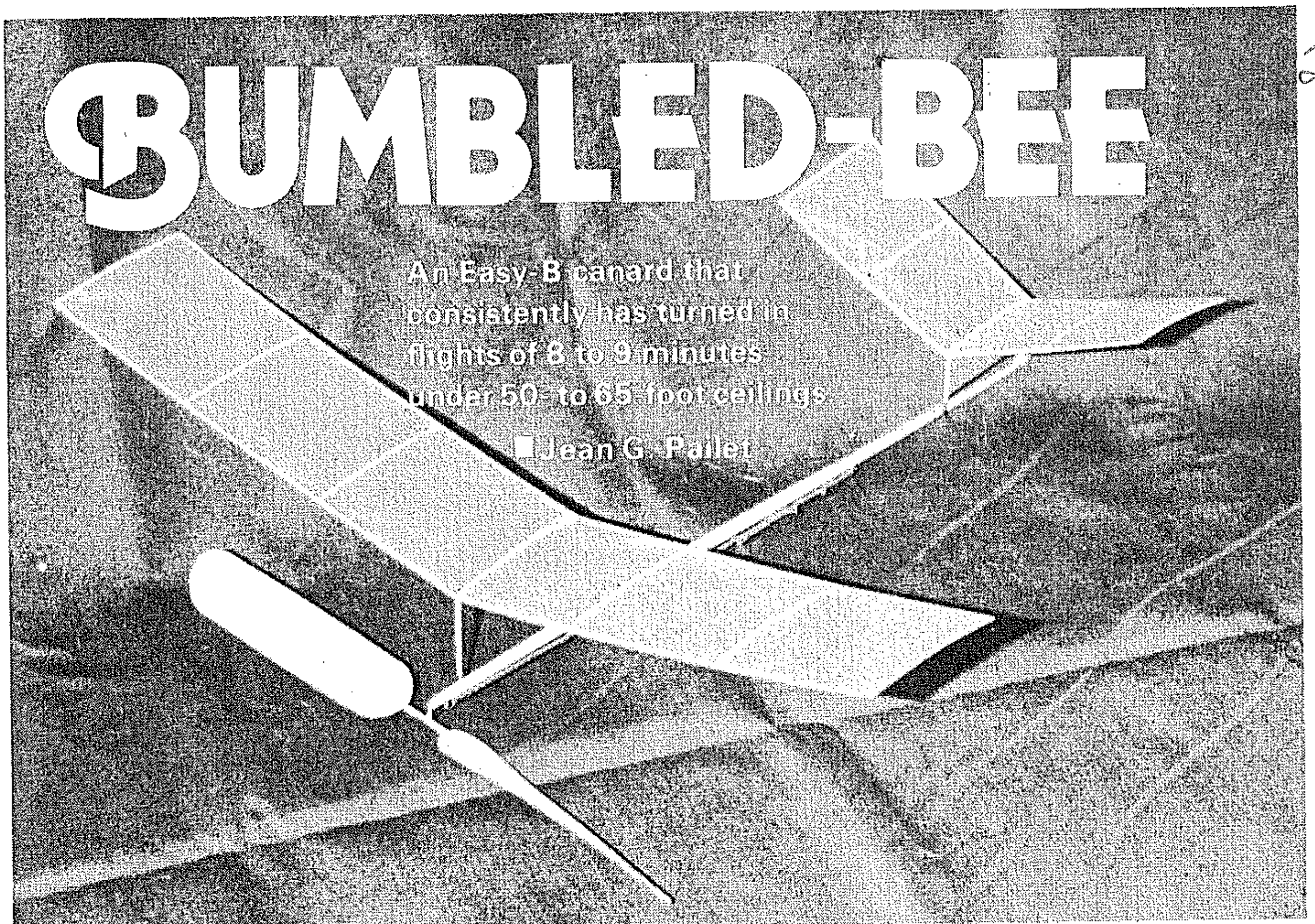


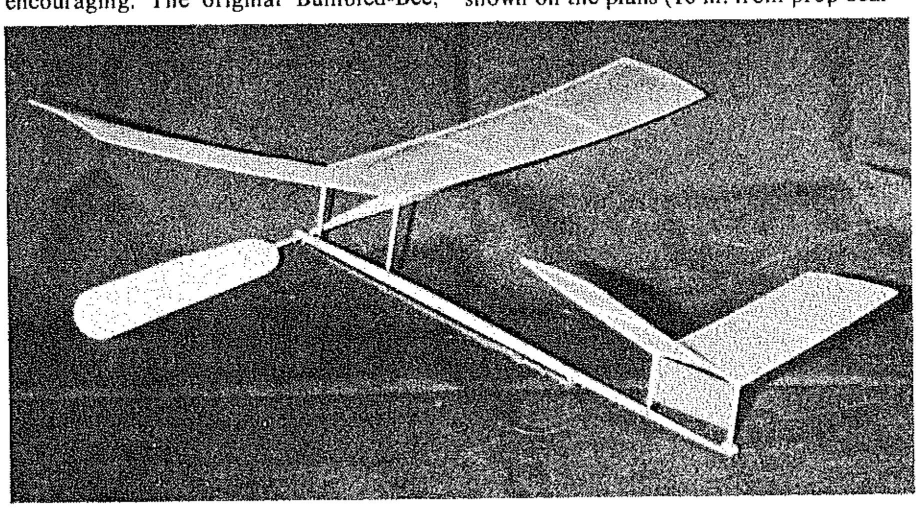
South view of a north flying airplane. Original idea was to reduce hang-ups (not yours) by putting the prop in rear, but it was found that reducing the span of forward surface enabled model to penetrate smaller crevices than otherwise possible. "Backs off" more readily.

IT WAS ORIGINALLY intended to christen our little Easy-B canard the "Bassackwards," but in deference to the tender young eyes which may be reading this text we settled for "Bumbled-Bee." In either case, the entire project has been a bumbled, bassackwards comedy of contradictions. But then you ought to expect the collaboration of an RC columnist and a CL Contest Board member to result in an unusual Indoor model!

The author (past CLCB chairman and present CLCB member) developed the design from a concept initiated by George Myers (writer of the monthly Radio Technique column in *Model Aviation*). The original fun-fly model evolved into a competitive airplane and we are now experimenting with a larger version of the Bumbled-Bee in the Indoor Paper Stick event (page 15 of the December 1976 issue of *MAN* has photos of Barry Pailet with the canard he flew in the Paper Stick event at the 1976 Nationals).

While an original goal was to reduce hang-ups on obstructions by moving the prop aft, the resulting reduction in the forward span has enabled the model to penetrate smaller crevices than would otherwise be possible. However, all flight experience to date has indicated that hang-ups really are fewer, and those which do occur, seldom require anything more than patience for ultimate retrieval. This seems to be because the aft CG (compared to conventional designs), combined with the decreasing forward thrust as the rubber motor winds down (remember, in most hang-ups the prop will remain free to turn), tends to induce the model to "back-off" and free itself. Stall recovery from bumps and hang-ups also seems to be an improvement over conventional tractor designs.

