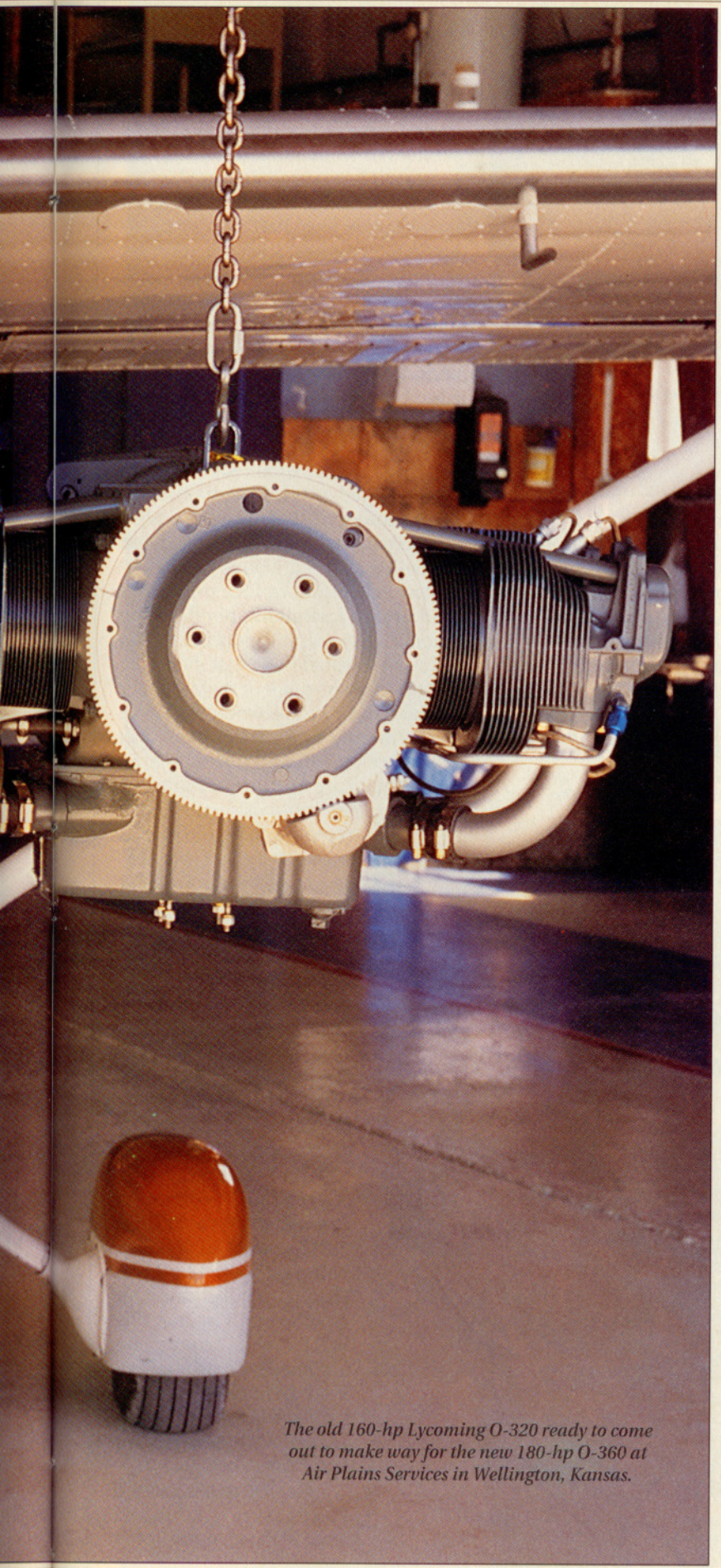


The old 160-hp Lycoming O-320 ready to come out to make way for the new 180-hp O-360 at Air Plains Services in Wellington, Kansas.

