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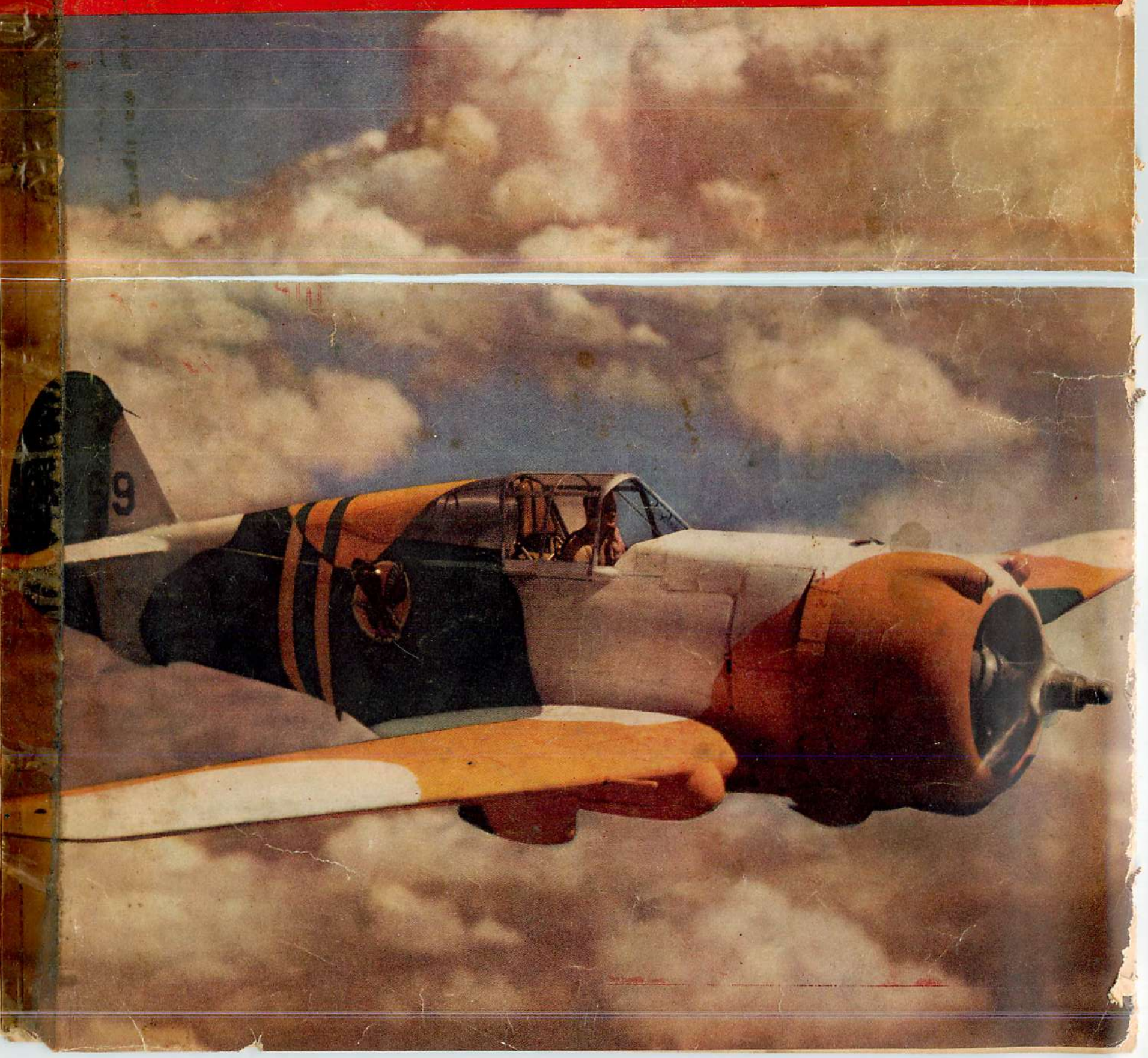

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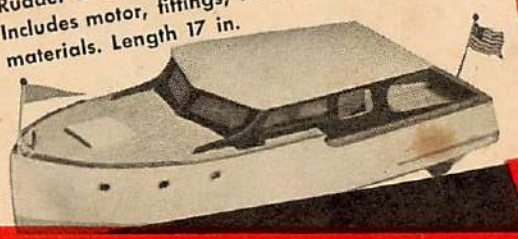

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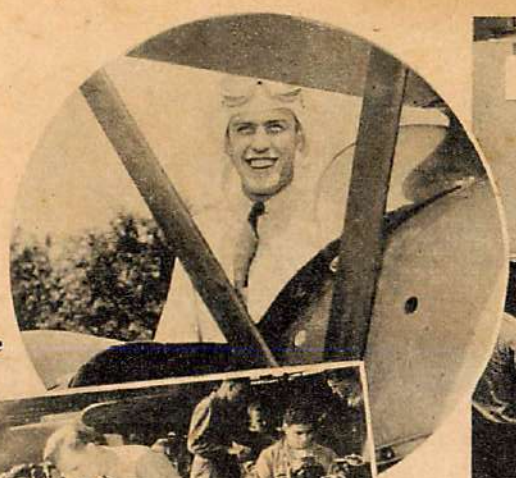

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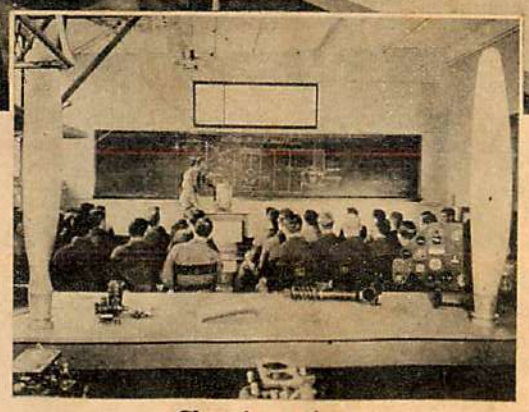

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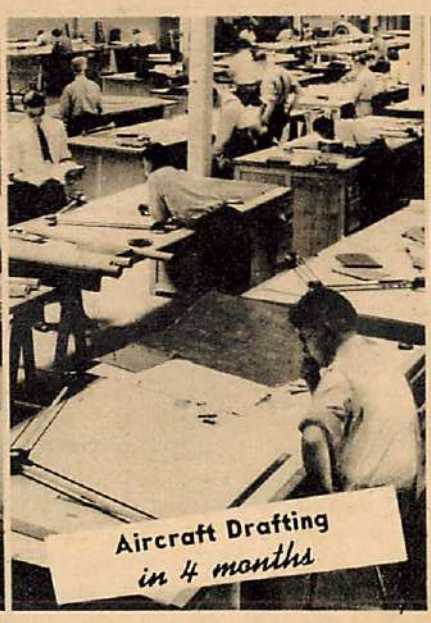

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GO into the next room and take a look at my plane! No, Willie, we're not kidding. It can happen, and did over in Jersey City, N. J. Alex Dwyer, private flier, hated to leave his plane out all winter so he got himself a saw and chisel and went to work. He ripped a hole in the side of his house where there was a vacant room and, with the help of friends, removed the wings of his plane and shoved it in. Unfortunately a few feet of tail stuck out—as did the B-18A's at Mitchel Field. At Mitchel Field they cut curved sections out of the rolling doors so they could still shut them. Dwyer, on the other hand, boarded up the wall about his plane and said it would be all right. (The prop can be used to slice apples or onions with during the long winter evenings.)

★ ★ ★

An interesting little sidelight on the recent flight across the country by the Lockheed Hudson bombers with 1,200 horsepower Cyclone engines has come to light. The flight was made in twelve hours, in itself a pretty good record, but it looks even better when we find out that it was done at *only fifty percent throttle.* It's small wonder, when features such as this combined with the great range and load-carrying capacity are considered, that our merchandise finds almost frantic markets abroad.

★ ★ ★

The other day a very pretty lass called at the lost-and-found department of a Pittsburgh bus line to retrieve her bag containing money, keys, and whatever else lassies carry in their handbags. No news item so far, but wait. It was none other than Marjorie McCabe, who has charge of P. C. A.'s lost-and-found department.