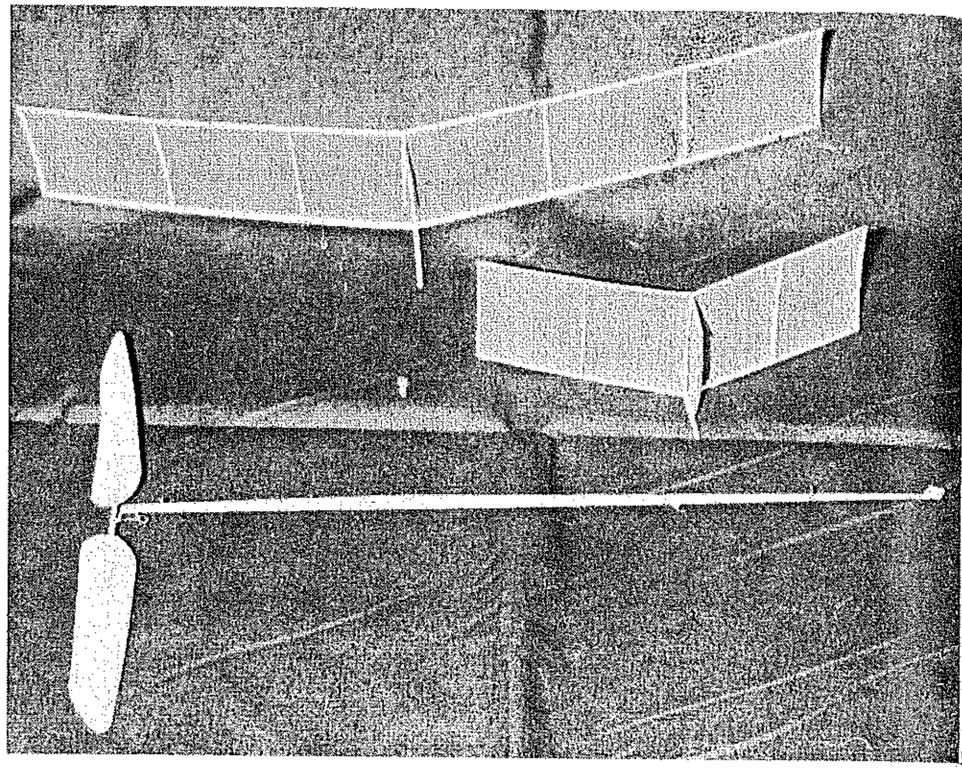
Contest performance to date has been encouraging. The original Bumbled-Bee, shown in the accompanying photos, weighs in at slightly over 3 grams and has competed effectively in both Easy-B and Penny-Plane events in the Northeast. It has consistently turned in flights of eight and nine minutes under 50- and 65-ft. ceilings. Therefore, built lighter to truly competitive Easy-B weights, or adopted to Penny-Plane surface areas, the design seems to have much yet-to-be-realized performance potential. Incidentally, the motor length shown on the plans (10 in. from prop bear-



The forward fin, just tissue between the two struts, provides a built-in control of the desired flight circle. The rear support of forward surface is glued to the right side of the motorstick, while front support is on center line. Stall recovery from bumps and hang-ups seems superior.

ing to rubber hook) conforms to Penny-Plane rules. If you plan to fly your Bumbled-Bee only as an Easy-B it would probably be advantageous to increase the motor length an inch or two. Doing so will give you added motor-winding capacity, as well as helping to keep the CG forward, where we want it.

Which brings us to a few brief words on CG location, before getting into the construction comments. Even if you have to add a bit of ballast (note the small lump of clay shown at the nose of the prototype Bumbled-Bee in the accompanying close-up pictures), keep the CG at, or forward of, the location shown on the plans! Building the forward canard surface stronger and heavier than might otherwise seem normal, serves the dual purpose of getting both weight and strength at the nose where they are most needed for proper balance and to absorb all the bumping abuse. To aid in proper CG location, the motorstick dimensions shown in the drawing have been slightly modified from those of the original model shown in the pictures. These changes were incorporated in the enlarged Paper Stick model and proved quite effective in positioning the CG at the proper location.



What you see is what you get. Do note the small lump of clay ballast at front end of motorstick. The general idea is to keep the CG position at, or forward of, the position given on the plans.

Construction

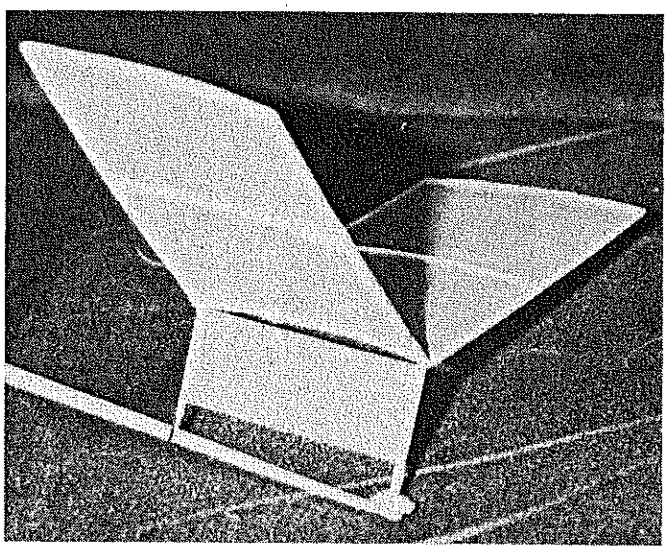
Construction of the Bumbled-Bee is simple and conventional. All basic materials (wood, fittings, condenser-paper covering) were obtained from Micro-X Products, P.O. Box 1063, Lorain, Ohio 44055. It is especially important to use a double-support prop bearing and to mount it on a small wedge between it and the motorstick to assure proper down-thrust (see plans). The double-support bearing also provides a means for adjusting side-thrust to help attain the desired flight circle.