PHOTOGRAPHY BY MIKE FIZER

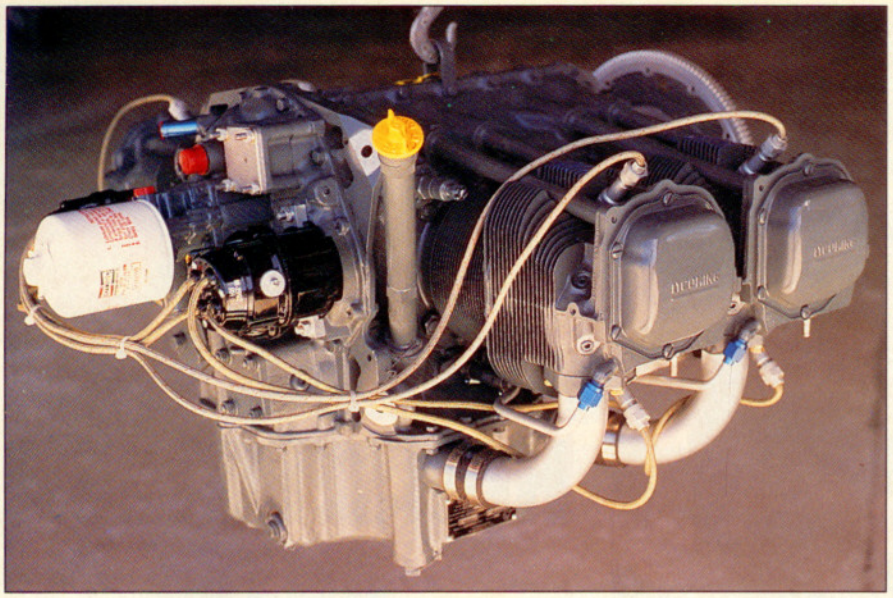
BETTER THAN NEW 172

UPPING THE HORSEPOWER ANTE

Engine upgrades bring performance but at what cost?

BY THOMAS B. HAINES

Packing additional performance punch into an airplane seems simple: Decrease drag, or increase horsepower. But neither is possible without referencing that first law of aerodynamics: There is no free punch. ■ Starting with a clean sheet of paper, one can minimize drag by building a tiny, narrow airplane with stubby wings. It will go fast on little horsepower, but the passengers and crew will be uncomfortable, and unless heavy and exotic wing devices, such as slats and slots, are employed, the stall speed will be high. ■ Building a bigger airplane means more weight and additional horsepower. Extra horsepower usually means more drag in the form of a greater frontal area, even more weight, and the requirement for additional fuel, which adds weight or detracts from useful load. ■ In our Better Than New 172 project, we didn't have the luxury of a clean sheet of paper. Our subject is a 1978 Cessna 172N that *AOPA Pilot* is refurbishing and modifying this year. Our goal is to take advantage of the per-



formance, safety, and comfort improvements that have developed since the airplane was manufactured. Come January 1995, it will be given to some fortunate new AOPA member or one who renews his membership in 1994. Later in the year, we'll write about airframe mods and ways to improve the avionics, interior, and paint, but our first task was increasing the power.