★ ★ ★

Six of a kind! The flying family of Fort Morgan, Col., claims some kind of record, and we think they deserve one. All six members are licensed pilots, and all learned from one of the sons. Paul Young, who holds an instructor's ticket, has taught them all, from his fifty-nine-year-old father right down through his mother, sisters, and brothers to his young sister Cora Mae, who is seventeen and has just soloed. Mrs. Young, the mother, soloed several months ago. The family has its own eighty-acre field and should very well need it, we'd say. We'll bet Paul's Cub has some hot cylinders at the end of a clear week end.

★ ★ ★

Most exciting of recent rumors has it that Consolidated is considering a high-speed flying wing. Design is by Davis, whose super wing was used on the fifty-two-place Consolidated which startled the aviation world with its astounding wing loading of forty-nine pounds per square foot. Wind-tunnel tests on a model of the flying wing have already been run. Should Consolidated go ahead with the project, we may witness what might very well change the entire course of aviation.

★ ★ ★

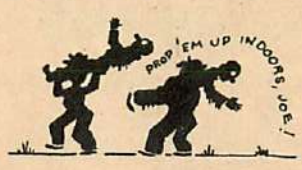
That war is mighty expensive we all know. A striking example of the tremendous diversion of resources from better purposes is the TNT-filled aërial bomb. Four hundred kgs. of coal are required for one kg. of explosive. Thus, a 2,000-kg. bomb requires the equivalent of a trainload of coal!

★ ★ ★

After some experiments last winter we again have with us the ski plane. Canadian Colonial Airways, having satisfied themselves that there is a great demand for this service, have gone to work with a bang, scheduling six flights daily to Montreal, four of them nonstop and two with stop-offs at Burlington, Vermont. Ski equipment will be carried free of charge, and special rates will be given to skiers. Guess we'll have to dig up a couple of barrel staves and a pillow and go along for some fun.

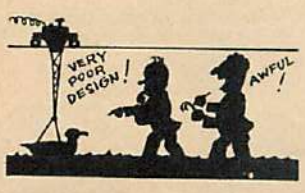
★ ★ ★

It's news when a plane turns out to be so efficient that it nearly kills its own crew, but such is the case with many of the modern European bombers designed for high-altitude work. Some of the British bombers have been so designed and powered for high-altitude flying that the crews have been almost frozen to death. Such high performance was built into the ships at the expense of personal comfort of the crew members that the men arrive over their objective too numb to do efficient work. Take, for example, the case of the pilot of one bomber who had a motor catch fire on the way back from Germany. He discovered his front gunner and rear gunner were insensible from cold. He finally landed the ship in unknown territory and, helped by the two other members of the crew, got the two frozen men out of the ship. Many similar incidents are reported, even in British publications. On the other hand, American bombers are designed to give their crews every consideration for comfort, based on the theory that efficiency depends upon comfort.



★ ★ ★

After-dinner speakers are wont to tell the hackneyed story that their success in aviation started with boyhood flight tests of a dead seagull. Here's a super seagull yarn, and it comes from the N. A. C. A. Some scientific brains, attached to the towing basin where miniature hulls are tested, took to pondering the efficiency of a seagull's "hull." It was no time at all before one of the birds, stiffened with liquid air, found himself the subject of research for further national defense.



WHAT'S YOUR QUESTION

This department will attempt to answer any questions concerning aviation. Those of general interest will appear on this page; others will be answered by mail. Inclose a three-cent stamp to insure a reply. ★ All inquiries regarding appointments for U. S. army air corps flight training should be addressed to the Adjutant General of the Army, Washington, D. C. Those concerning application for naval aviation training should be addressed to U. S. Navy Bureau of Navigation, Washington, D. C. ★ Persons interested in applying for air corps ground training, such as that for airplane and engine mechanics, riggers, instrument and radio men, as well as aerial photography and parachute work, should address the Commandant, Aircraft Technical School, Rantoul, Ill.

QUESTION: What is the meaning of the terms payload and useful load? What is the price and performance of the Jacobs-powered Beechcraft? Of the Continental-powered Stinson 105? C. E., Marion, Ind.

Answer: Useful load includes pilot, gasoline, passengers and baggage; payload is only passengers and baggage, plus mail, as on airliners. The price of the 285 Jacobs Beechcraft is about $11,000, it has a top speed of 185 miles per hour and cruises at 177 miles per hour. The Stinson 105 has a top speed of 120 miles per hour, cruises at 105 miles per hour. The price is in the neighborhood of $3,000.

Question: Can you tell me where I could obtain information concerning the operation and building of gliders, and requirements for a glider pilot? N. P., Uniontown, Pa.

Answer: The Soaring Society of America, 1909 Massachusetts Ave., Washington, D. C., has a manual on operation of gliders. It may suggest also a publication on glider construction. For glider-pilot requirements write to the Civil Aëronautics Authority, Washington, D. C.

Question: I noticed that in connection with the Lea Bill there was a statement to the effect that five percent of those trained for flying by the C. A. A. were to be non-college men. Could you give me more information on this? J. H. L., Conneautville, Pa.

Answer: Sorry, we do not have any further information on that. Suggest that you write directly to the Civil Aëronautics Authority, Washington, D. C.

Question: Can you give me the details of landing flaps used on the Boeing B-17? Does the trailing-edge section of the wing lower to form a flap, or is it a unit which is built separately and folds into the wing? Where can I obtain maps suitable for charting a cross-country trip, and what is their approximate cost? R. S. K., Mifflintown, Pa.

Answer: The Boeing B-17 has a split trailing-edge flap. The lower part of the trailing edge is hinged and can be lowered to form a landing flap while the upper part of the trailing edge is rigid. You can purchase strip maps for cross-country flying from the Civil Aëronautics Authority, Washington, D. C. They cost approximately thirty-five cents each.

Question: What is the cruising and top speed of the Stinson Reliant SR-10C? Where can I get a flying model of a Hawker Hurricane? J. M., New Glasgow, N. S., Can.

Answer: The top speed of an SR-10C is 175 miles per hour, cruising speed 154.5 miles per hour. Write to the Cleveland Model & Supply Co., 4508 C73 Lorrain Ave., Cleveland, O.; they may have a flying model of the Hawker Hurricane.

Question: Could you give me a list of manufacturers who make a two-cylinder air-cooled aircraft motor of around twenty-five to thirty horsepower? L. A. P., Point Huron, Mich.

Answer: The Aëronautical Corporation of America, Cincinnati, O., used to make a motor similar to this, but are now making engines of higher horsepower. Anyhow, write to them, as they may still have some of the older motors in stock.

Question: Do you have a list of government-approved aviation schools? H. C. S., Bound Brook, N. J.

Answer: Suggest that you write to the Civil Aëronautics Authority, Washington, D. C.

Question: Could you send the names and addresses of aircraft manufacturers in California? C. G. T., Selfridge Field, Mich.

Answer: Douglas Aircraft Co., Santa Monica; Consolidated Aircraft Corp., San Diego; North American Aviation, Inc., Inglewood; Ryan Aëronautical Co., San Diego. There are several others.

Question: A friend of mine says that the engines used in the Schneider racers had a speed of 18,000 revolutions per minute. I don't think it possible. If these figures are not true, what is the speed of those engines, especially the Fiat AS.6 used in the Macchi-Castoldi? B. W. C., Jr., Springfield, Mass.

Answer: I am afraid that your friend is very much mistaken. The Schneider Cup racing planes used the Rolls-Royce "R" engines, which developed 2,300 horsepower at no more than 3,200 revolutions per minute, while the Fiat AS.6 used in the Macchi-Castoldi has 3,100 horsepower at 3,300 revolutions per minute.

Question: Would you please tell me what an aëronautical engineer does? Does this course provide a good future and what are the minimum and maximum salaries? Which college would you suggest to study aëronautical engineering? S. R., Rockaway, N. Y.