All wing and canard ribs are cut from .030 C-grain stock, and the leading and trailing edge spars for both surfaces are cut, tapered as shown, from .040 B-grain stock. Surface support posts are round-sanded from 1/20" sq. strips. These posts fit into tissue paper sockets made from dope saturated ¼ × ½" tissue strips formed by rolling around greased 3/64-in. dia. wire. Basic wing and canard incidence settings can be obtained by making the forward canard post 1½ in. long and its rear post 1¼ in. long; the forward wing post should be 2 in. long and the rear wing post 1⅞ in. long. Thorough flight testing is the only way to determine what additional incidence trim adjustment are required for your particular model in any particular site.

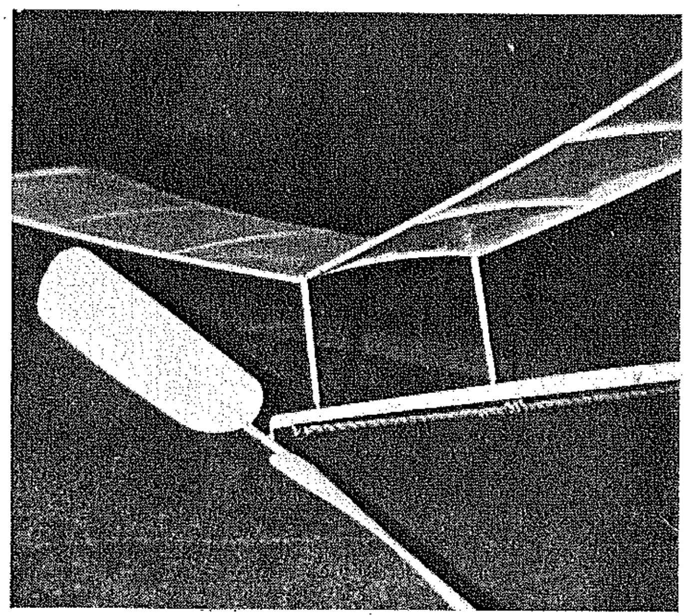
Prop blades are cut from .020 B-grain sheet. They are formed by soaking in hot water and then being taped to the surface of a 3-in. diameter cylinder (a standard Mason jar is fine) at a 30-degree angle to the base. They are then either air-dried or baked dry in a warm oven. The center prop post (or hub) is 1/16" sq. balsa strip, reinforced with a small doubler at the center, and the prop shaft and the fuselage hook are .012 wire.

Covering material is condenser paper. Having always had problems working with conventional condenser paper cement (normally shellac) we've been using a thinned (about 1 part water to 1 part glue) mixture of white (Elmer's) glue for a num-