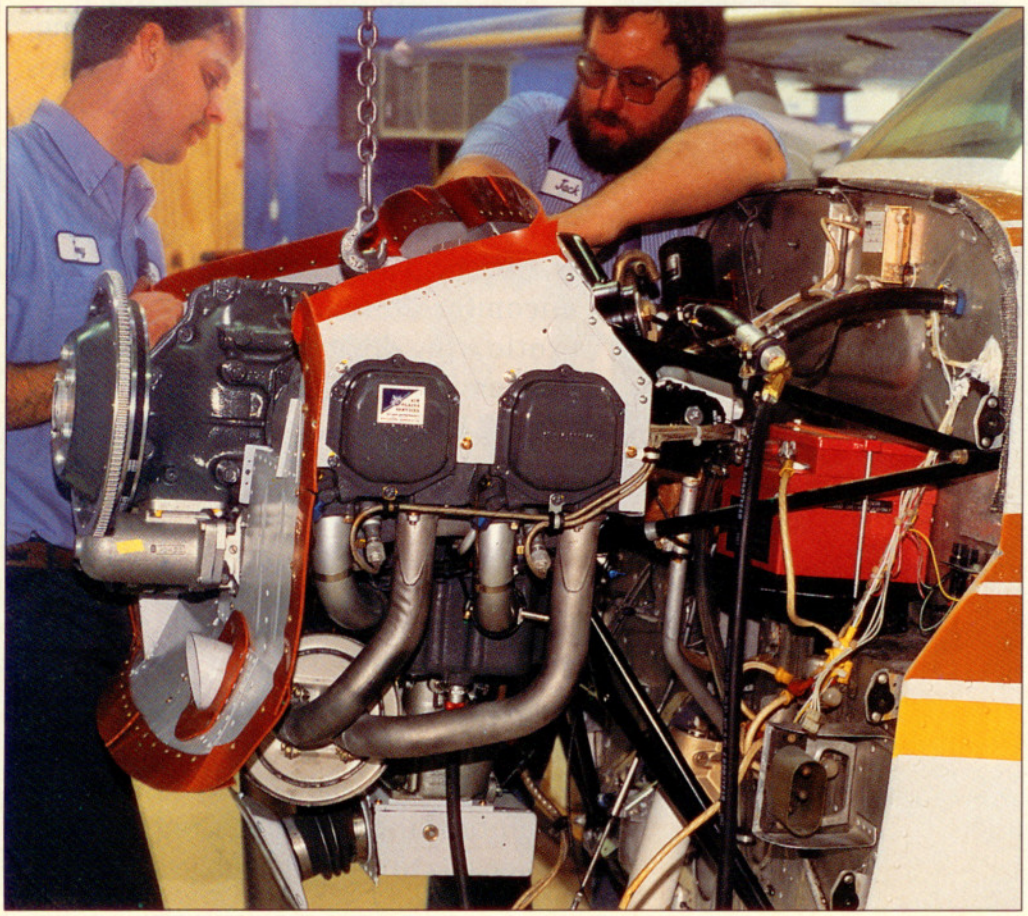
Bearing in mind the Catch-22 of aerodynamics, we decided to replace the 160-horsepower stock engine with a 180-hp powerplant and to apply a few simple wing improvements to boost runway performance. We'll discuss the wing changes and other airframe mods in a later issue.

The best thing about the engine upgrade is that the larger powerplant can be wedged into the same cowling, which means no additional drag.

A number of companies can perform engine upgrades for Cessna 172s. One of the most prolific is Air Plains Services of Wellington, Kansas. In the 12 years it has owned the supplemental type certificate to replace the stock Lycomings in post-1967 172s with 180-hp O-360 engines, the company has completed some 500 deliveries, according to Darrin Jacobs, general manager. Penn Yan Aero Services of Penn Yan, New York, is another company that owns a similar STC. Included in both cases are new fixed-pitch Sensenich propellers.

