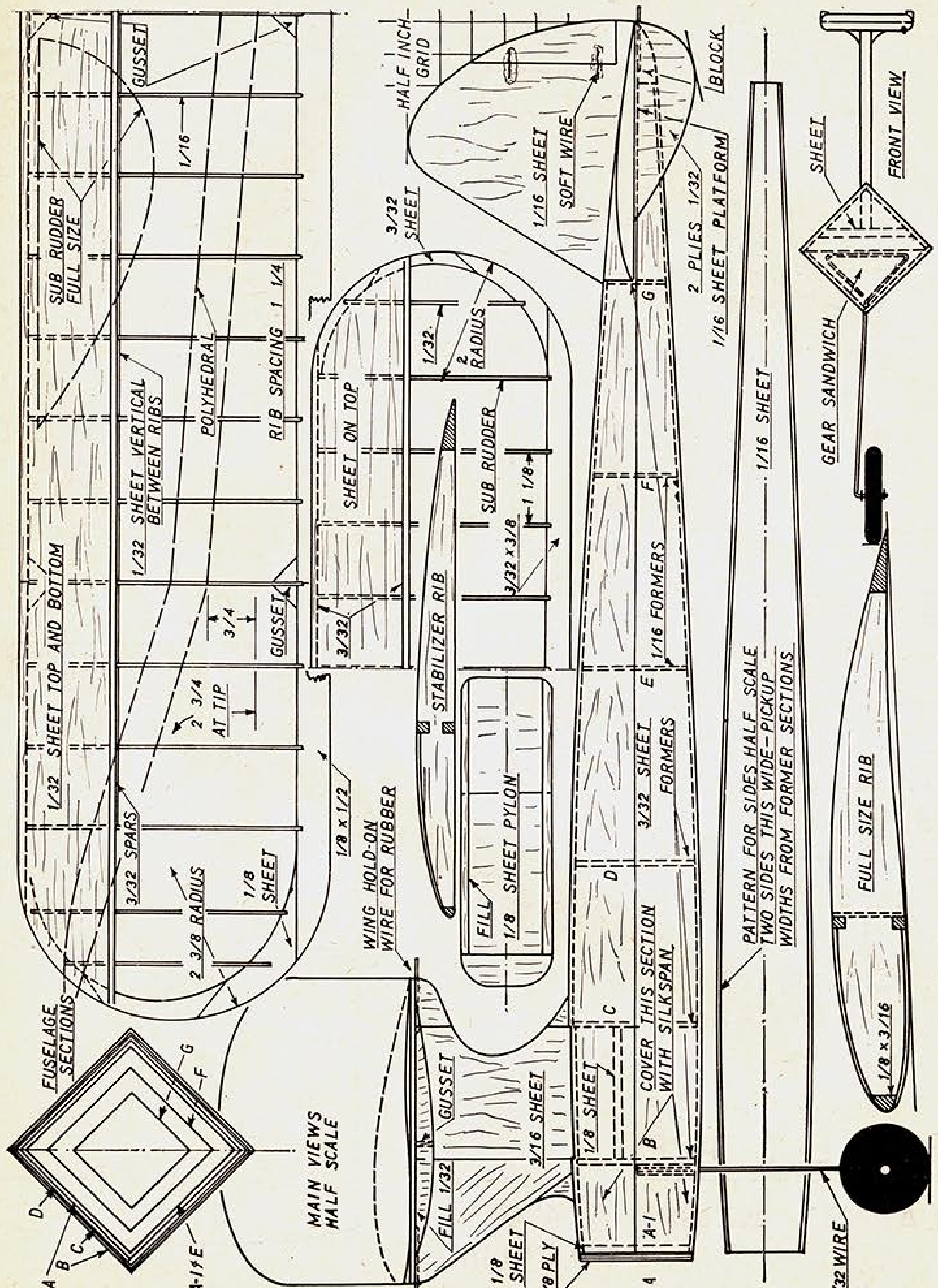

The Firecracker

by BILL WINTER

FOR "half class A" with the *O.K. Cub* furnishing power, the *Firecracker* is the result of several weeks' intensive building and experimenting with these interesting baby-engined jobs. Principal objectives were good flight time, ease of adjusting, freedom from warps, and maximum strength without a weight penalty, and a high order of stability. This, truthfully, is largely a matter of mixing known facts with one's flying experience. The notion that anyone can produce a world beating airplane is archaic, plane reputations frequently being made by the designer's skill in flying them in contests. The most one can hope for is an easy to fly, viceless, high performance machine.

