed propeller systems:
- the control system automatically adjusts pitch through the use of a governor,
- without attention by the pilot, to maintain a specific preset engine rpm within the set range of the propeller

if engine speed increases:
- an overspeed condition occurs and the propeller system responds to reduce the engine rpm.
- The controls automatically increase the blade angle until the desired rpm has been reestablished.

Each constant speed propeller has an :

- opposing force that operates against the oil pressure from the governor

On some models:

- counterweights mounted on the propeller blades, or associated parts;
- move the blades in the high pitch direction as the propeller turns

Other forces used to move the blades toward the high pitch direction include air pressure:

- contained in the front dome
- springs,
- aerodynamic twisting moment

6, FEATHERING PROPELLERS

FEATHERING PROPELLERS reduce propeller drag:

- to a minimum in case of one or more engine failure conditions

A feathering propeller is a constant speed propeller used for :

- to change the pitch to an angle of approximately 90°

propeller is usually feathered when the engine:

- fails to develop power to turn the propeller

By rotating the propeller blade angle parallel to the line of flight, the drag on the aircraft is greatly:

- reduced

With the blades parallel to the airstream, the propeller stops turning and minimum windmilling, if any, occurs:

- The blades are held in feather by aerodynamic forces.

Almost all small feathering propellers use oil pressure to take the propeller to:

- low pitch and blade flyweights
- springs, and compressed air to take the blades to high pitch.

Since the blades would go to the feather position during shutdown:

- latches lock the propeller in the low pitch position as the propeller slows down at shutdown

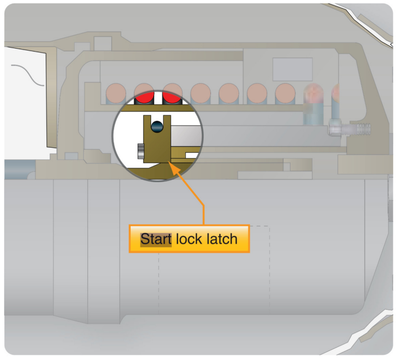


Figure 2-16. Feathering latch.

In flight, the latches are prevented from:

- stopping the blades from feathering because they are held off their seat by centrifugal force

Latches are needed to prevent:

- excess load on the engine at start up.

If the blade were in the feathered position during engine start:

- the engine would be placed under an undue load during a time when the engine is already subject to wear.

Start

7, REVERSE-PITCH PROPELLERS

Almost all reverse-pitch propellers are of the feathering type.

reverse-pitch propeller is a :

- controllable propeller in which the blade angles can be changed to a negative value during operation

The purpose of the reversible pitch feature is to produce:

- a negative blade angle that produces thrust opposite the normal forward direction

Typically, when the landing gear is in contact with the runway after landing:

- the propellers blades can be moved to negative pitch (reversed), which creates thrust opposite of the aircraft direction and slows the aircraft

As the propeller blades move into negative pitch,:

- engine power is applied to increase the negative thrust.

This aerodynamically :

- brakes the aircraft and reduces ground roll after landing

The angle of attack encountered by the blades change as the:

- aircraft speed changes

Reversing the propellers also :

- reduces aircraft speed quickly on the runway just after touchdown and minimizes aircraft brake wear

Some aircraft are able to backup using:

- reverse-pitch propellers

PROPELLER LOCATION

1, TRACTOR PROPELLER
2, PUSHER PROPELLERS
3, CONTRA-ROTATING PROPELLERS
4, COUNTER-ROTATING PROPELLERS

1, TRACTOR PROPELLER

Tractor propellers are those mounted on the:

- upstream end of a propeller shaft in front of the supporting structure.

Most aircraft are equipped with this type of propeller.

major advantage of the tractor propeller is that :

- lower stresses are induced in the propeller as it rotates in relatively undisturbed air

2, PUSHER PROPELLERS

Pusher propellers are those mounted on the:

- downstream end of a propeller shaft behind the supporting structure

Pusher propellers are constructed as:

- fixed

or

- variable pitch units

By placing the propeller behind the wing, :

- airflow over the wing is straight and basically void of the spinning air mass.

Seaplanes and amphibious aircraft have used a greater percentage of:

- pusher propellers than other kinds of aircraft. On land airplanes, where propeller to ground clearance usually is less than the propeller to water clearance of watercraft

pusher propellers are subject to:

- more damage than tractor propellers

Rocks, gravel, and small objects dislodged by the wheels are:

- quite often thrown or drawn into a pusher propeller.

Similarly, planes with pusher propellers are apt to encounter propeller damage from:

- water spray thrown up by the hull during landing or takeoff airspeed

Consequently, the pusher propeller is commonly mounted :

- above and behind the wings to prevent such damage

3, CONTRA-ROTATING PROPELLERS

used on a limited number of airplanes.

The propellers are mounted on:
- two concentric shafts that rotate in opposite directions

Such installations have:
- little torque effect generated by the propellers
- as the torque from one unit is largely negated by the torque from the other propeller

Having a contra-rotating propeller installation reduces:
- the diameter of the propeller disc that would otherwise be necessary using a single propeller.

Figure 2-18. Contra-rotating propellers.

4, COUNTER-ROTATING PROPELLERS

The benefit of the counter-rotating design is especially beneficial on :
- twin engine aircraft.

