

*One of the most vital parts of the plane,
too often it is ruined or
allowed to grow feeble before its time
because of ignorance and neglect*

Your Propeller

It has been said that professional general aviation pilots can be distinguished easily from the amateurs by the care they take with preflight and postflight inspections. But a remarkable fact is that even among the most professional, a sizeable number give scant attention to one of the most vital parts of their flying machines. The propeller, an airfoil assembly that—as its name implies—propels a plane into motion and through the air, is too often given no more than a passing glance during the walk-around.

The most highly stressed part of the airplane, it is probably the most abused from the standpoint of attention and care. Its singular vulnerability to damage, coupled with widespread lack of understanding of its proper care, contribute to dangerous and costly neglect.

With virtually every general aviation airframe manufacturer gearing for greatly accelerated production, AOPA sought to learn what is happening today in the propeller industry, without which piston-engine aircraft would be thrustless and unable to fly. Its findings indicate that the estimated \$10,000,000 annual propeller manufacturing and maintenance business has all that it can handle in keeping up with the current production demand. More knowledge by plane owners that would contribute to longer life of their propeller

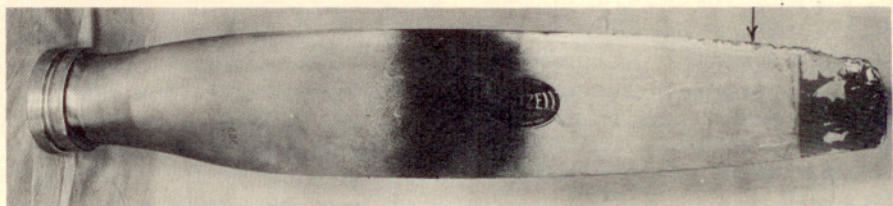
assemblies therefore would be regarded as a boon to the propeller industry as well as the owner's pocketbook.

FAA's consolidated listing of certificated repair stations for 1964 includes five major propeller manufacturers in this country and about 70 repair shops that specialize in propeller work. The manufacturers produce an estimated 60,000 to 75,000 props a year for installation on new aircraft and for replacement of worn or damaged blades.

While airframe and engine technologies have advanced prodigiously since the beginning of powered flight, the evolution of the propeller, because of its very nature, has been more subdued. Some manufacturers view as the greatest single advance in propeller know-how that of the Wright brothers when they adapted the principle of the steamship pusher-type prop to a tractor-type whose thrust would pull a heavier-than-air machine through the atmosphere. "We wonder what they thought about," said one manufacturer, "in the way of the propeller blade activity factor, pitch distribution, airfoil section, number of blades, body effect, vibratory stresses and other engineering matters that must be considered today in designing and creating propellers for planes built to specific performance criteria."

Other propeller experts see as major

Here is a neglected propeller blade headed for an abbreviated end—both in life and length. Badly dented and nicked tip and leading edge above is shown in closeup below. Arrows indicate areas corresponding to location of fractures in failed blades



Needs Care

advances in the technology the advance from wooden to mass-produced metal props and subsequent steps forward to durable alloy controllable and constant speed air foils. Less spectacular but similarly significant improvements have been seen in recent years in performance, serviceability, maintenance and reliability of lightplane props.

There are two primary sources of propeller damage and failure. By far the most commonly cited prop damage is tip and leading-edge scratches, nicks and dents caused by foreign objects. Some of this can be prevented by avoiding high r.p.m. ground run-ups and landing on unpaved runways. A second common form of damage is the bent or twisted prop. This damage is usually inflicted by contact with large or fixed surfaces—noseovers, towbars, taxiing into holes or over tiedown posts, wheels up landings—or by trying to move the plane by pulling on the propeller blades. Usually more readily apparent, such damage requires replacement or extensive reconditioning work.