How well does the *Firecracker* meet these requirements? After many test flights in the still air of evening it became apparent that the *Firecracker* will do from 2:30 up, on 20 seconds engine run, with the *O.K. Cub*—subject to props, fuels, and similar factors. A great many flights ended somewhere between 2:30 and 3:45. Most effective flights that were not influenced by conditions, were a 55-second hop on a five-second motor run, and 4:15 (when it hit wires) on 25 seconds. A few flights did last longer but it was assumed that risers had been encountered. While these are not spectacular times, they are still-air times taken late in the evening, and are a yardstick of an airplane's worth. It will occur to fans of the racing-engined .60 classification that a *Cub* job must get exceedingly high, in little time, and then glide like blue blazes to rack up comparable durations. That the *Firecracker* is such a hot airplane—and it increases by a substantial margin any duration the writer has had out of his bigger airplanes—is mostly due to the extraordinary pep of its power plant. Of course, a few other considerations also have their affect.

The *Firecracker* was developed simultaneously with another pylon ship of about the same size (for foreign consumption), *Baby Spitfire*-powered, which provided an excellent opportunity for comparing the effects of pylon height on turn, duration, and adjusting. The other pylon differed from the *Firecracker* in that the pylon itself was 3/4 inch lower, Vee-dihedral was used, and the fuselage was streamlined by the use of a circular cross section. A two-wheel gear was fitted, whereas the *Firecracker* has but one wheel (which the reader might want to retract to get still higher time), and two small sub-rudders for ground stability. Flown with the same fuel and the factory-supplied prop, the *Baby Spit* job had roughly a comparable performance but its characteristics were quite different. An extensive study had been made of wing areas for that ship and the experience was carried over to the development of the *Firecracker*. It is felt that this wing area analysis, while representing a mean of everyone's experience, is, after the power of the engine, primarily responsible for the good performance.

A graph was worked out with wing areas reading vertically from nothing to many hundreds of square inches, and with engine displacements reading horizontally from left to right, from .02 for the *Infant*, up to .60. Now it is no secret that areas have always been larger in proportion on small airplanes than on big ones. For instance, under the old rules (changed late in 1947), so-called minimum area jobs became mighty rare as displacements went down. Good Class A models frequently had at least an extra 50 square inches tacked on to permit control and good glide. Under those rules an *Infant* job, had such existed in those days, would have qualified with an area of 23 square inches and a weight of 1.6 ounces! On the other hand, as plane size increased, minimum airplanes became reasonable, especially in Class C (of '46), where the wing would be allowed a minimum of close to 700 square inches.

With such models in mind, a point was established on the graph for the old minimum area C job. For the present-day *Infant*, another point was made for a 75 square inch minimum. When these points were connected, a line resulted that gave "hot" airplanes all across the board. In some cases, particularly in A, these jobs would be too hot for comfort. To establish a line for maximum areas for good contest performance, 120 square inches was plotted for the *Infant*. Then, since the big ships vary so in area, a study of several successful .29 jobs of various designers, resulted in 500 square inches. Connecting these two points, and extending the line on up into the big ships, gave maximum good-performance areas. Further, a reasonable compromise area line was drawn, beginning with 100 square inches for the *Infant*. For the *Fire-*

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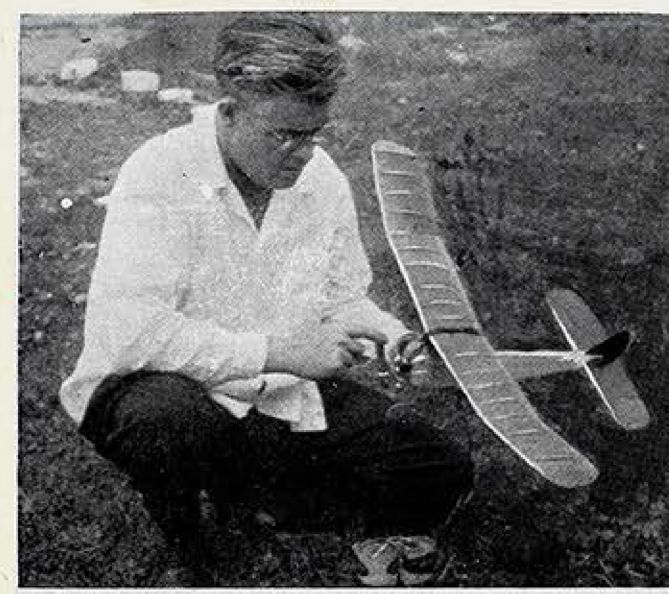