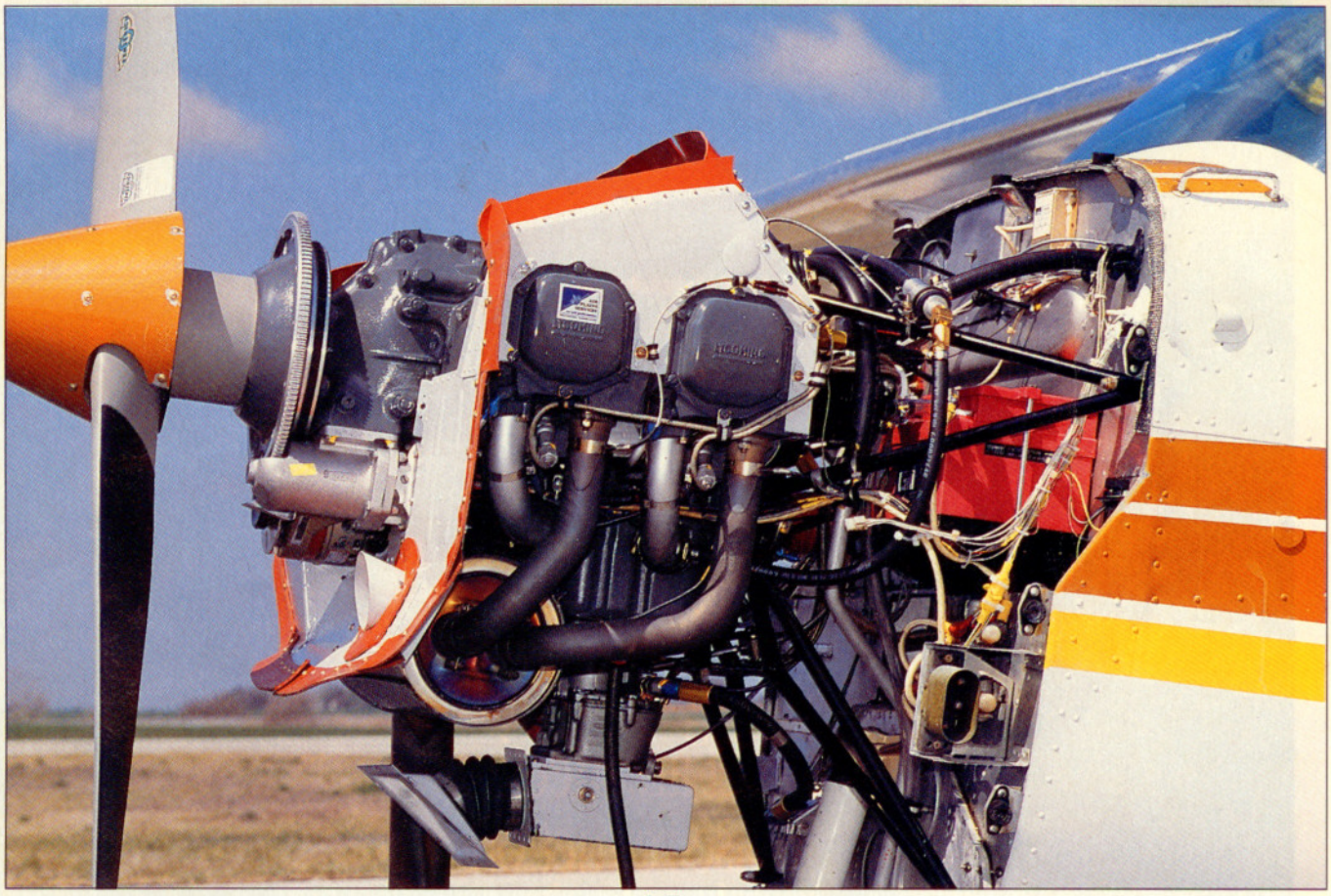
Avcon Conversions and Bush Conversions, both of Udall, Kansas, offer similar fixed-pitch conversions for some models of 172s. They also offer some variants with constant-speed propellers. The constant-speed propellers somewhat reduce pilot work load during turbulent operations by automatically keeping propeller rpm in check. One would think that the ability to fine-tune the pitch of the propeller for takeoff or cruise would increase performance in both regimes, but reports we've seen and comments from owners indicate that the performance advantage is small, though company literature reports impressive gains. The necessary governor, heavier propeller, and associated hardware make the airplanes heavier and increase maintenance costs, and the costs of the kits alone can run an additional $2,000 to $3,000 over the fixed-pitch variants.

Besides the 180-hp engine with its tidy new baffling, Air Plains has many STCs for 172s such as a manifold battery upgrade à la factory 172Ps that eliminates the battery box.