When an engine fails or is unable to produce power on a twin engine aircraft, the pilot has to :
- implement compensating action to sustain aircraft altitude and maintain steerage

One action is to:
- feather the propeller.;
- This reduces drag on the side of the aircraft with the troubled engine
- Next the pilot must input corrective rudder action.

Twin engine aircraft with similar rotation propellers will typically possess:
- asymmetrical yaw between the engines.

In other words:
- there will be a greater yawing action when one engine fails than the other

With clockwise rotating propellers, there will be :
- greater yawing action when the left engine fails

Consequently, the pilot needs to input :
- greater amounts of rudder and rudder trim to compensate for a failed left engine than for a failed right engine.

In such cases, the left engine is termed the : “critical engine.”

benefit of having counter-rotating propellers is the elimination of the:
- “critical engine” from the aircraft

The critical engine of a multiengine aircraft is defined as:
- the engine whose failure would most adversely affect the performance or handling qualities of an aircraft

Figure 2-19. Counter-rotating propellers.

PROPELLER REMOVAL AND INSTALLATION

Always use the current manufacturer's information when removing and installing any propeller.

REMOVAL

First step:

- Remove the spinner dome in accordance with applicable procedures.

It may be necessary to:

- index the spinner prior to removal so that the spinner may be installed in the same relative position with the propeller to maintain pre removal balance.

Second step:

- Support the propeller assembly with a sling

If the same propeller is to be reinstalled and has been previously dynamically balanced:

- make an identifying mark (with a felt tipped pen only) on the propeller hub and a matching mark on the engine flange or propeller shaft
- to make sure of proper orientation during reinstallation to minimize dynamic imbalance.

Third step:

- Remove the lockwire and/or safetying devices

Use caution to prevent:

- scratching the propeller during the removal of the lock-wire

- Remove the hardware securing the propeller to the shaft

It may be necessary to use:

- special wrenches

Do not allow the tools to damage the :

- crankshaft, engine case, or propeller

Fourth step:

- Place the propeller on a suitable cart or fixture for transport or storage

INSTALLATION

Most flanged propellers have:
- six studs configured in a four inch circle.

Dowel pins may also be:
- used to absorb torque during operation and index the propeller with respect to the propeller shaft

Perform the applicable steps to :
- clean the engine flange and propeller flange with quick drying stoddard solvent or methyl-ethyl ketone (MEK).

(Observe safety precautions when handling such chemicals)
- Install the O-ring in the O-ring groove in the hub bore or on propeller shaft.

(NOTE: When the propeller is received from the factory, the O-ring has usually been installed or is included with the shipment)
- With a suitable support, such as a crane hoist or similar equipment or adequate personnel; carefully move the propeller assembly to the engine mounting flange in preparation for installation.
- Install the propeller on the: engine flange
- Make certain to align the: dowel pins, if used, with the corresponding holes in the engine mounting flange
- As the attachment studs are longer than the dowel pins, ;

exercise care when threading the studs through the mounting holes to avoid damage to the threads.
- The propeller may be installed on the engine flange in a: given position, or 180° from that position.
- Check the engine and airframe manuals to determine if: either manual specifies a propeller mounting position.
- Insta ll the propel ler mount ing ha rdwa re per: manufacturer's instructions
- Torque the propeller mounting nuts or bolts in accordance with the: proper specifications and safety wire the studs or bolts in pairs (if required by the aircraft maintenance manual).

- If safety wire is not used: install the appropriate safetying device.

- Be careful to prevent slippage of wrenches during the torquing process.

- Following the installation of the propeller, the technician must : connect any additional items included with the propeller system, such as wires for the propeller de-icing system.

- If equipped, the spinner must be installed: Spinners range from small simple units retained by a single screw,

- As spinners are part of the rotating mass during operation, technicians should: index the spinner in relation to the spinner bulkhead so that during reinstallation the two may be reunited in the same relative position.

- Some manufacturers index : the spinner and bulkhead at the factory

- Reinstalling the spinner in a different position may result in: vibration during operation.

- It will be necessary to perform a: post installation test of the propeller.

- After the test, the technician should check for: oil leaks on controllable-pitch models and correct any defects

- Next, the technician should complete the : appropriate paperwork

PROPELLER CLEARANCES

propeller is capable of causing :

- damage to itself, the engine, and surrounding objects.

when the aircraft experiences a propeller strike:

- the propeller and engines will need to be inspected and repaired.
- In extreme cases, the engine and propeller will need to be replaced.

To minimize the risk of encountering propeller strikes:

- an array of clearances between the propeller, ground, water, and structure has been established.

for nose wheel aircraft the minimum clearance between the tip of the propeller and ground is

- seven inches (18 cm)

for a tail wheel aircraft:

- nine inches (23 cm)

These clearances are when the aircraft is in its normal takeoff or taxing attitude, whichever is most critical.

There is a requirement of at least 18 inches (46 cm) of clearance between the propeller and:

- water on aircraft that land and takeoff from the water

A requirement of at least one inch (2.54 cm) of clearance in a :

- radial direction is required from the tip of the propeller to the structure of the aircraft

Additional radial clearance may be required to prevent:

- detrimental vibrations

There must be a minimum of 1⁄2 inch (1.27 cm) clearance between:

- any part of the propeller blade and any stationary part of the aircraft.

Positive clearance between the:
1, rotating parts of the propeller
2, spinner
3, stationary parts of the airplane
is required.