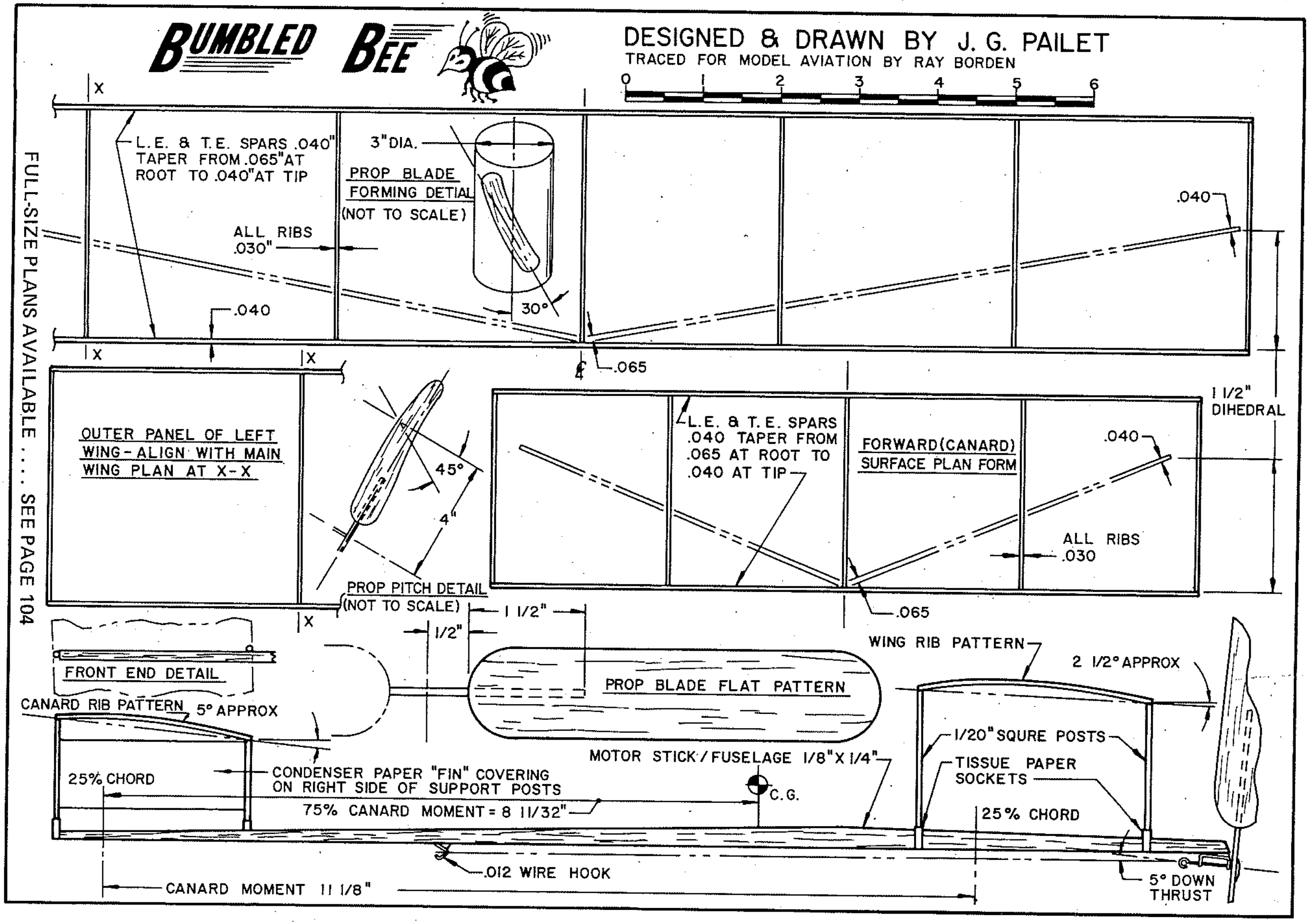
Continued on page 97



Incidence adjustments of the canard surface—and the wing—are provided by conventional tissue sockets, made from dope-saturated strips wound around 3/64" wire. Struts are moved up or down minutely for making adjustments. Model has done well in Pennyplane as well, and a larger version is quite competitive in the Paper Stick event.



Propeller blades are made from .020 B-grain sheet, soaked in hot water, then taped to surface of 3-in. dia. cylinder—Masonry jar is fine.



FULL-SIZE PLANS AVAILABLE .... SEE PAGE 104

Sympo 78: If you can whip out an article covering some aspect of Free Flight within the next month or two, please send an abstract of the proposed paper to Bob Dodds, Box 436, Rancho Stanta Fe, CA 92067.

Bob Meuser, 4200 Gregory St., Oakland, CA 94619.

Bumbled Bee/Pailet

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ber of years with great success. We also pre-shrink our condenser paper by dampening it and allowing it to air-dry before applying it to the structure. This reduces later warping of the surfaces due to varying humidity.