Those looking for a serious boost in horsepower may want to consider a 220-hp Franklin engine conversion. The Franklin engines are now built in Poland by PZL and are being imported by Atlas Motors, Incorporated, in Winchester, Virginia. The STC for the 172 conversion is owned by Arizona Aero Mods in Sonoita, Arizona, but the company is not yet able to deliver kits; that may change by year-end.

Both Penn Yan and Plains were anxious to work with us on the Better



Than New 172 project. We have used Penn Yan previously for an engine overhaul and thus were familiar with its good work. We had never dealt with Air Plains, but we had flown several of its 172 conversions and were impressed with the quality. In addition, Air Plains has the ability to install a number of other modifications on-site, such as Flint Aero fuel tanks, which we felt were necessary to increase the 172's endurance and to feed the thirstier 180-hp engine. Located just down the ramp from Air Plains is Horton, Incorporated, which specializes in producing STOL kits, another mod of interest. So with one-stop shopping in mind, we headed west to Kansas.

Our N model N737QN is a particularly good candidate for an engine upgrade because of the notorious O-320-H2AD engine out front. That particular model of engine, installed in 172s from 1977 through 1980, quickly earned a reputation for munching down camshafts and lifters. Lycoming eventually fixed many of the concerns, and today the engines often reach time between overhauls with few problems, but the reputation remains. 172Ns represent about one third of the Lycoming-powered 172s, but Jacobs says the model represents nearly 80 percent of the conversion market.

We decided to replace the 160-horsepower stock engine with a 180-hp powerplant.

We picked up N737QN after its engine conversion in late March just two days before Air Plains received its STC to install the 180-hp Lycoming engines in the 172G and 172H models, as well. The G and H models, built from 1965 through 1967, are powered by 145-hp Continental O-300 engines. Eventually, the company plans to be able to offer engine upgrades to all of the early 172s. Air Plains also was about to receive an STC to replace the 235-hp Continental O-470 engines in some models of Cessna 182s with a 285-hp Continental IO-520.

For those satisfied with the 160-hp performance of their 172Ns but anxious to be rid of the -H engine, Air Plains can provide a kit to install the 160-hp Lycoming O-320-D2J engine that Cessna put on its 172P models. The kits, sans engine, start at $995.

But looking for more performance, we opted for the 180-hp kit, which includes an O-360-A4M engine. The complete Air Plains kit normally includes a factory-new engine, but for the Better Than New 172 project, Lycoming offered to provide us with a factory-rebuilt engine. Last year, Lycoming provided a factory-overhauled engine and installation for our Good As New 172 project (see August 1993 *Pilot*). In a factory-overhauled engine, parts must meet Lycoming specifications, or they are replaced. The components of a factory-rebuilt engine meet new limits, and the engine gets a new logbook and serial number.

As part of its overhaul process, Lycoming supplies either new or overhauled magnetos, starter, and carburetor, depending on the type of overhaul specified. New engines, of course, contain only new parts. To that, Air Plains adds a new Sensenich propeller, spacer, and bolts; rebuilt alternator; and a host of parts it builds itself under parts manufacturer approval. Among the Air Plains–built parts are baffle, airbox, and exhaust modifications and a cowling mod that repositions the oil door

on the 172N models. The -H engines require the oil door on the top of the cowl. The O-360-A4M engines require the door on the right side of the cowling. Also included in the kit are new engine mounts and bolts, fuel and oil lines, scat hoses, air filter, alternator belts, and vacuum hoses.

