

INDOOR AND SMALL SPACE RADIO CONTROL FLYING

By KEN WILLARD

WITH growing scarcity of flying fields, particularly in built-up areas, the idea of an indoor radio-controlled model has a lot of appeal. There are plenty of drill halls, gymnasiums, village halls and the like which would be excellent places to fly such models, that is, if you could make an R/C job which could fly safely within the space available.

Until recently, the idea was pretty far-fetched; then along came the transistor with its lightweight and low drain features, and, suddenly, the lightweight radio was an actuality. Sure there are still some problems to be worked out, but the sets now becoming available are reliable enough and light enough to do some experimenting.

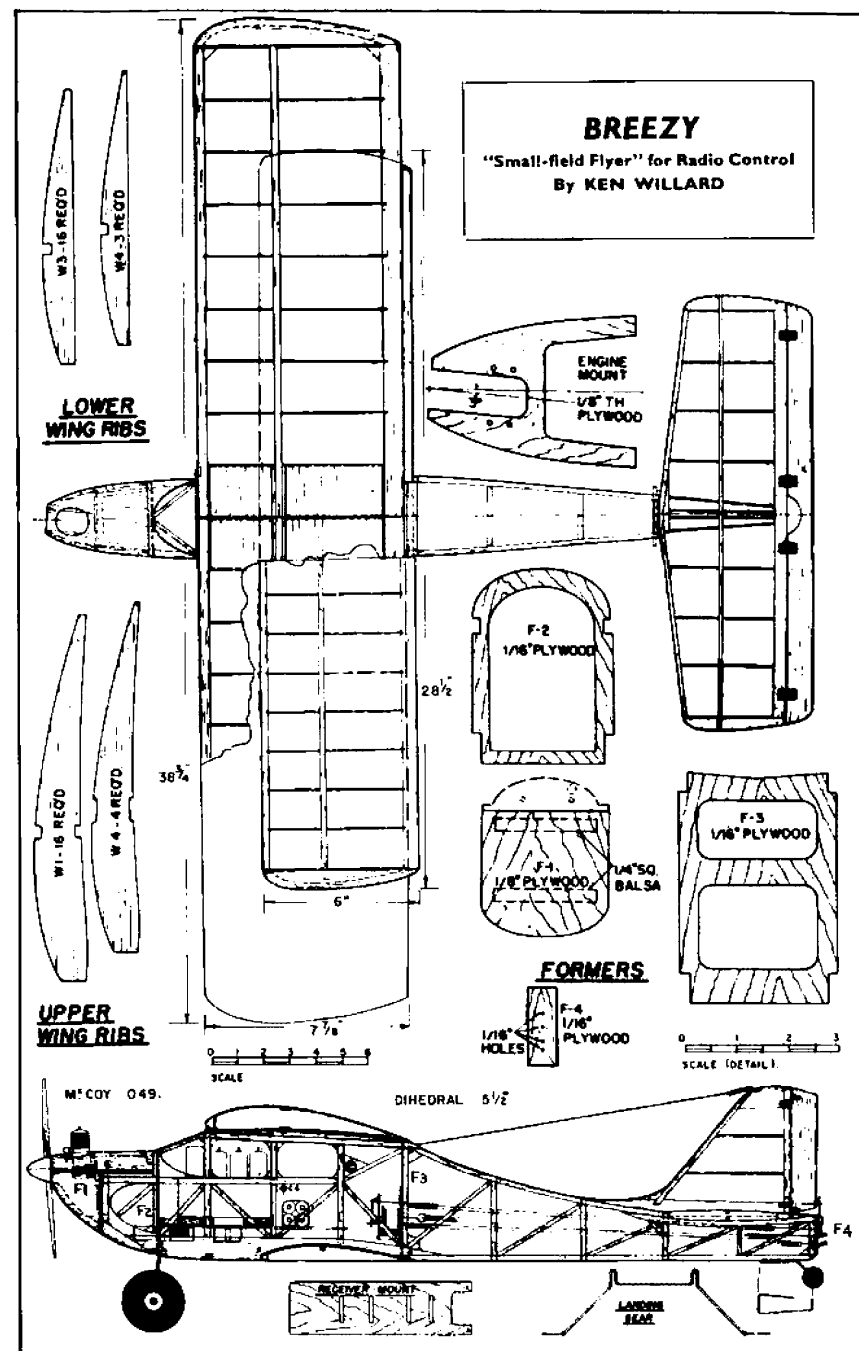
Actually, the indoor R/C job is nothing but a refinement of the small-field R/C model. I have been designing them for quite some time, starting with the little *Breezy* biplane which appeared in *Model Airplane News* a few years back (not to be confused with the commercially produced *Breezy* monoplane which came out a little later). The biplane has the basic characteristics of high manoeuvrability combined with the chance to get a low wing loading and a fairly small model. Therefore, it was logical that my first attempt at an outdoor job would be a biplane.