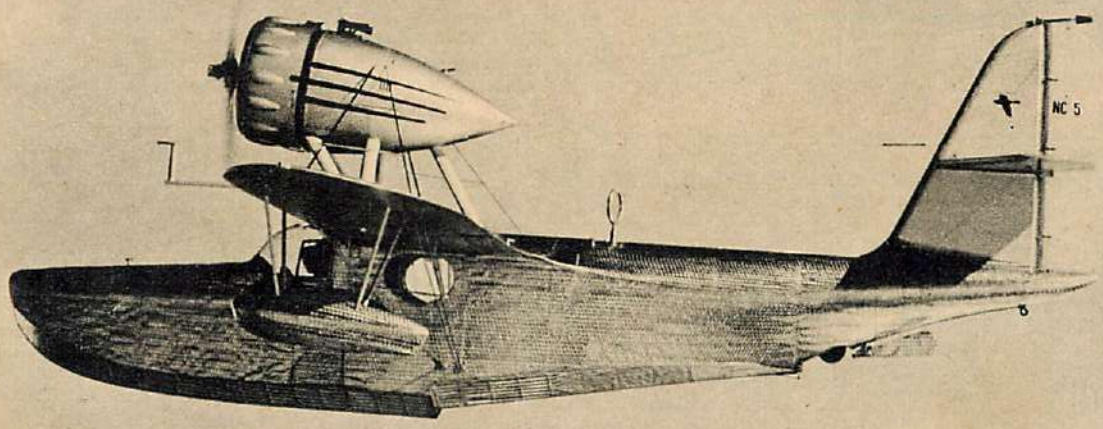
Answer: Aëronautical engineers are engaged in a great number of specialties. These include design, stress analysis, wings, fuselage, engines, instruments, propellers, metallurgy, radio, electricity, production, maintenance, et cetera. The minimum salary is about $2,000 a year, and some get as much as $10,000 and more, depending on their importance and knowledge. A good aircraft engineer has a very promising future. I would suggest New York University as the best engineering school in your immediate vicinity.

Question: Could you please tell me when the next issue of Jane's "All the World's Aircraft" is coming out, how much it costs and where I could buy it? I understand that it gives more information about U. S. planes than can be had in America. T. F., Shaker Hts., O.

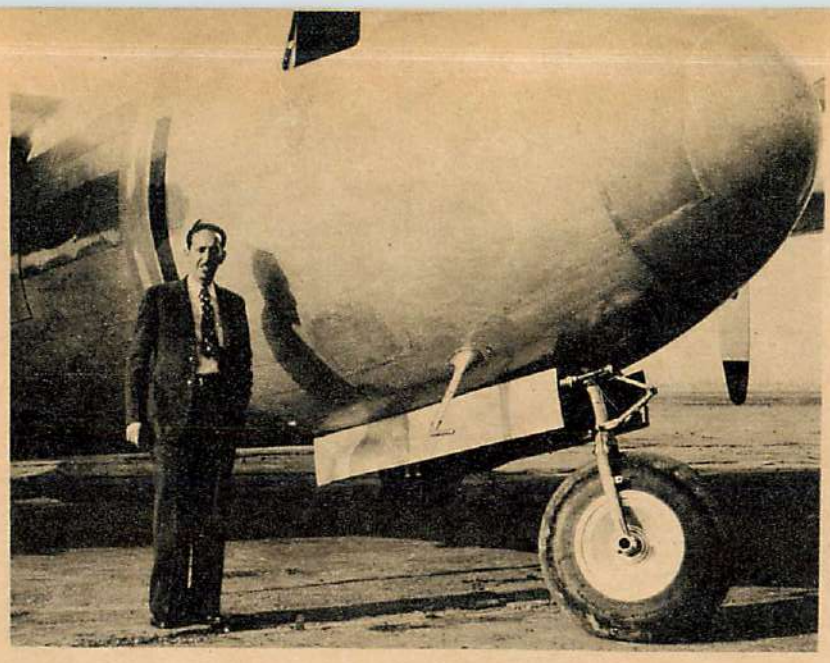
Answer: The 1939 issue of the book is out already. The 1940 one will appear sometime next spring. The price of the book is around $15, and you can order it from the Foreign News Depot, Times Bldg., N. Y. C. It is the best compiled book on aircraft in existence, although it does not give more information than can be obtained from magazines. The fact that you can get most of the information on all the planes in the world right out of one book gives it its greatest value.

THIS WINGED WORLD

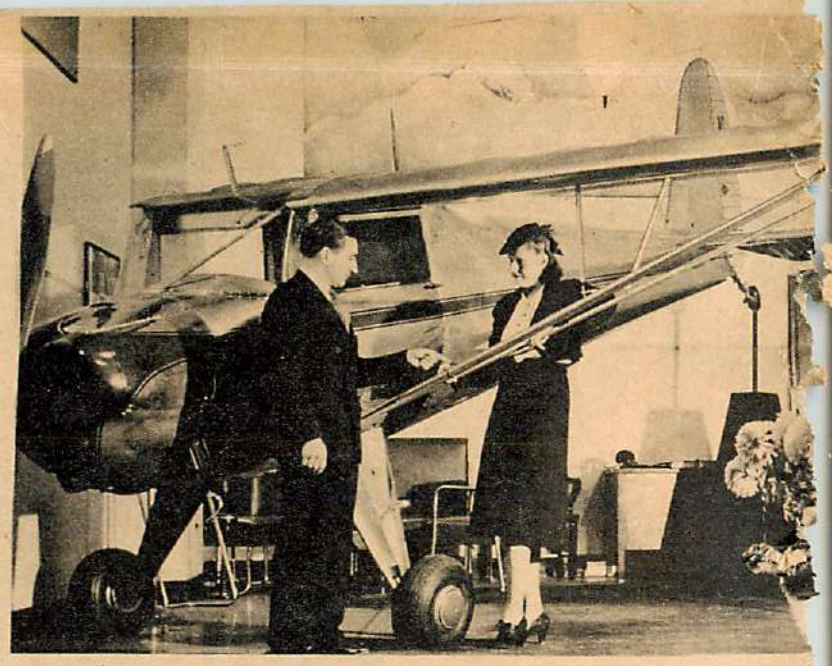
Air Trails review of aviation as seen through the camera.



This exceptional flight shot by Hans Groenhoff shows the C. A. A.'s new Fleetwings stainless steel amphibian for experimental use.

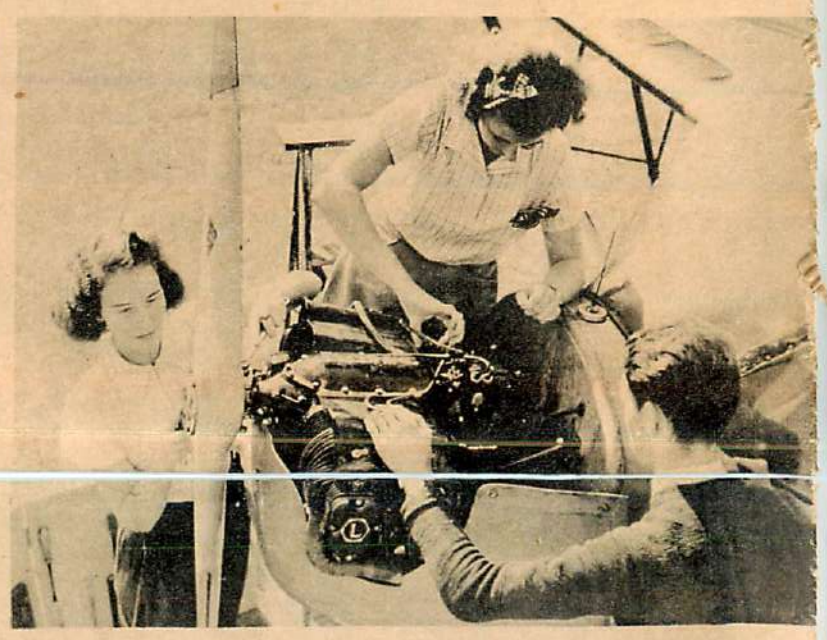


New model and old master. An interesting close-up of the nose and forward wheel of the Douglas DC-5 passenger transport and its test pilot, Benny Howard, the old testing maestro himself. After wheel retracts, portal closes.



Spider and the flier. An innovation and precedent were recently established by Luscombe in opening a permanent airplane showroom in New York. This marks the beginning of auto-sales technique as applied to aviation.