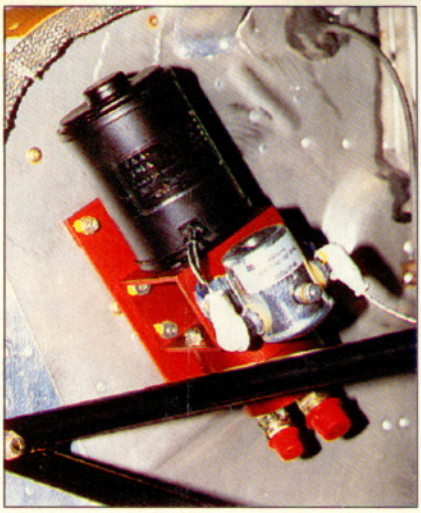
The extra horsepower makes the modified airplanes eligible for a gross weight increase to 2,550 pounds when six-ply tires are installed and when flap travel is limited to 30 degrees, as it was on the 172Ps, the last model built by Cessna. In the case of the 172N, the increase means an extra 250 pounds of carrying capability, but the larger engine and the Air Plains components weigh 16 pounds, yielding an increase of 234 pounds. Included with the weight increase is a remarked airspeed indicator denoting about a 3-knot-higher stall speed, both with and without flaps. Those wishing to preserve the short-field capability that comes with the stock 40 degrees of flap travel may forgo the gross weight increase.

The complete 172N kit installed at Air Plains, including a factory-new engine, runs $21,995. The kit can be shipped out for $19,995 for installation at your local shop. Expect to pay for about 60 hours of installation time. Other models of 172s can be converted for $1,000 to $2,000 less, partly because no cowling mod is necessary.

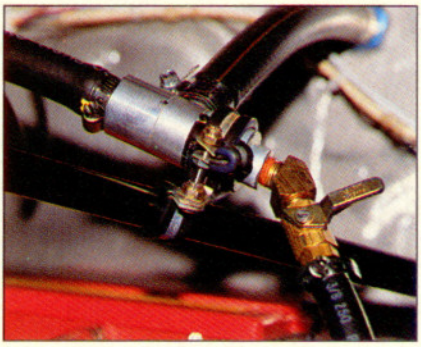
So what's all this do to a 172's performance? Air Plains claims its flight tests show an average increase of 13 to 16 knots in cruise and a 300- to 400-fpm increase in climb rate. Our flight tests before the engine conversion show that N737QN cruised at about 118 knots at 2,600 rpm at about 3,500 feet and at about 400 pounds below gross weight while burning just under 10 gallons per hour. The pilot's operating handbook says it should make those speeds at 2,550 rpm at the stock gross weight of 2,300 pounds and on only 8.4 gph.

Air Plains performed flight tests on the airplane after the Horton STOL kit was installed but before the engine conversion, and again after the conversion for FAA certification purposes.

We were able to fly the airplane only briefly after the engine conversion and STOL kit installation before it was due at the interior and avionics shops, but preliminary numbers show a cruise of 127 to 130 knots true airspeed at low altitude and nearly full throttle but at a budget-draining 15 gph. As part of the engine break-in process, we did not lean the mixture. After break-in, the fuel burn should decrease to about 10 gph. We'll report more specific performance and fuel-burn numbers in a later issue.



To improve safety and reliability, we added an Oilamatic Preoiler (above) and a Precise Flight standby vacuum system. The Oilamatic eases starting wear and tear; the Precise Flight does the same for the pilot if the vacuum pump fails.



At least based on the rules of aerodynamics, the engine upgrade for the 172 is a good choice. The performance boost allows a generous increase in gross weight that far more than offsets the weight of the engine. There is no increase in drag. When burning 10 to 12 gph, endurance will be decreased, but you have the choice of throttling back to fly at the speeds and fuel burns of the stock airplane. The installation of the Flint auxiliary tanks, which we'll discuss in more detail in a later issue, offset the extra fuel burn and even allow an increase in endurance. A free punch? No, it costs nearly $22,000, not including the extra fuel tanks.

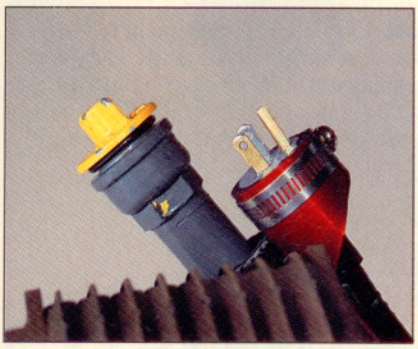
But our Better Than New 172 project is not just about performance. Our other objectives are to improve the safety, reliability, and comfort of the airplane, as well.