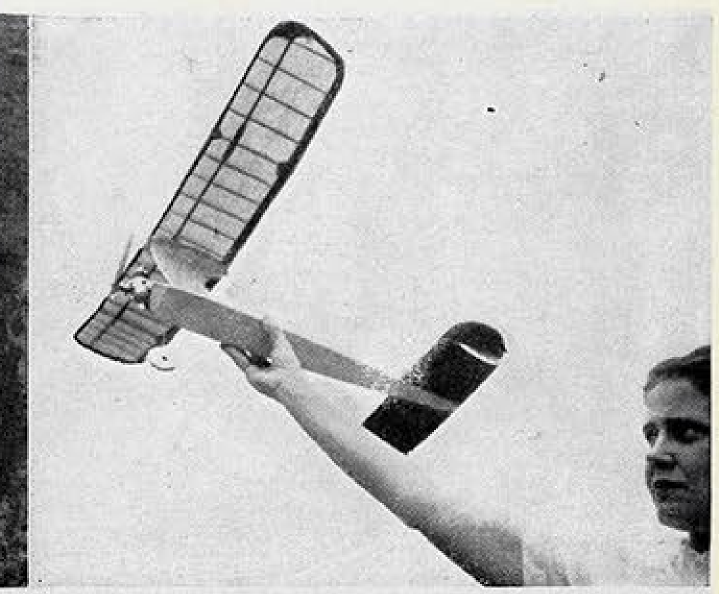

Bill prepares to "light" the *Firecracker*. These illustrations were made with an early wing; final wing had sheeted leading edge

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cracker, the intersection of the .049 displacement line and this compromise wing area line, gave approximately 140 square inches of area. (If considerable weight is to be expended on timers, it would be well to up this to, perhaps, 150 square inches.) With weight on the ball for the power loading rule now in force, the *Firecracker* then has a wing loading of about 5 oz. per square foot.

The tail moment arm is one-half span; the stabilizer area at 37% perhaps looks small, judging by many pylons. The NACA 4612 airfoil gave most satisfactory results having, for this particular ship, what must have been an optimum wing thickness. Wing thickness, and its L/D ratio, must be matched to an airplane for best results. While this is a rough rule-of-thumb procedure, a thicker wing belongs on a ship inclined to have high drag, and a thin wing on a sleek machine. To preserve airfoil accuracy, the wing is sheeted forward on both top and bottom surfaces, the sheet butting against the spars, with the spaces between the ribs then being filled with 1/32" sheet with the grain vertical. This gives an exceedingly strong wing and one that is close to being warp free. Complaints are heard about some stunt ships with top and bottom spars and sheeted leading edge sections, because they are said to be tricky to assemble accurately. However, the light spar webbing not only adds great strength but, if put in while the wing is on the bench, locks the construction against warps. No rigging angle is incorporated in the wing, the wing having only its normal incidence. When many of these airfoils are mounted "flat" they already have a number of degrees incidence. While the author has always had best results with the NACA 6409 when set at about 6° total incidence, the 4612 has performed well at low angles on both Wakefields and these two pylons.

The fuselage is built-up of four 1/16" sheet balsa sides, laid over diamond bulkheads. The stab, like the wing, is built-up, but is sheeted on the top surface only. It, too, is virtually warp free. Circular tips were employed on wing and tail to ease the enlargement of the half-scale plans. No one has ever conclusively proved that one wing-tip shape is better than another on gas models, and it is probable that round tips are as good as any. The fin is sheet balsa. Since the model is not overweight, why not use sheet where possible? It is stronger and better in every way for such usages on small airplanes, particularly where paper and hot fuel become a problem.

Performance depends to an important degree upon the propeller. Unfortunately, no one has propounded facts on prop selection. Far too often, the manufacturer's power curve for an engine is considered the only important factor in fitting a prop. Quite frequently, a bigger prop at less rpm will give better results in free flight. Diameter and blade area are but two other factors that affect climb, particularly when one engine sees duty in both U-control (at high rpm with small prop) and in free flight (with slower turning, larger prop). It is questionable that blind adherence to rpm will produce the best performance. In other words, engine performance may suffer a little by choice of prop, yet a given airplane may outclimb a sister ship with a high speed prop.

Using *Glow Flite*, and various mixtures of *Glow Flite* and *Dyna Fuel*—the two we happened to have handy—the *Firecracker* was flown with a great many props. Besides noting the varying performance and flight characteristics, it was decided that prop pitch (holding to a given diameter) is a remarkably precise way of controlling the flight of a model, rather than playing with rudder and offset. During most of our test flying, no downthrust or offset was used. Frequent alterations in props, hence in torque, prevented this. By progressive increases or decreases in pitch, power turns were adequately controlled.

Of the propellers available at the nearest hobby shop when this was written, only the *Ashland* 6-1/2" x 5-1/2" CO2 prop gave top results for this airplane. In fact, the best times were made with this stick. All manner of props were cut down, from 8" x 3" *Top Flites*, through *Rite Pitch* square-tipped 7" x 3" stunt props. Two basic props were developed; one was the Ashland, and the other a small one-blader, using a lead counterweight, a la the *Airco* Infant prop. This latter prop yielded very high rpm and can be considered (in proportion) to be equal to the racing engine big ship combinations. After numerous flights it was confirmed that the slower two-blade prop was yielding better times, although, rated from spectacular flight speed and noise, it appeared as if the one-blade affair had won hands down.

Both props affected adjustments so much that it is evident that one should not say how any one model will fly, or how to adjust it, unless a specific prop-engine combination is considered. Best performance from the *Firecracker* came with left power turns. Like other pylons we are familiar with, the *Firecracker* has