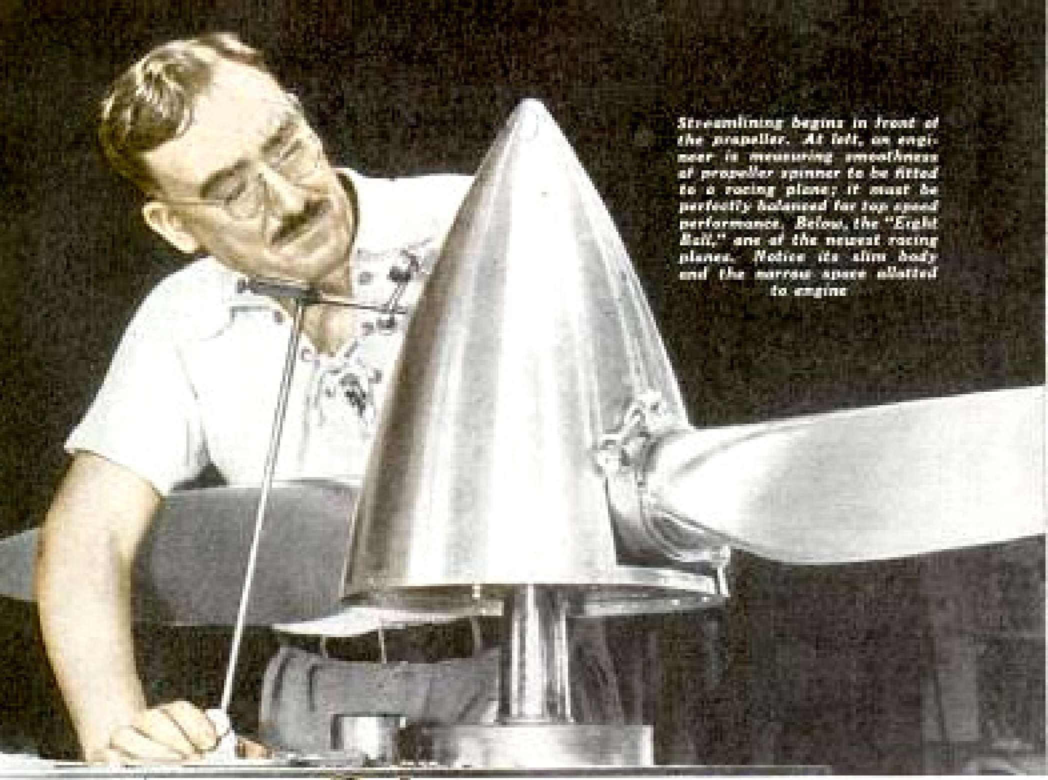


Streamlining begins in front of the propeller. At left, an engineer is measuring smoothness of propeller spinner to be fitted to a racing plane; it must be perfectly balanced for top speed performance. Below, the "Eight Ball," one of the newest racing planes. Notice its slim body and the narrow space allotted to engine

The SECRETS of

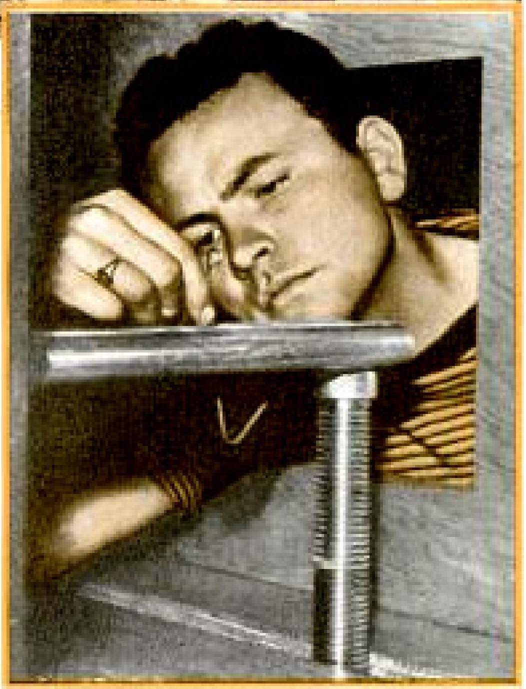
By KEITH RIDER

Race Plane Designer

THE fastest airplane in the world today is an old-fashioned antique. It is an Italian seaplane that cost more than $1,000,000 and set an official record of 440 miles per hour. That was four years ago and the record still stands.

Today we can break that record any time we like at only a fraction of the cost. World records can be bought at bargain prices this year compared with the tremendous sums that have been spent in the past. A 500-miles-per-hour plane now might cost a mere $60,000.