Since the small-field *Breezy* was designed, several new lightweight radios have appeared. So far, the lightest of the lot is C.G.'s all-transistorised receiver which even uses a power transistor in lieu of a relay. Also, it operates on three volts, and the small wafer cells which C.G. puts out are ample power. The limiting factor on this receiver is that it is designed with the Bonner SN escapement in the circuit, and if you use another escapement, your chances of success are marginal, because the magnetic efficiency and operating characteristics of the Bonner are different. However, this limitation is not serious, since the Bonner SN is very reliable; the trouble that I have with it is not the escapement—it's my own inability to remember what's coming up. I finally had to give up and go to the Bonner compound—which uses the same coil, but is bigger and heavier. I saved some weight by cutting it down to a minimum size, and it has proven very successful in the indoor biplane. Another thing you have to do is to take receiver out of the case and use only the chassis. Lightweight is paramount, and you can't afford to carry a case around.

(EDITOR'S NOTE: British readers can use the Kraft receiver described on page 25 and following pages on Printed Circuits with the Rising Superlight-weight Escapement.)

As for the engine, I tried several ideas. First was a rubber band motor. I gave it up because the motor run is too short. Next I tried an old Campus "B" CO₂ motor, but it didn't have enough poop. I finally settled on Cox's Pee-Wee -020. It is far too powerful, but you can convert the power into just the right amount of thrust by making a small metal prop. to fit behind the regular prop., but bend it into reverse thrust—just enough to cut the total forward thrust into just what you want. But watch out for your fingers!

Now we've settled on a radio and an engine. What about the airplane?



It should not only be light and manoeuvrable, it should also fly very slowly, both for ease of control in a limited space, and to keep damage down when you goof on the controls, which you will.

Two factors in wing design help to keep flying speed at a minimum; one is high aspect ratio, the other is high camber. The former has the drawback of reducing manoeuvrability so a compromise is necessary. But high undercamber has no drawback except perhaps a bad stall characteristic—and we can live with that. Generous dihedral is required so you can rock the model around in tight turns.

To fly at the minimum speed, a high angle of attack is required. This is achieved by using lots of downthrust on the motor together with pretty high angular difference between the wing and the tail. With this arrangement, the engine drags the plane through the air at a speed just above the stall speed associated with the high angle of attack. In fact, when the engine cuts, the plane picks up a little speed! This is because the glide is achieved at a slightly lower angle of attack.

From all the foregoing considerations, a variation of the *Breezy* biplane was designed. To keep weight down, a long narrow fuselage seemed logical, with the top wing up on cabane struts. The aspect ratio of the wings was increased, and the result was a long, thin biplane. This model flew fine—but it was too fast!