Nicks, dents, scratches and surface roughness—the latter usually caused by sand or dust abrasion, water or climatological corrosion—can lead to prop failure if not spotted and corrected promptly. Nicks and deep scratches (one-sixteenth of an inch or more in depth) create what is known as stress

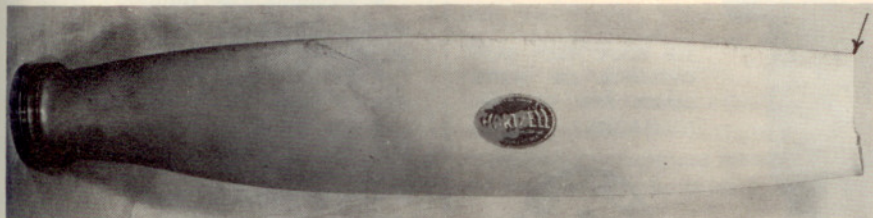
raisers or points of concentrated stress. On today's higher-powered aircraft especially, if these stress raisers are not promptly and expertly removed they can cause fatigue cracks to develop in short order.

The propeller is constantly subjected to extremely high centrifugal forces, bending moments due to thrust and torque, and vibratory forces from the engine while a plane is in flight. That is why it is especially susceptible to the risk of what appears to be minor damage becoming a major problem quickly.

Each propeller blade theoretically has a service life greater than that of the aircraft or engine at the time of its original installation. If it is properly maintained and serviced and carefully checked before and after each flight, chances are that the prop will never have to be replaced. Unattended damage, however, will quickly shave away its prospective service life.

How can the nonmechanically minded pilot tell whether his prop is actually damaged and whether that damage may result in incipient failure? There are a number of indicators, both in appearance and performance, that repair stations regard as danger signals. As mentioned above, any dents, nicks, scratches or surface roughness should be inspected critically. If there is the slightest suspicion that the damage may

The end result of propeller neglect may be the loss of tip in flight. Origin of fracture, a comparatively shallow dent, is indicated by arrows in full and cross-sectional views



Sp
ab
co
on
by
to
R:
la:
C:
R/
O:

t

A
y:

G

Ia

D
in
ca
is
fe
el
fi

affect the propeller's proper operation, a qualified repairman should be consulted. Chief among other indicators of potential prop failure are these:

Rough, irregular operation at low r.p.m.; abnormal rotational or end play; controllable props may gradually reduce their rate of pitch change; a reduction may be noted in rate of feathering, or props may fail to feather; the engine may surge on take-off or during normal cruise; r.p.m. may not develop in the normal manner or the prop may not appear to control r.p.m.; oil or grease leaks may be noted around the hub; propellers on multi-engine aircraft may not remain synchronized.

There are other abnormalities which, if not taken care of, may lead to serious trouble affecting not only the propeller, but other parts of the plane that are affected by propeller action. Manufacturers say the best course of action is to contact a qualified repairman at the first suspicion of abnormal propeller action.

Every repair shop and prop manufacturer offers his own list of do's and don'ts that will contribute to a longer and more reliable life for propellers. A compilation of some of those recommendations might well serve as a prop check list for all pilots:

- Don't allow your propeller to get full of nicks and dents.

- Don't fly a plane whose propeller is damaged.

- Don't try to straighten or recondition a damaged propeller or install a replacement yourself. It takes the knowledge, tools and skill of an expert mechanic. Besides, it's a violation of rules.

- Don't let anyone work on your propeller unless you are confident that he is qualified and certificated by FAA to perform such work.

- Don't push or pull on the propeller as a means of moving the plane on the ground.

- Don't perform engine run-up on surface areas of loose rocks, sand or gravel.

- Don't operate a plane for more than 18 months between propeller assembly overhauls.

- Be aware of and familiar with manufacturer's publications and FAA manuals related to the propeller on your plane.

- Examine the propeller dome assembly frequently for excessive sludge accumulations.

- Be sure that spinners do not rub against blade shanks or hub parts.

- On controllable props, keep the hub well greased to prevent rust and corrosion.

- Wipe propeller blades off with an oily rag occasionally to prevent corrosion.

- *Always* perform a careful visual inspection of the entire propeller immediately before and after each flight.

By following these few common sense suggestions the propeller on your plane should give you little trouble or cause for concern. ●