The Care and

■■The original Wright Flyer displayed a formidable disdain for tires and brakes. It had neither. And while aircraft design has advanced considerably since Kitty Hawk, the attitude of pilots towards their airplane tires and brakes has not. All pilots use them, many pilots abuse them, but hardly any pilots give them a second thought.

The blame for this blasé behavior by the pilot fraternity can really be laid on the doorsteps of the makers of tires and brakes. They make them well, so well in fact that some brakes and tires go for seasons, even years, with little or no care at all.

Such blind faith in one's landing gear is quite a tribute to the manufacturers. It's also ill-advised. You see, tires do wear out and brake pads do wear thin. Woe to the pilot who rides the concrete ribbon on gear pushed past the brink.

So to avoid some unpleasant surprises from the neglected gear below, a few words on the care and feeding of aircraft tires and brakes:

The most common problem besetting aircraft tires is improper inflation, or, more precisely, underinflation. This matter of too little air for too much tire can produce a chain reaction in damage, but the net result is always the same—a shorter tire life.

Underinflated tires tend to wear heavily in the shoulder area of the tread. Low tire pressure also increases the chances of bruising the sidewalls and shoulders against rim flanges and may cause inner tubes to slip and shear off the valve stems, with obvious consequences.

Heat, the tire's worst enemy, also comes with underinflation. Aircraft tires are designed to flex more than auto tires. That's why they can withstand the tremendous shock of touchdown. However, that same pliability increases friction, which in turn causes heat. When the flexibility of tires is increased by underinflation, the heat effect is aggravated and the temperatures soar. When tires get very hot, the tread and carcass materials begin dissipating and the tire is permanently weakened.

This heat damage may not be immediately noticeable, but it does occur. In fact the heat damage resulting from an aborted takeoff in a high-performance aircraft is so severe that all the tires should be scrapped immediately, whether they look bad or not.

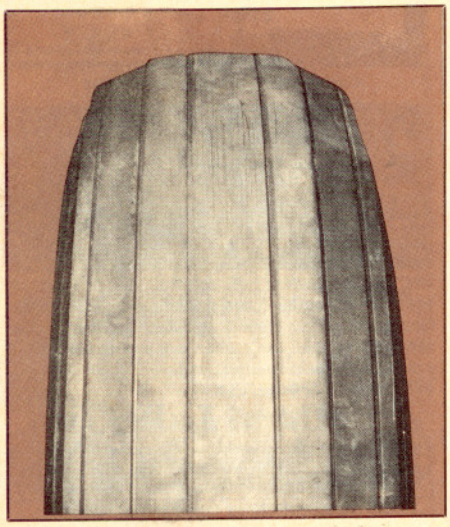
Overinflation has its own bag of maladies. When pumped full of too much air, a tire will wear excessively in the center of the tread, thus decreasing traction and increasing the likelihood of cut treads.

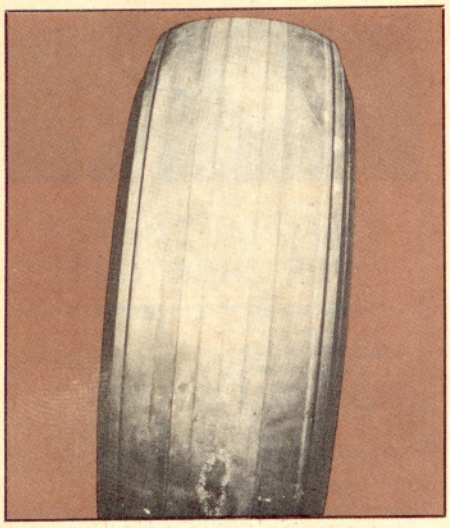
The procedure for correcting overinflation or underinflation is simple enough: pump air in or let it out, accordingly. For checking tire pressure, an ordinary hand gauge should be used. The gauges found on compressed air pumps have been known to tell lies.

Before testing his tires for proper inflation, the aircraft owner should be aware of a few tire idiosyncrasies.