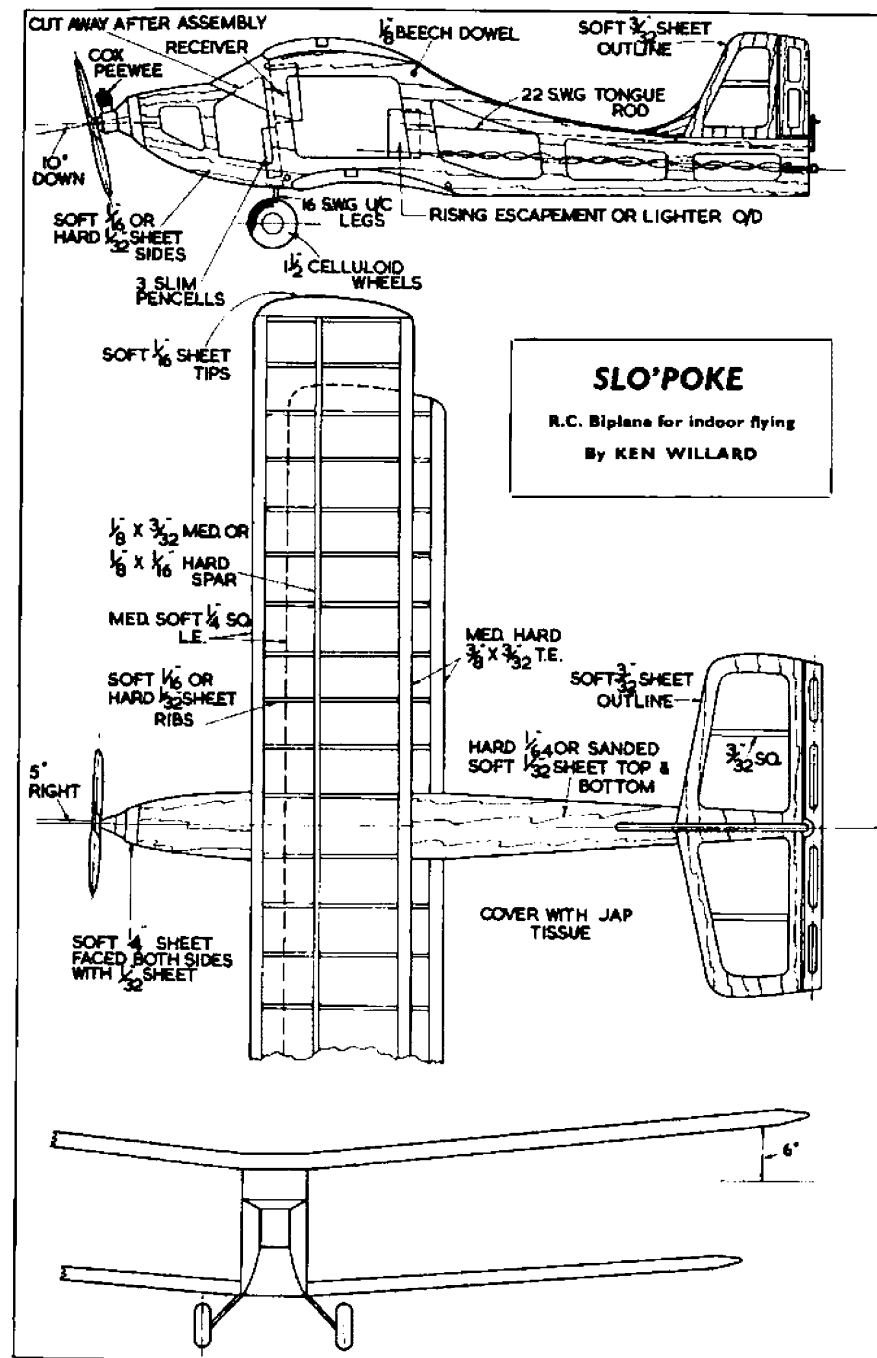
The next design went back to the cabin type fuselage, because of the higher frontal area and bigger drag. I used the same wings and tail, and found a definite improvement. This design, with a 33 in. wing span, weighed in at six ounces, and is still flying. However, it requires an area about 100 feet by 125 feet for safe manoeuvring, and this is still a little large.

While flying the little biplane, which Bob Bowen, editor of the *Lark* newsletter, christened the *Slo'poke*, I had another idea for a design which held promise. In the first place *Slo'poke* had the prop. out in front, which is a bit of a hazard to people who might be watching. It also had a landing gear, which added weight. How about a new concept—from an old one, of course—with the prop. in back and a skid to land on? I had also discovered that the Bipe is much stronger than is necessary when you get down to these lightweights—it even flew right into the trunk of my car one day, banging the structure in several places without damage.

Another point; with a pusher, the engine would be in back and forcing the exhaust back as well—so let's go to a profile job and let everything hang out in the breeze. Finally, let's go really indoor in the design concept, with a single-wing.

When the model was finished, I covered the wing with Jap tissue, and then made my mistake. I didn't plasticise the dope enough and when the covering dried after the first coat, the airplane was named *Warpy*. I should have used the same size wood for the leading and trailing edges, but I didn't and the trailing edge really warped up. This gave me a lot of washout—more than I wanted, but I figured it would be all right to experiment with, so I finished up the model, fuel proofed it, and took it out early one morning to test in calm air.

This model proved to be a truly named indoor job. It weighs 3½ ounces, has a 33 in. span, 7 in. chord, and flies slowly enough so that you can run alongside of it. Don't try it, though, unless you've checked your transmitter-receiver



combination to be sure the receiver isn't swamped when the transmitter is too close. The model is adjusted to fly in a 30 ft. circle to the left. By pressing the button on the transmitter once, right rudder pulls the airplane slowly into straight flight and then into a gradual right turn.

Warpy is what I would call a sort of "laboratory" model. It does the job, but it isn't much to look at. But it does point the way, and for you experimentally-minded modellers, it isn't too hard to make a few refinements to the design and come up with a really attractive indoor R/C job which you can fly in the local high school gymnasium (get the principal's permission first!). For example, make the boom hollow, and run the torque rod through it—maybe close in the cabin area with a light shell of balsa.

I have given some thought to another design. It's a variation of *Warpy* with tractor engine (easier to adjust for flight). Again, it's a rather ungainly and fragile design but I think it has possibilities. The open framework, single surface wing and lightweight radio are virtually mandatory for very small areas, since slow flight is a must, and that means ultra light wing loading. A couple of transverse balsa or thin plastic baffles (or "windscreen") in front of the radio and escapement will deflect the engine exhaust as well as create drag which is desirable.

You may have trouble equalling the weights which I have indicated. However, a *seven ounce version of Warpy*, which a friend of mine made, does a pretty fair job, although faster by about one-third. So there is some leeway.

You probably already have an idea or two of your own, so go to it, and let us hear how you make out.