Power requirements will, of course, vary from site to site depending upon ceiling height. However, you will most likely be working with .035 to .065 rubber with loop lengths between 10 and 14 in., depending upon the weight of your particular model and, again, the characteristics of the site. Adjustments for the desired flight circle (we fly conventionally, to the left, in 35- to 50-ft. circles) are partially built-in by virtue of the "fin" (formed by the condenser paper "covering" between the two support posts for the forward canard surface) being off-set for left turn, because the socket for the rear post is glued to the right side of the motorstick while the front socket is on the center-line. Additional turn trim can be accomplished by using either side-thrust or differential incidence (twist) on the left and right canard halves, or by some combination of the two.

Optimum flight performance requires much trial-and-error testing of varying combinations of power (rubber cross-section, length, and number of winds), and wing and canard trim settings. Two particular tips: don't be afraid to experiment with CG location by adding a (very) small amount of ballast (clay) fore or aft, and be sure to wind the rubber-motor *to the left*—otherwise, you're going to be very embarrassed when your Bumbled-Bee tries to fly back towards you instead of forward away from you. However, when you do get it going in the right direction, and with patience and a methodical approach to trim adjustments, we think you'll find this little Easy-B canard fun to fly and fully competitive with more conventional designs. At the very least, it's an eye-catcher and a conversation-starter.

Engine Technique/Jehlik

continued from page 51

Too lean: Not enough fuel; the engine starts, gains rpm rapidly, and then slows down or dies, usually in 3-5 seconds. Be prepared to adjust the needle valve soon after the engine starts. I've provided plenty of props with chances to chew on my fingers, and finally learned it's best to think about what I may have to do before starting the engine.

Safety precautions: Be aware that fuels are flammable. *Do not* smoke around fuels, be careful not to cause sparks with battery leads. *Do not* stand beside an engine when it is running. Prop blades thrown off at high velocity are like arrows. *Do* wear glasses, preferably with safety lenses to avoid splashed fuel in your eyes, and to protect them from moving objects. *Do* use ear protection; model engines are definitely loud enough to cause permanent partial hearing losses with enough exposure. Think ahead; plan what you will do and develop a ritual about it. Do use only wood or fiberglass props in tests.

f) Now your new engine is running smooth and rich; the real business of bench running begins. What should you do, what should you know?

1) First: While running, feel the engine carefully. Touch the crankshaft housing; it should feel cold at all times. If it is warm or hot, stop the engine. The shaft will be too tight in the housing, bearings improperly mounted, etc. This means, take the engine apart to examine the surfaces of the shaft and housing bore for signs of rubbing or galling; and back to the duPont white rubbing compound or #400 wet or dry paper to remove all signs of damage.

2) Feel the bottom of the crankcase front and back. Heat in the front means a problem with the rear ball bearings; in the rear, with the rotary valve induction (if the engine has it). Crankshafts pressed too tight in bearings, or loaded so that the bearing inner race is pulled off-center, will cause heat, lose power, and fail prematurely. Be sure the shaft slides in the bearing with easy finger push fit. Heat at the rotary valve means the valve is too close to the backplate, or warped, or pushed by the crankshaft drive pin into the backplate. By process of elimination you can identify the problem and correct it.

3) Feel the upper part of the crankcase for "hot spots." The case should remain cool where the bypass transfers are located and feel evenly hot around the fins. In contrast, the head should feel really hot, where you want to pull your hand away involuntarily. 70% of the heat absorbed by the engine itself is typically expressed through the head. If the upper part of the case is apparently as hot as the head, stop the engine, disassemble and hold the sleeve (wiped dry) up to a light and carefully look for bright shine or gall marks. That means too tight in that portion of the sleeve.

4) Condition of piston/sleeve: Lapped Steel: If the sleeve is shiny the full distance above the exhaust port, the piston/sleeve fit is too tight. There are two remedies: (a) run it in, and (b) lap it in. I do not recommend running a tight piston in, because it places too much strain on the reciprocating parts and takes too long to arrive at a correct fit (unless you use Lustrox as obtained from Duke Fox and used as directed). I prefer to lap again with the duPont white compound.

If the piston begins to show small vertical scratch marks when you look at it through the exhaust port, do not run until lapped out. I have found that those little marks really cut the power and life of the engine if you allow them to develop. I have lapped a new engine seven times in order to