The price of speed has been going down because our knowledge of speed has increased. More is known now about airfoil



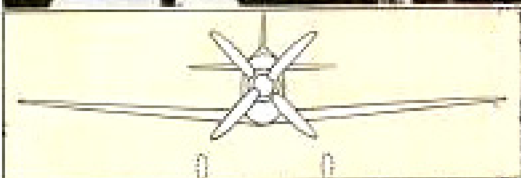
SPEED • •

shapes and engines. The Italians used a special 3,000 horsepower Fiat in their seaplane but with our present knowledge we could make a 1,500-horsepower engine go faster. This because we have learned to obtain high speed by designing more efficient airplane shapes.

The story of speed is written thus: horsepower multiplied by 375 and divided by resistance in pounds equals miles per hour. The figure 375 is a conversion factor. That's the same as saying the more power and the less drag, the faster you go. The frontal area of the engine is the biggest contributing factor to drag, hence in-line engines are "faster" than radials of the same horsepower. Another speed problem is to get the most horsepower out of the lightest engine weight. A light engine requires less wing and a small wing

The author, top, with six-cylinder racing engine rated at 260 horsepower from which 475 horsepower is developed by making changes. Bottom, adjusting hot wire anemometer to measure air flow speed around model plane parts in wind tunnel

Top view of 500 m.p.h. racer showing small wing and extreme thinness of fuselage



Front view of 500 m.p.h. racer showing streamlined wing fuselage

Top, inspecting tail group controls of the "Eight Ball." Bottom, a speedy racer, the "Jeep." Diagrams show top and front views of racer theoretically capable of 500 miles per hour

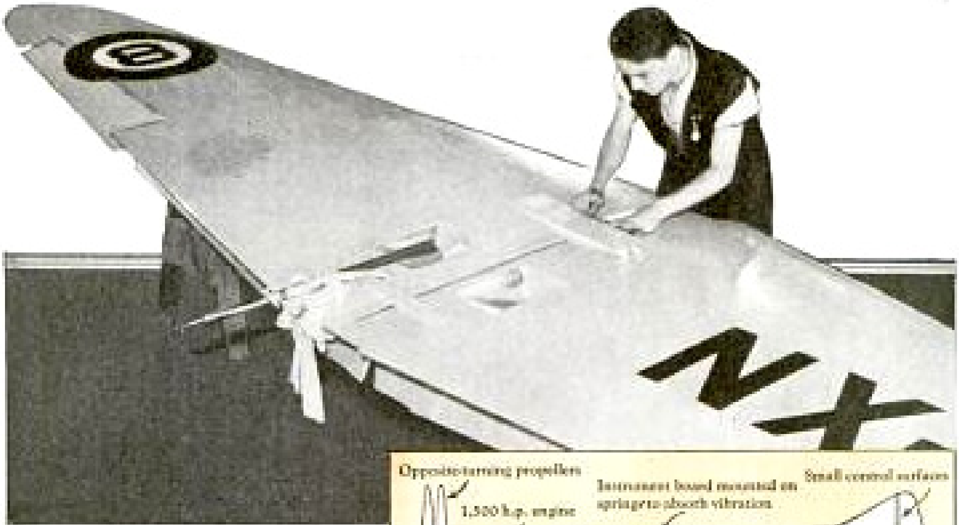
helps reduce drag. In theory it would be feasible to fly a high-speed wingless airplane consisting simply of engine, fuselage, and tail group if there were some way of launching, landing and obtaining lateral control.

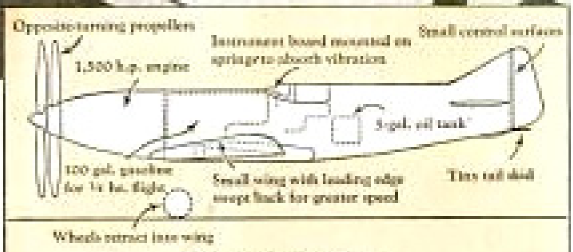
Here's a description of a super-plane that could go 500 miles per hour. No matter where it is built or what minor details are changed, it will follow these major specifications pretty closely.

The plane will be a full cantilever low-wing monoplane resembling present race planes in design. It will be built of wood, full monocoque molded plywood 100 per cent skin stressed. The fuselage and wing skins will be about three-quarters of an inch thick. Wood is better than metal for speed designs because we can shape wood to hold the exact airfoil curves needed.

The wing would have a span of twenty-six feet and the plane would be twenty-three feet long. It would be a land plane, with long flaps to help cut down landing speed, and retractable landing gear. The plane would be entirely enclosed with only a cockpit air scoop and carburetor air scoop opening into the wind. It would land at about seventy-five miles per hour.