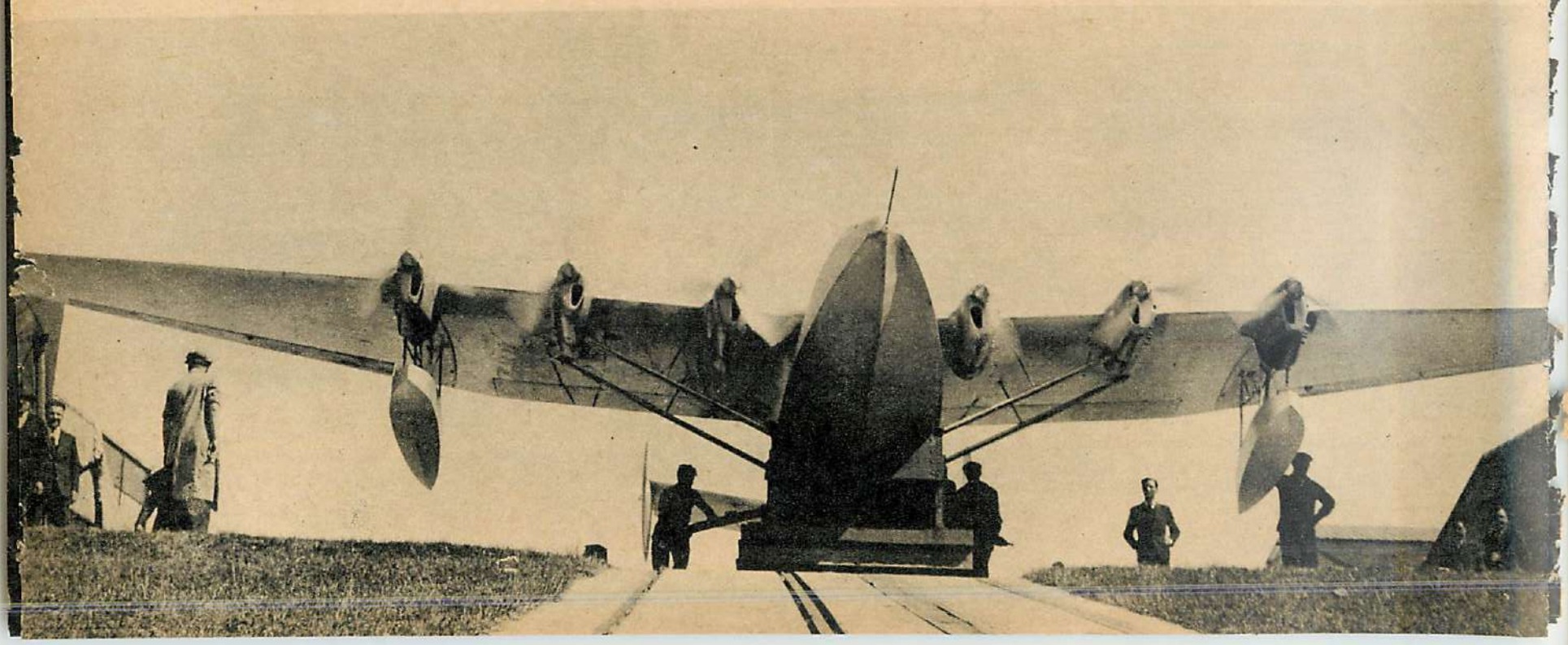
Not "go-grease" but coconut milk is used in the christening of the "Courier." This light plane is to be flown by the Second Fahnestock South Sea Expedition. Left, Bruce Fahnestock, Jr., and wife, and right, John Fahnestock and wife.



Lucky Lycoming! Three young ladies who apparently seem to know very well what it is all about. These young aviation students are members of the Lake Erie College unit of the C. A. A. Citizen Training Program.

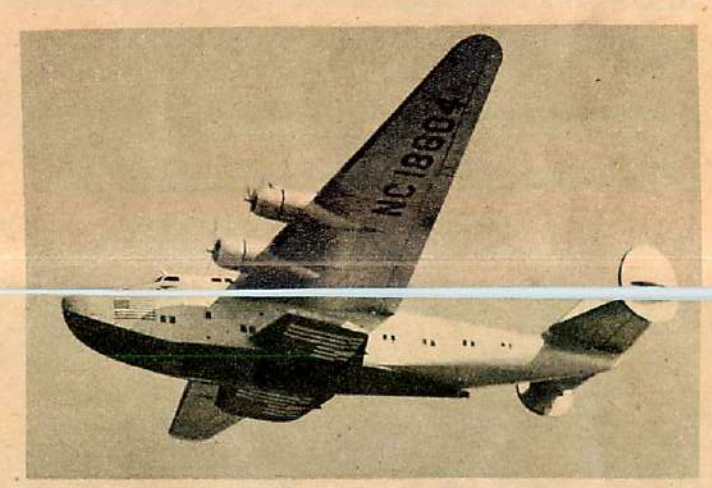
THIS WINGED WORLD

Our idea of a real flying scale model. This perfect one-third scale model of a giant flying boat, the Potez 161, is in itself as large as many full-size transports. Test flights of this are used to provide data for big ship.

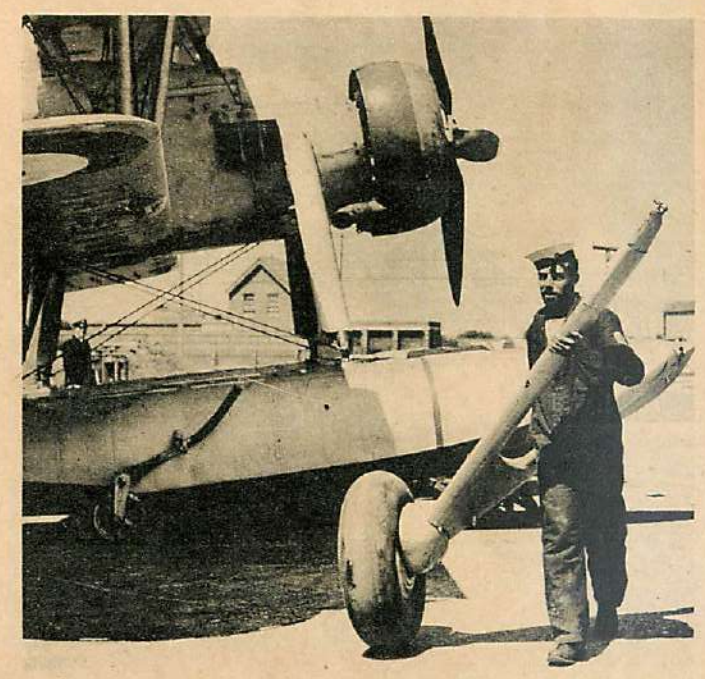


Off to see the blizzard! This sleek twin-engined seaplane shown during test trials went to the South Pole with Commander Byrd. This Barkley-Grow, outfitted with special equipment and instruments, is to be used by the commander and his pilots for extended aerial survey flights over antarctic wastes.

Neither the man in the iron mask nor a bird in a gilded cage, but a forest fire fighter in new equipment of steel face mask and padded suit. Dropped with fire-fighting equipment near inaccessible fires, they prevent great damage.



Taking no chances of being mistaken for anything but American, this Pan American Clipper sports the stars and stripes on her sponsons.