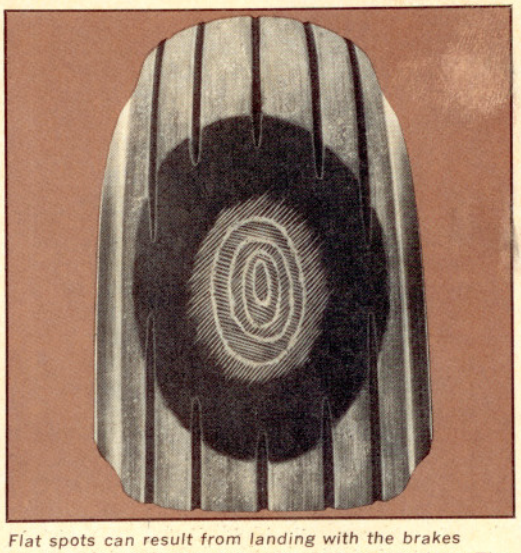
During landing and rollout, the air within a tire will have been heated by friction. This warm air will be at a greater than normal pressure, since heat expands. Consequently, tires should be allowed to cool off for two or three hours before being checked for proper inflation.

A tire operated at below-normal inflation levels shows excessive wear on both shoulders. Increased flexing caused by underinflation can age the tire prematurely.





An overinflated tire, such as this one, wears rapidly in the center part of the tread.



Flat spots can result from landing with the brakes on, pivoting with a locked wheel, or heavy braking. Tire should be replaced when the casing is exposed.

Show them a little tenderness and all your landings will be happy ones

Feeding of Tires and Brakes

This hot-tire deception also comes into play when you fly from hot to cold climates. Try flying from Miami some balmy January morning and then landing, say, in icy Atlanta. The tire pressure will have dropped considerably, about a one-percent decrease in pressure for every five-degree drop in outside air temperature. This same kind of drop can be expected when a plane is rolled out of a heated hangar and onto a frigid ramp. Pilots should anticipate this pressure change and intentionally overinflate their tires to compensate for it.

Too much pressure can only be caused by pumping too much air into the tire, but underinflation can result from a variety of causes.

One of the most common complaints about general aviation tires—and there really aren't very many—involves pinhole leaks in sidewalls of tubeless tires. Well, they were designed that way.

All tires, be they tube or tubeless, are subject to air seepage over extended periods of time. In the case of tubeless tires, air escaping from the inner liner could be trapped by the tire plies and result in sidewall blisters, a very serious problem. To prevent this blistering, the tire manufacturers have built sidewall vents into the tires so the trapped air can escape fully.

As noted earlier, tread wear can signal an airplane owner of either under- or overinflation. There are tread-wear warning signs as well.

Should the tread show excessive wear on just one side of a tire, there's a good chance the wheel is out of line. Righting that situation is a job for a mechanic.

Excessive wear in one section of the tire could mean the wheel is out of balance, since the heavy side of the tire would have a tendency to strike the runway first on landing. Unbalanced tires can also produce excessive vibration during ground operations. As with alignment problems, balancing also falls within the mechanic's bailiwick.

When visually inspecting a tire, a pilot is likely to find all kinds of lumps and bumps and cracks, but few such blemishes will actually disqualify a tire for continued service. Generally, a tire is still safe and fully operable as long as the fabric is not exposed and as long as some groove remains in the tread. The strength of the tire comes from the fabric "carcass," and not from the rubber tread. Therefore, if the carcass is protected, the strength is retained. The grooves in the tread exist primarily to permit water to pass under the tires, thus minimizing the danger of skidding or hydroplaning on wet runways. Bald tires set on a rain-slick runway could make for an interesting ride, since skidding tires are uncontrollable.

Blemishes that do require a tire's removal include any severe blisters, any cuts in the tread that extend more than half the distance between two grooves, and any cuts that expose the fabric beneath.

A pilot can reduce the chance of serious tire cutting by keeping ground operating speeds at a minimum. Since aircraft tires are under relatively high pressure, they're more susceptible to nicks and cuts than are automobile tires. High-speed taxiing drives rocks, gravel and similar debris farther into the tread.

