THE STOUT INDOOR TROPHY WINNER

How You Can Build the Stick Model That Captured the Stout Indoor Trophy at the 1938 National Contest, Detroit, Mich.

By HEWITT PHILLIPS

This plane was designed to combine very light construction, which makes it capable of long flights, with sufficient strength and stability to make it a consistent contest performer. The use of tungsten wire bracing on the wings and fuselage gives a structure which is as rigid as those ordinarily used, but much lighter. Because this type of construction is not as rugged as the unbraced type, greater care must be used in constructing and handling the model.

The motor stick is made by wrapping a piece of soft quarter-grained balsa 17 inches long and 21/32 inch wide around a 3/16-inch diameter glass or metal rod. The motor stick blank is sanded down until it weighs .014 ounces. After gluing the seam, the struts are attached which support the wire bracing. These are 1-1/4 inches long and 3/64 inch in diameter.

Next the wire fittings are glued on and finally the tungsten wire. The tension in the wire should be sufficient to bow the stick 3/16 inch. This results in a motor stick which weighs .017 ounces and which will take the pull of a loop of 7/64-inch rubber weighing five times as much.

Construction of the tail assembly is quite conventional. Tail boom is made from a piece of quarter-grained balsa sanded to paper thinness, 8 inches long 5/8 inch wide at one end tapering to 3/8 inch wide at the other. A tapered form to wrap it on may be made by winding a triangular piece of writing paper around an end of a 1/16-inch metal rod.

The center rib of the stabilizer, which forms a continuation of the tail boom, is also hollow. The blank used for this rib is 5 inches long and tapers from 3/8 inch to 3/16 inch wide. The two sections of the boom are joined by a 3/8-inch length of 1/32-inch diameter aluminum wire to provide for adjustment of the rudder and stab. Spars in the tail assembly are sanded round taper from 1/16 inch diameter in the center to 1/32 inch at the tips. Ribs in the tail surfaces are approximately 1/64 inch square in cross section. No camber is used in the stabilizer.

Framework for the wing is constructed in the usual manner, but its design has several peculiarities because of the use of tungsten bracing.

Instead of tapering evenly from a maximum cross section at the center to a minimum at the tips, as is done in cantilever wings, the wing spars have a cross section which varies in the following manner: The spars are 1/16 inch by 3/32 inch at the center, tapering to 1/16 inch in diameter by 2 inches out (Continued on page 37)
breaker points and adjust them to the engine specifications. Assemble the engine, using a good grade of oil on all bearing surfaces, but take care not to "slop" the oil all over the outside of the new clean engine. Grind your screwdriver to fit the screw slots and a neat assembly job will result. Paint the cylinder and spark plug case with a dull black cylinder dressing; following carefully the instruction on the can. To further dress up the engine, purchase an acorn nut the correct size for the crankshaft threads. This does away with the unfinished front most engines seem to have. The next step is to put on an oversized hat (if necessary) and show your new (?) engine to your fellow modelers.

The Stout Indoor Trophy Winner
(Continued from page 9)
from the center, increasing again to 1/16 inch by 3/32 inch 6 inches out from the center, then decreasing to 1/16 inch in diameter 2 inches in from the point of attachment of the wire brace.

The cross section then increases to a maximum of 1/16 inch by 1/8 inch at the point of attachment of the wire, and tapers off to 1/32 inch in diameter at the tips. Where one of the foregoing dimensions is greater than the other, the spar is understood to be set on edge; that is, with the longer dimension vertical. Wherever the spar is not round, it is sanded to an oval cross section. The two sections between the center and the brace which are 1/16 inch in diameter are made thin because very little bending occurs there. Such places are known as "points of infection" in beam theory.

Wing ribs are 1/64 inch square in cross section. The camber of the airfoil is slightly lower than that commonly used, because this appears to be the best practice for very light ships.

Weight of the completed wing frame, with clips but no covering or bracing, is .019 ounce. It is covered with micro-film before the tungsten wire is attached. It is absolutely necessary to attach the wire braces from both the front and rear spars to the front wing clip, as is shown in the plans, in order to prevent twisting of the tips.

There is a single brace wire on top of the front wing spar, which only comes into play in pulling the plane out of a dive. If the model is flown in a hall large enough to avoid hitting obstructions, this top brace may be omitted. It is a good idea to glue a piece of 1/64-inch square aluminum about an inch long in the front lift wire on the left wing to provide for adjustment on the wash-in and wash-out of the tips. The two tips may be washed in or out simultaneously by moving the front wing clip back and forth on the motor stick.

A microfilm propeller was used on the winning flight of the model. The type shown is as efficient as a good wooden propeller and weighs only .011 ounce. It was made by building the blades on a block carved to the correct helical shape. Pitch is the same as that of a wooden prop carved from a block 1 inch by 1-1/2 inches by 15-1/2 inches. Blades

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are covered on both sides to insure an efficient prop.

Another feature of this model which may require some explanation is the flexible music wire thrust bearing. High wing indoor ships in which the thrust line passes well below the center of gravity tend to be extremely unstable. Mr. Charles H. Grant explained this effect in his "Aerodynamic Design of the Model Plane" series in MODEL AIRPLANE NEWS and showed that one solution would be to tilt the motor stick to bring up the thrust line.

Some builders unwittingly overcome this difficulty by using a sufficiently flexible motor stick which bends at the start of the flight and gives the prop enough down-thrust to overcome any stalling tendency. When a rigid braced stick is used, however, the thrust line is in the same position throughout the flight. If the model is adjusted to fly level correctly, it will stall at the start of the flight; if it is given down-thrust to prevent stalling under power, it will fly too fast or even dive at the end of the flight. This tendency can be overcome by use of a flexible thrust bearing, which bends under the tension of the rubber and gives the propeller down-thrust at the start of the flight. If some difficulty is experienced in getting the right amount of change in the thrust line a bit of experimenting will solve that. The original craft worked well with a bearing of .014 music wire with a single loop 1/16 inch in diameter as shown in the plans.

Upon completing construction of the trophy winner, you may be anxious to fly it but lack the nearby armory or hall available. Have you a large room? Fine, then watch the next issue of MODEL AIRPLANE NEWS. We'll present a sure-fire method of computing the potential duration of your plane after making gliding tests. In the meantime keep the cat away from the microfilm.

The Physics of the Airplane
(Continued from page 27)

plane controls. These bearings are self lubricated and can be self-aligning over a limited displacement. The self-aligning bearings assume a limited amount of distortion without a decrease in the frictional efficiency. In the example of control surfaces, this supplements the movement of large control surfaces and contributes safety when the moving surfaces may be seriously overloaded for limited durations of time. See Figure 1.

While friction is detrimental in many instances, yet without friction insufficient traction between the tire and the runway would be developed so that the airplane could taxi forward, gain speed and finally take off. Also in the act of landing, the reverse is true. The runway of the airport offers a certain degree of friction to the rolling airplane with the result that within a moderate distance it stops rolling of its own accord. If the airplane is equipped with brakes, it will be found that these brakes are especially equipped with brake shoes which have a composition lining of high friction characteristic which develops a large

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