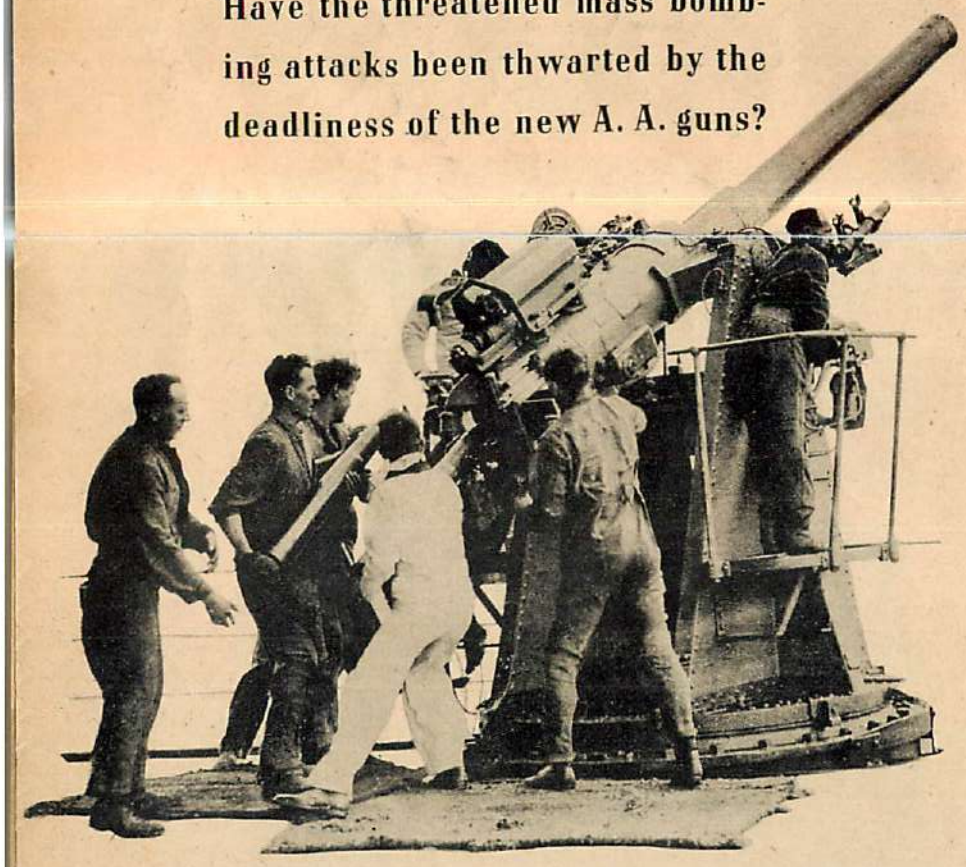


Hey, put that back! This is not the bane of airmen's lives, a souvenir hunter, but a bearded British Naval Air Arm man trundling along a detachable wheel from a seaplane. Ship: Fairey Swordfish.

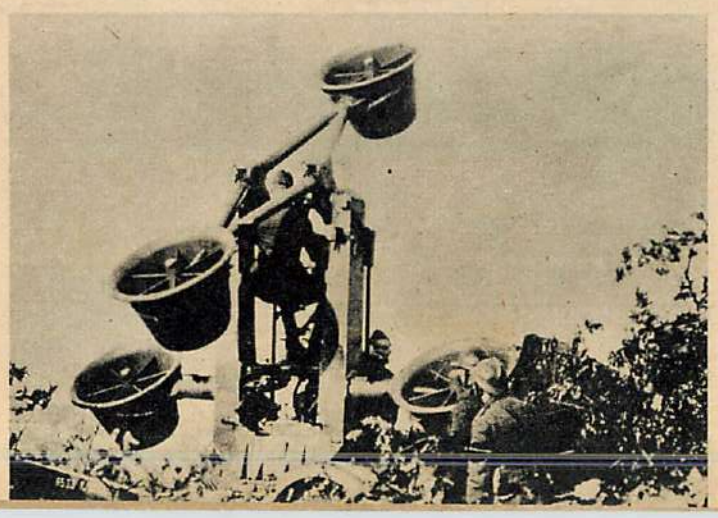
THE WORLD'S GUNS ANTIAIRCRAFT

Have the threatened mass bombing attacks been thwarted by the deadliness of the new A. A. guns?

Germany has dotted her hills with A. A. guns such as this one in its protecting trench. Above it flies a Fieseler "Storch."



Typical of the antiaircraft equipment aboard British warships is the one shown. This is one of the larger type with a seven-man crew. Note padded nonskid mats in case a shell is dropped. Below—Belgium's tin ears, hearing planes miles off, are cocked toward Germany.



ONE of the maxims of war is that a new engine of horror is five times as hard to contrive as a counter-device to block and neutralize it. This was seen in the use of poison gas, the tank, the destroyer, the mine. It is being demonstrated as strikingly today in the new antiaircraft guns.

Years were spent in devising the airplane prior to its debut in the World War, but almost overnight much of its effectiveness was written off by the "archie." By slow, progressive stages this weapon has now become one of the deadliest known to man; certainly, with its "jeep," that amazing fire director, it is the most extraordinary development in the modern history of ballistics. And to my mind it supplies the chief reason why Hitler and Goering have failed to turn loose that long-dreaded aërial blitzkrieg.

The A. A. gun got off to a bad start, slumped for about ten years after the War, and only since the Spanish civil war has it really gone to town. At first in 1914-15 the French frantically turned their 75s upward at the swiftly darting Taubes and Fokkers. The effort was on the scale of a duck hunter armed with a popgun. They did little better with a quickly developed small-caliber rifle for high-angle fire. As late as 1916 the archie required an average of 11,000 shots to bag a Boche. By 1918 the British three-inch A. A. gun had narrowed these odds to 1,500 rounds. In the end, both London and Paris were largely saved by the archie, though all told it accounted for only one out of five planes brought down.

Today war planes fly three times as fast, ten times as far, twice as high. On the ground, the A. A. gun's progress has been even greater. It has attained a point of efficiency where toward the end of the Spanish conflict it accounted for four out of five planes brought to earth! True, that new wonder rifle, the Swedish Bofors' 88-mm. (3.5-in.) which the German Condor Legion tried out, largely accounted for such marksmanship. But other guns—the British 3.7-inch and new 4.5-inch and the American 3-inch—have given countless examples of their power, range and effectiveness against the fastest combat and bombing planes.

The early World War guns failed principally because they couldn't always find their target. In time the Allies developed

Above—Uncle Sam's deadly three-inch A. A. guns at night practice. Right—Your Uncle's all-important height-finder instrument that is the despair of foreign powers. This is part of the fire-control unit of all A. A. batteries.

BY ALLAN FINN

predicting methods to put a bead on an audacious foe, but they were not very satisfactory. It took years of experimentation afterward—mostly in the United States—to devise those magical fire directors which transmit mathematical calculations of Einsteinian proportions electrically to the batteries. A modern A. A. battery consists of a sound detector, searchlights, altitude finder and other minor precision instruments, but it is this director, with its predicting mechanism, that is the real brains of the whole set-up.

The marvels of the A. A. artillery have made it the most thrilling and romantic division of field gunnery. It is wholly different from all other forms of cannonading. The A. A. gun's problem is to hit a target moving in three directions. Its task is complicated by the necessity to eliminate the curved trajectory. For this reason, all A. A. guns are flat trajectory weapons with high muzzle velocities. They use shrapnel, or high-explosive shells, fused and many of them fitted with tracers so that their proximity to the target may be observed through the trail of smoke given off. Firing is, of course, done entirely by prediction, since it is impossible, as in other branches of artillery, to correct the range empirically from observation of shots through ordinary methods. Indeed, guns lack the conventional sights. Every shot, as a matter of fact, must be calculated afresh.

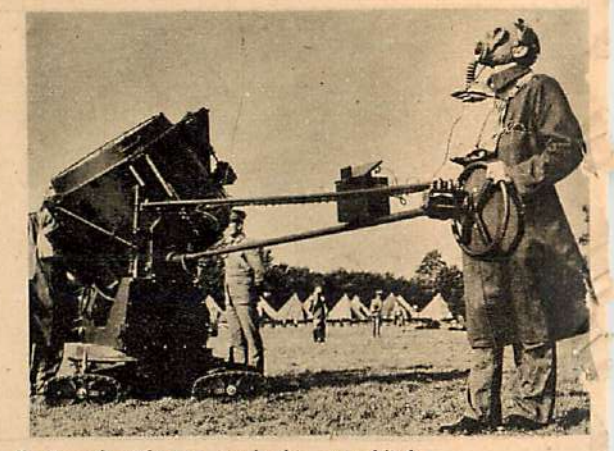
The rifles themselves differ, too, from other field pieces. For one thing, the barrels are proportionately much longer to their caliber. Guns of the three-inch type have barrels ten feet long and fire about twenty-five shells a minute. The higher muzzle velocity is needed to get them up quickly. The breech lock is fully automatic; the round, about two and a half feet long and fifteen pounds in weight, is inserted and the breech block closes behind it and opens afterward, automatically ejecting the empty shell case. These guns can be pointed in any direction without moving the carriage, and limits of elevation are from minus to eighty degrees. With a maximum horizontal range up to 45,000 feet and a vertical range up to 37,000 feet, they can shoot within ten degrees of straight up and ten degrees below horizontal. In traveling position they weigh about eight tons and can be towed by truck at fifty miles an hour. So mobile are they, in fact, that their muzzles can begin spitting fire in a few seconds from scratch.