One type of tire cut comes from no fault of the pilot at all. Given time, tires exposed to smog, sunlight and weather in general will develop a random pattern of shallow fissures on their sidewalls. Tire men call this "weather checking." Unsightly as it may be, it does not affect tire strength as long as the fabric is covered.

Since a tire's strength is in the carcass and not in the tread, old tires can get a new lease on life when given a new tread. Retreading, long common in the auto industry, is also extensively practiced in aviation. Airlines and the military are the heaviest users of retreaded aviation tires, but there are several general aviation retreading firms as well, scattered around the country. Flight schools are these retreaders' prime customers, but the service is available to everyone.

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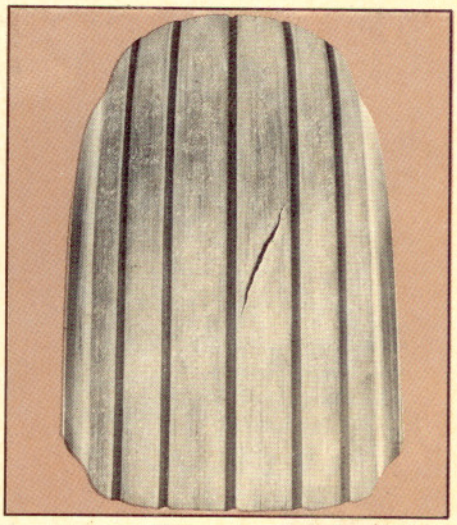
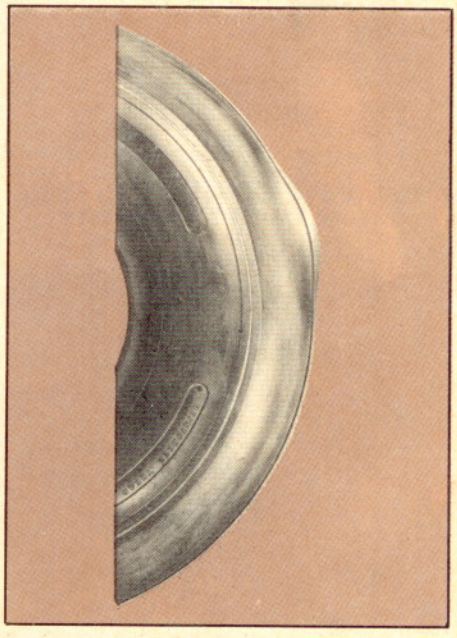
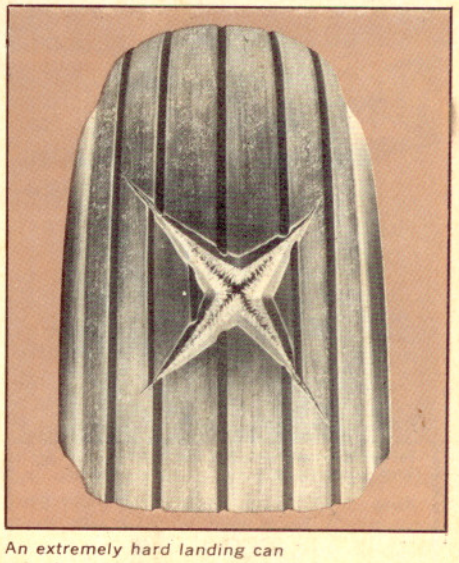
Since this cut extends across more than 50 percent of the tire rib, the tire should be replaced.



This bulge is an example of tread separation from the casing underneath, due to excessive loads, cuts, or flex heating from underinflation. End of the road for this tire. Photos courtesy of Goodyear Tire and Rubber Co.





An extremely hard landing can actually rupture an aircraft tire.

The cost of retreading a tire is about half the price of a brand-new one, but in most cases the tire owner must also pay shipping costs.

Many users maintain they get longer wear out of their retreaded tires than out of new tires, a fact that delights the retreaders and goes pretty much unchallenged by tire makers.