The engine would be of 1,500 horsepower, liquid cooled, twenty-four inches by twenty-four inches in cross section and about five feet long. It would probably consist of two V-8 units hooked back to back and driving two propellers, one in front of the other and turning in the opposite direction. Such two-way propellers are necessary to overcome engine torque and give good control. The engine-cooling solution would be cooled by means of skin radiators, as would the oil supply. The power plant would weigh about 800 pounds, developing close to two horsepower per pound, and would have a useful life of only a few hours at open





Side view of 500 m.p.h. racer

Completing race plane wing, top. Side view of plane which might make 500 miles an hour or more and, bottom, small tail surfaces of modern racing plane

throttle. Ready to fly, the plane would weigh about 2,800 pounds. About half its total cost would be for developing and testing the engine.

There is nothing radical about such a plane. Construction could be started any time because nothing really new need be developed. Every part of the design has been tested. The exact top speed would depend primarily upon horsepower and a more powerful engine would make the plane faster still.

Lack of horsepower has been the big drawback to higher racing speeds in the United States. Our best in-line racing engine today, even when "hopped up" as much as the pilot dares, still develops less than 500 horsepower. With such engines pilots expect speeds of better than 300 miles per hour in straightaway dashes. That is quite an advance over anything done so far but hardly comparing with speeds we will make next year if the bigger racing engines that are being discussed become available.

One of these possibilities is a new "unitwin" Menasco consisting of two six-cylinder, in-line, air-cooled engines placed side by side and geared together through clutches to turn a common propeller shaft.

(Continued to page 124A)

The Secrets of Speed

(Continued from page 709)

There are also projects to re-design stock automobile racing engines into lighter and more powerful motors of about 488 cubic inches and turning up to 6,000 revolutions per minute. There has been talk, too, of a tremendous power plant to consist of two 1,500-horsepower, twin-row radials, one mounted behind the other, with the rear unit geared through the front unit to turn two blades of a double propeller. In this case the large frontal area of the radial ought to be more than compensated for by the power the combination would develop.

Eventually, years from now, someone is going to set a speed record that no one can ever beat with the present type of airplane. Man has always flown at about half the velocity of the average revolver bullet and has his eyes set on an ultimate speed of close to 750 miles per hour, the speed of sound. He will never attain that in a winged propeller-driven airplane, of course, for the limiting factor is really the velocity of the air moving around the plane, and the velocity of air over the top of the wing is always greater than the forward speed of the plane. There is a great falling off in efficiency of airfoil shapes above 500 miles per hour, as has been learned by turning propeller blades at such speeds.

Designing a race plane is primarily a matter of building the plane around the best engine available. One way to get speed is to make the wing as thin as possible but structural considerations prevent this from being carried to an extreme. In any event the wing tips are thinned down considerably because there is less need for great strength at the ends.

Another way to get additional speed is to cut down on the size of the wing although this makes the plane sloppy on the turns. A wing loading of twenty-five pounds per square foot is about right for planes competing in closed-course races. Heavier wing loading will make the plane faster in straightaway flight but it will mush badly and lose speed on the turns. Sometimes during an air race you will see one fast plane catch up with a competitor on each straight leg and then drop back as the other plane makes a tighter and faster turn.

One of the biggest problems in designing a fast plane is to find room inside for all the gear and tanks that must be carried. The fuselage is barely wide enough to accommodate the pilot and is just high enough to allow the pilot to hide behind the engine and still see out. One reason why a low wing is favored for race planes is that it offers a convenient place for retracting the wheels.

In the old days when biplanes were raced it was customary to "tune" a ship by adjusting its rigging before each race but now a plane has to be tuned before it is built. Getting the proper balance is a delicate and extremely important job. Variable loads such as the fuel supply are placed close to the center of gravity. The oil tank is a handy weight because it can be placed nearly anywhere inside the fuselage to help stabilize the balance. Only a small amount of oil is used during a race.

The whole idea in balancing is to get the plane to fly a straight level course with the hands off the controls. That is difficult and the average race plane "hunts" up and down, forcing the pilot to make slight corrections with the controls. That cuts down top speed because the drag is increased when a control surface is moved into the wind.

In the same way that automobile racing has been a proving ground for the motorcar industry, airplane racing has contributed many things to make modern planes safer and more efficient. Retractable landing gear and landing flaps are good examples. Investigation of aileron flutter resulted partly from the troubles racing pilots were having. Much of the streamlining of today's airplanes can be traced directly to the race course. The cantilever low-wing monoplane shape and the use of wing fillets were partly developed by racing. Motor troubles peculiar to aviation, such as cooling problems, have also been whipped in part because of the resourcefulness of the fast-flying pilots.

¶Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.