The mechanism of the A. A. gun is so complex that only a few artillerists can operate it. The whole process of sighting and firing is synchronized electrically, with the altitude finder and director often hundreds of yards distant from the guns, connected by long lengths of cable. There is no sight setting, no laying of guns on the target. The robot range finder and director

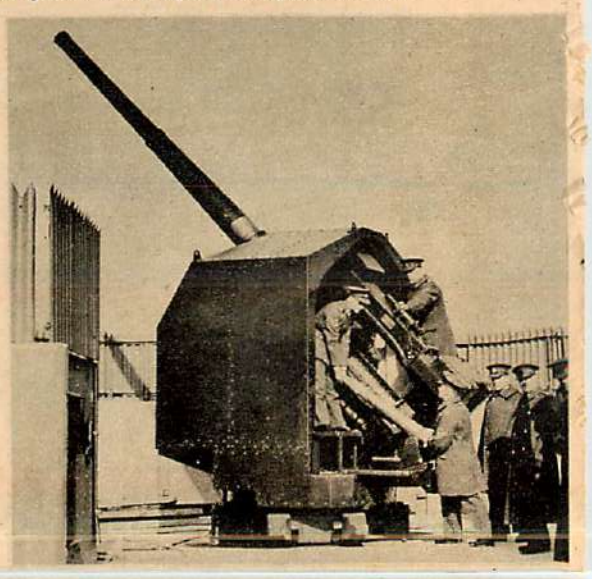
compute the direction and velocity of the wind, the density of the atmosphere; they make allowances for the drift of the projectile, the speed and maneuvering of the target; they take care of fuse requirements. All this data is digested in a split second and transmitted to dials on the guns. The sweating gunners simply crank and load as the long gray snouts continuously move upon the target, which may often be out of human sight.

But long before these two gadgets swing into action, the sound detector with its grotesque assortment of horns is picking up the throb of a distant motor. This sensitive instrument, also now highly perfected, can locate a plane, providing it isn't gliding in with engines throttled to idling speeds, from thirty-five to sixty miles off. Warnings of from five to ten minutes can thus be given to the A. A. battery. For night work a comparator co-ordinates the detector and the searchlight. The horns pick up the motor purr from one angle and the light from another within one or two degrees. The data so obtained is automatically rectified by a sound-lag corrector, and is electrically transmitted by a self-synchronizing receiving motor to a dial with pointers. In clear weather these lights, which range up to 800,000,000 candlepower, can illuminate an object four miles away. They not only blind the approaching pilot, but blot out the entire landscape below him. But it takes a deft hand to keep a bead on a plane rocketing along at 350 miles an hour. At their best, the lights function most efficiently at 12,000 feet, though they have a top of 20,000 feet. Improvements, however, are constantly being made, and I have heard reports of the appearance on the Western Front of a new "invisible" light which cannot be seen by the pilot but projects him starkly against the heavens. Also, there are reports that the United States army has developed a "black ray"—a heat detector which makes use of infrared rays that can pierce space to a height of twenty miles.

But neither the sound detector nor the fire predictor would be worth tuppence without that magic little instrument, the range finder. It is an optical device fitted with telescopes which calculate the height, angle of elevation and direction of the approaching plane. It is a tube about twelve feet long and six inches in diameter, mounted upon a tripod. At either end is a small opening with crossed lines. Through a peephole in the center of the tube the operator looks for his quarry, and his line of sight to it goes out the left opening at a right angle to the long axis of the tube. Through the opening at the right his line of sight converges on the plane at an acute angle. With one angle to work from, the length of the base of the triangle (length of the tube) known, and the degree of the acute angle determined, the instrument automatically computes the distance of the plane. This intelligence is transmitted electrically to the nearby director. To determine the approach- *(Turn to page 46)*

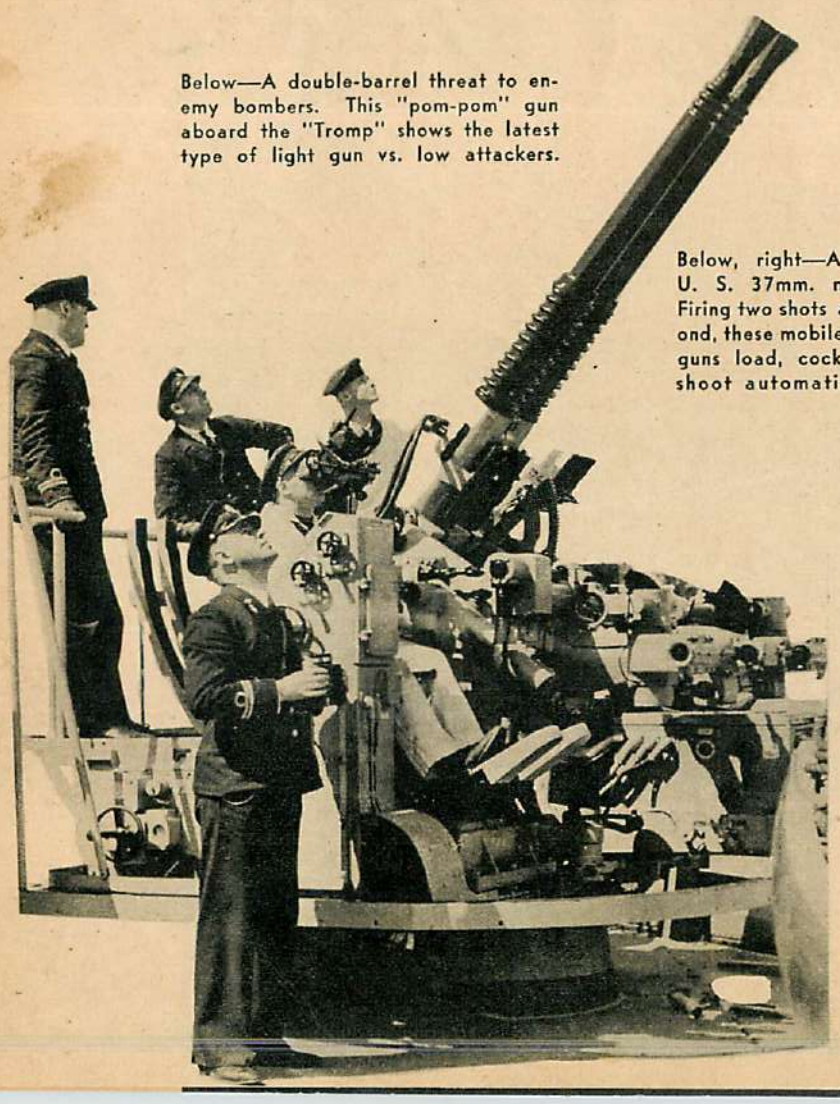


Equipped with gas mask this searchligh, operator directs the beam from beyond the glare. Note light's caterpiller treads.

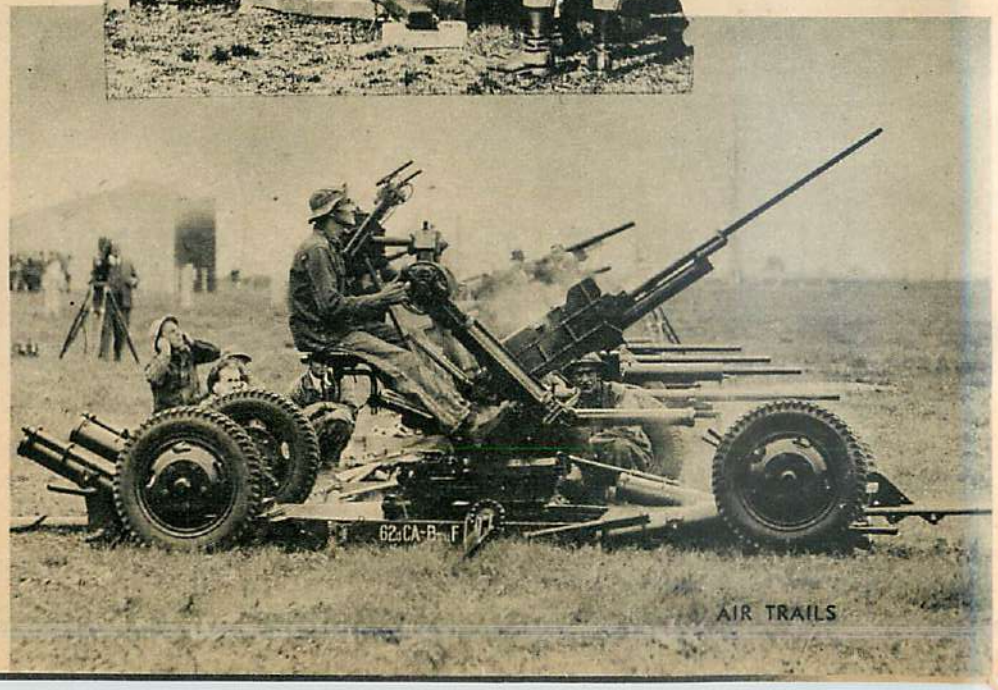


Britain too is ready with her 4.5" guns as shown protected by a steel canopy and corrugated-iron fences. This caliber gun is being used in the defense of London. Left—One of the deadly Swedish guns that was so effective in Spain, accounting for 4 out of 5 planes shot down.