A spokesman for Goodyear Tire and Rubber Co., the largest aviation tire manufacturer, said a retreaded tire may indeed last longer than a brand-new tire, because the retreads can actually be thicker than the original tread. However, the Goodyear spokesman noted correctly that a tire carcass has just so many lives, and a retreaded tire is automatically one life old with its first retread. The maximum number of retreadings for most general aviation tires is about three.

FAA regs do permit aircraft owners to remove, repair and install tires, but the people at Goodyear suggest that such major tire care should really be left to a mechanic. Jacking up an airplane and removing a tire from a wheel requires special tooling and a good bit of know-how. A novice could get hurt. An airplane tire is under rather high pressure, so high that a valve core can come out like a pistol shot.

With simple maintenance like proper inflation, and slow taxiing speeds, an airplane tire can last in excess of 500 landings. That's a lot of flying, and certainly about the time for a mechanic to look over the plane anyway. Have him inspect the landing gear while he's at it, and if it's time for new tires, let him be the one to wrestle with the rubber.

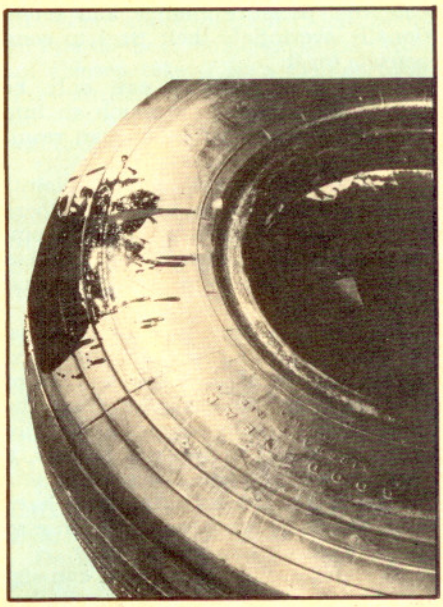
Two last notes on tire care. Oil, brake fluid, grease, tar and the like have a deteriorating effect on rubber. Should such goo be found on a plane's tires, the junk should be removed by wiping the tire with a gasoline-dampened cloth. Then the area should be washed with soap and water. Also, electricity changes oxygen to ozone, which prematurely ages rubber. So, if a plane is placed in storage, it should be kept in a cool, dry place away from electric motors.

A natural companion to good tire care is the proper use and maintenance of an airplane's brakes. All pilots need brakes to stop and to turn, and so presumably they all know how to use brakes. Not so.

There's a common assumption that continued braking causes heat and that heat is bad for the gear. That's true. But many pilots also assume that intermittent braking, or pumping the brakes, will help cool the gear and thus reduce the heat threat. That's false.

Studies by the military show that such intermittent braking during rollout does not provide enough cooling to justify the extra runway a pilot wastes in the procedure. The fact is that the heat buildup takes time, and in some cases wheel and tire temperatures don't reach their maximum until 15 to 30 minutes after heavy braking. The plane could be tied down and the pilot working his second cup of coffee by that time.

Another common braking error involves sharp turns, or pivoting. An aircraft should never be pivoted by locking one wheel. It's bad for the tire, since the sheer forces involved can severely strain the casing plies, sidewalls and beads of the tire. A small rock can actually be screwed into the tire in such a maneuver. During tight turns the inside wheel should be allowed to roll on as large a radius as possible.



Oil, tar, brake fluid, degreasing agents and chemicals can cause rubber to deteriorate. Tires should be wiped clean with a gasoline-dampened cloth and then washed immediately with soap and water.

Obviously, landing speeds should be kept to a minimum, since high speeds call for heavy braking. That in turn means faster wear on the brake pads and excessive heat buildup in the tires.

As far as brake maintenance is concerned, FAA is not nearly as lenient as it is with tire care. Almost all aircraft brakes today are hydraulic, and FAA will permit the owner to fill the brake's hydraulic reservoir when it gets low. And that's all. Everything else involving brake care must be done by a mechanic.

The foregoing seems like a lot to do and remember about tires and brakes. What it really boils down to, though, is this: For the longest wear from your aircraft tires and brakes, keep the air pressure up and the ground speed down. By following those two simple rules, pilots can leave the road worries to the roadhogs and get on with the business of flying. □