We took on the safety and reliability

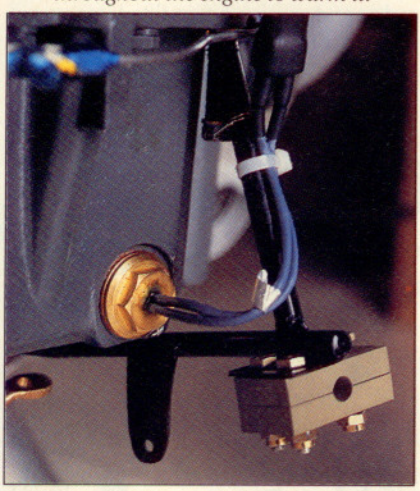
issues by making several improvements to the stock engine instrumentation and to the engine itself.

One of the most damaging times in the cycling of an engine is the startup. To decrease engine wear and ease starting, we installed a Tanis engine heater and an Oilamatic engine preoiler.

The Tanis TAS-100 heater, priced at $381 (uninstalled), is a simple system that can be installed on a four-cylinder engine in about an hour, according to the manufacturer. Hot plugs, which look like cylinder head temperature probes, are installed in each cylinder head and in the intake oil screen. Flat thermal pads are attached to the oil pan and the crankcase. A three-prong power lead is secured to the oil dipstick. Connect an extension cord from the power lead to a wall



Plugging in the Tanis TAS-100 engine heater energizes probes and thermal pads throughout the engine to warm it.



socket and throw a blanket over the cowling, and in about five hours, the oil will be up to at least 40°F, even with outside temperatures as low as -30°F.

Further easing the startup process is the Oilamatic Preoiler, a nifty electric oil pump that mounts to the firewall (see "Airframe and Powerplant: In the Lube," March *Pilot*). A push of a button on the panel activates the pump and sends oil through the engine and brings oil pressure up to operating range before the starter is engaged. The Oilamatic sells for about $1,200 for singles and $2,200 for twins. Single-engine installation takes about a day.

Sigma Tek provided us with a new vacuum pump for the Better Than New 172 project, but even the best pump can fail at the worst of times. As a fallback, we also installed a Precise Flight standby vacuum system. The Precise Flight SVS III system alerts the pilot to a failed vacuum pump by lighting a red annunciator. The pilot then pulls a cable control knob on the panel that opens a valve connected to the manifold intake. The system works by using the differential between manifold pressure and ambient atmospheric pressure to drive the gyros. To achieve the differential, the throttle must be reduced until the vacuum gauge shows 4 or more inches of mercury. It's not as sophisticated as a separate standby pump, but there are few moving parts and little weight, and the price is only $429, compared to thousands of dollars for more sophisticated systems that often take more maintenance. Installation is four to six hours.

Air Plains also installed a passel of probes for some new electronic engine instrumentation. We'll let you know how well it works once the indicators are installed in the panel and we've had a chance to fly with them.

In the meantime, we're now working on the interior and avionics installation. Paint will follow in a few weeks. Look for the airplane with its new N172B registration to debut at the AOPA Fly-in June 11 at AOPA headquarters in Frederick, Maryland. It also will be displayed at Oshkosh and at AOPA Expo '94 in Palm Springs, California, October 20 through 23. □

Air Plains Services, Wellington Airport, Post Office Box 541, Wellington, Kansas 67152; 800/752-8481.

Oilamatic, Incorporated, Post Office Box 5284, Englewood, Colorado 80155-5284; 303/770-0175.

Precise Flight, Incorporated, Post Office Box 7168, Bend, Oregon 97708; 800/547-2558.

Tanis Aircraft Services, Incorporated, Post Office Box 117, Glenwood, Minnesota 56334; 612/634-4772.