Below—A double-barrel threat to enemy bombers. This "pom-pom" gun aboard the "Tromp" shows the latest type of light gun vs. low attackers.



Below, right—A new U. S. 37mm. model. Firing two shots a second, these mobile A.A. guns load, cock, and shoot automatically.



ALEC THE ACE

What happens when an Andes pilot who likes dog-fights meets a giant condor who hates airplanes?

HARRY OLIVER was off duty today. Harry was young in years—twenty-six, to be exact—though old in flying. When he was sixteen he had advanced his age two years to go to Pensacola. He was a credited naval pilot at the ripe old age of seventeen. He had flown the mail for lines in the States, and had come here to South America to help start one of the world's largest air lines. But Harry missed the military flying, didn't care much for this aërial bus driving he was doing. Still, having been in the game so long, he hated to get away from it. Hence the busman's holiday on the airport.

Even now he was sitting in the powerful little Falcon reserve plane that he had piloted so many times during the early days of South American flying over the Andes. The Falcon was resting, dusty and unused, in the far corner of the Santiago hangar, while Harry watched mechanics put safety into the air mail. They were doing a good job of checking on a sleek DC-3. Too good a job to suit Harry. He missed the thrill of wondering whether the pass would be open when he got to it, or whether he would have to buck a terrific head wind to get back out of the pass before he was trapped. There had been no radio observatory on El Cristo Ridge in those days to tell the pilot whether it was safe to fly or not.

But flying was a swell game, and Harry had no intentions of getting out of it. Perhaps it wouldn't be so monotonous if old Alec hadn't sold out on him. Alec was the pet aversion of all the pilots flying the Andes—except Harry. The giant condor hadn't been seen lately in the pass, had probably moved his nest to some other place in the high mountains that wasn't infested with roaring man-made birds.

Johnny Richards, waiting for his signal to take off on a scheduled trip, sauntered over to the Falcon and stared in at Harry.

"What's the matter, Harry?" he bantered. "Dreaming about the old days again? Sitting there forlornly in that old ice box when we've got nice new Douglases with warm cockpits, oxygen metered to us, and instruments that work! Man, aren't you ever satisfied?"

Harry grinned forlornly. "That's just what's bothering me, Johnny. I'm like the grandmother in the modern kitchen. I like my flying the hard way."

The motors on Johnny's Douglas coughed and popped a few times, roared, then settled to a steady *larumphing* while the co-pilot leaned out of the window and beckoned to Richards.

Johnny ground out the butt of his cigarette on the "No Smoking" sign and grinned. "Another nice comfortable jaunt over the hills, Harry, without having to worry about Alec biting me, then Buenos Aires for the night!" He smacked his lips appreciatively and hurried out to his plane.

Harry continued his absent watching of the varied activities of the hangar and reminisced. Johnny's crack about Alec set him wondering what had happened to old Alec. The gigantic, battle-scarred condor had a tremendous wingspread and a decided dislike for these roaring birds that were airplanes. He resented their intrusion in his kingdom of the peaks and snow-capped ranges. He had very effective ways of indicating his resentment.

Alec's family was large, or had been. Harry wasn't sure whether they were all members of Alec's immediate family, but there had always been ten or twelve dark-colored condors cruising with the craggy old gray monster. Many times Alec had led his flock in protest against an airplane flying through his pass. Three times mail planes had crashed as a result of one of the flock contacting a wing or propeller. Hell, Harry grinned, two more and the old bird would have been an ace.

Fortunately no one had ever been killed in one of these crashes, with the exception of the suicide condors, but it had been necessary for the pilots to make forced landings on the floor of the pass near the Trans-Andean railway. The wreckage had to be loaded on the train and shipped back to Santiago. But Alec had always seemed clever enough to let one of his flock do the suicide work, escaping unscathed himself. The pack thinned out, until finally old Alec was flying solo.

But Alec continued his one-bird war against airplanes. The pilots kept a lookout for him and did their best to avoid coming near him—all except Harry. Harry was too enthusiastic over his first flying training, military acrobatics. Every trip across the hump found him searching for the old bird, heckling him into a dogfight. Harry's pay vouchers showed an almost continual deduction for the time when Alec was active; fines for being inexcusably late in crossing schedules.

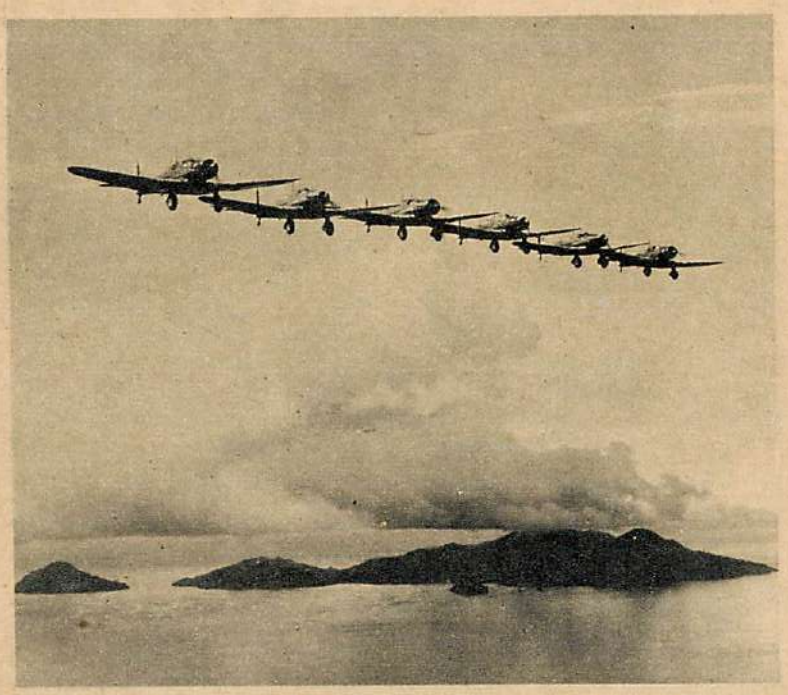
Every trip would find the giant condor and Harry's Cyclone-powered Falcon in a dogfight. Harry always won, because the condor couldn't seem to allow for the excessive forward speed of the airplane. His folded wing dives would always carry him past the tail of the Falcon. The prop wash was something else he didn't seem to understand.

On the last time Alec was seen, Harry figured that he must have played too rough with that old bird. He had enticed Alec into a dive at his airplane close to a rocky cliff, and when the condor overshot to the rear, Harry had blasted the supercharged Cyclone wide open. The slipstream slapped the bird against the rocks violently. Alec floundered around with an apparently broken wing. He had never been seen in the pass since that encounter. The operations manager had arranged for a *(Turn to page 51)*

BY WILLIAM HERBERT RANDALL

IF THE CANAL IS ATTACKED

New strategy calls for air bases 1200 miles distant from the Canal in every direction. Let enemy bombers try to penetrate the circle thus formed!



Uncle Sam's flying watchmen drone ceaselessly over the Isthmus keeping an eye out for suspicious activity. These six A-17s are part of attack equipment.

RUDELY shaken into action by world developments of the past year, Uncle Sam is speeding forward the greatest armament program in American peace-time history. With arsenals, shipyards and plane factories working at top speed, rearmament has been one of the big news stories of the year. Yet probably the most important phase of the whole plan is little known to the American public. It is a far-flung project aimed primarily at thwarting any attempted aërial attack on the Panama Canal—keypoint of our defensive system.

The recent spectacular rise of air power has brought on the stark necessity of immediate and far-reaching changes in Canal defenses. Aircraft builders in other countries as well as the United States are now able to turn out swarms of giant bombers, which can carry tons of deadly explosives over distances and at speeds merely dreamed of a few years ago. Technical advances will be accelerated by the war. Day by day the potentialities of offensive air power against our strategically essential but vulnerable waterway become more ominous.

The result is a program to expand the local defensive forces in the Canal Zone and to build a great chain of defensive outposts. The cost will be tremendous, for it is estimated that before the new measures are completed the total expenditures will run above the $350,000,000 original cost of constructing the Canal.

Before we go into what is happening down in the Caribbean,

By Lieutenant W. M. WOOD and JOHN G. NORRIS

let us look at the present situation and examine the place of the Canal in our national defense system in order to see why such an outlay is required. Why is the Panama Canal called "the defense key point" and the "nation's life line"? Of what great consequence if a Central American strip of rented land, ten by forty miles, were damaged, beyond its effect on shipping between the East and West coasts? Perhaps not a great deal if the United States were to build a "two-ocean navy," such as has been agitated recently in Congress, or if we created a huge standing army, with compulsory military service for all able-bodied male citizens. The latter, of course, is distasteful to American principles, and the former would cost billions.

The point is that we can safely maintain a small standing army because we expect our fleet to hold an enemy away from our shores and give us time to mobilize after war starts, time to train men and manufacture weapons to fill out skeletonized army and national guard units. But—we have two sea frontiers, two oceans bordering our shores from which attack may come—and only one fleet. Our navy is strong enough to defend the nation from attack by any single power, provided it is intact. If divided half in the Atlantic and half in the Pacific, one portion could be defeated and then the remainder be run down and wiped out by an enemy superior to either portion.

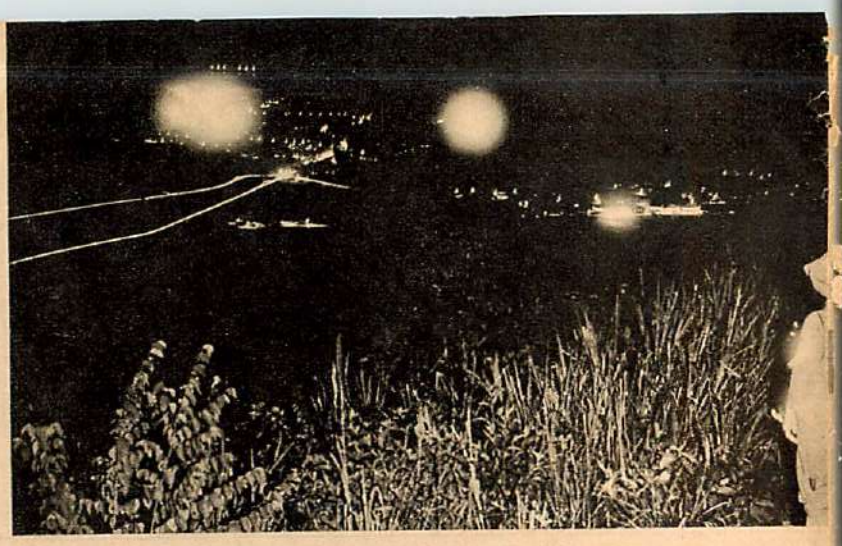
So traditional naval policy holds that the bulk of the American sea strength must be concentrated in one ocean, unless the navy be so superior to that of any other nation that half of it could whip any single enemy fleet. The navy department recently estimated the cost of duplicating the present fleet at more than $4,000,000,000—a tremendous sum even in these days of huge governmental deficits. And annual upkeep cost would be nearly double the present figure—expected to total a billion dollars this year.

Thus the full importance of the Panama Canal is revealed. The United States has based its military policy on a skeletonized army, one fleet "second to none"—and the Canal.

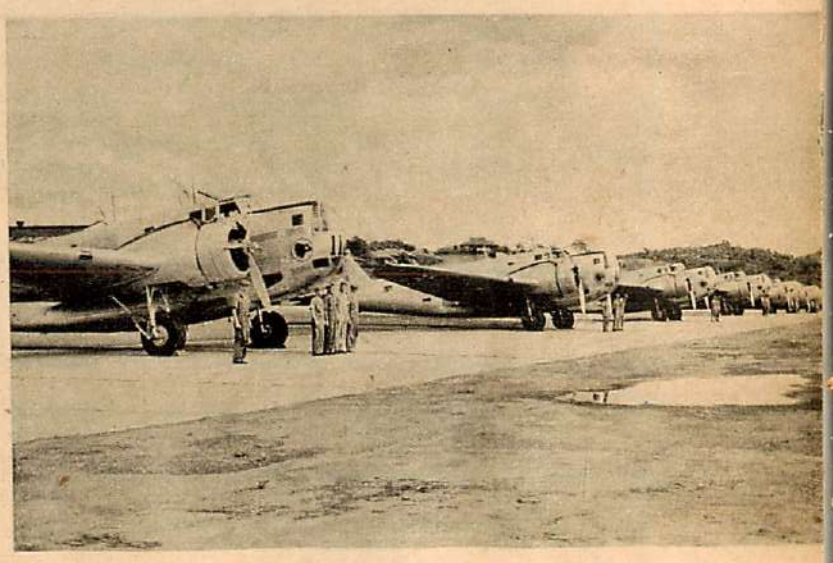
Let us see how the plan works. If an attack came from Asia and the fleet were in the Pacific, well and good. If, however, it were on the West coast, as is normally the case, and the attack came from Europe, then the defense of the Atlantic seaboard would rest on the air corps and the army until the fleet could come around to assist. It takes about three weeks for the fleet to come from its California bases to the North Atlantic via the Canal, and probably less under forced draft. And from the instant it comes through the Panama Canal, it would be a prime factor in any operations in the Atlantic. Without the Canal, however, an enemy would have about two months to land troops and bomb our cities before the American navy could "round the Horn."

If the Canal be destroyed or captured, the navy can protect only one coast and the other will be open to a hostile attack. Thus our entire scheme of defense would fail. As a former war secretary, John W. Weeks, once said: "All plans for the naval defense of the United States are predicated upon the uninterrupted use of the Canal."

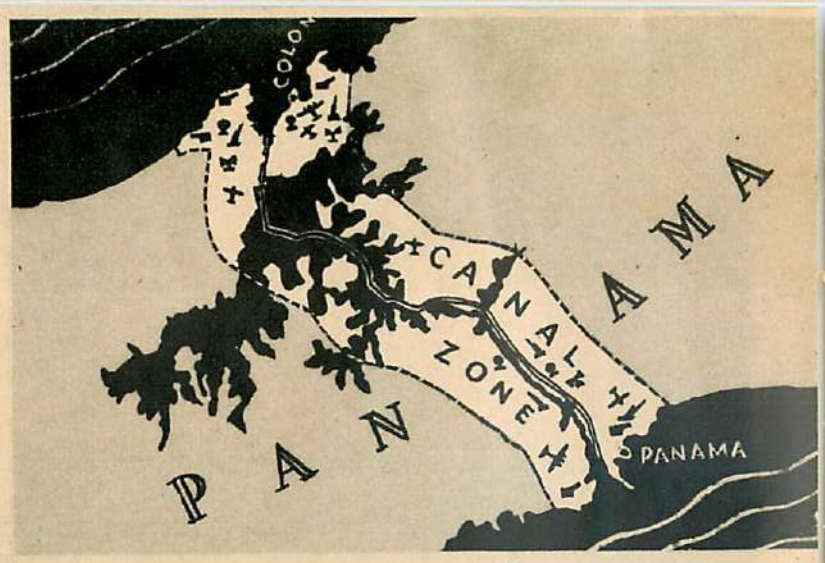
For years, the United States has relied upon coast defense and antiaircraft guns, a force of about 15,000 *(Turn to page 54)*



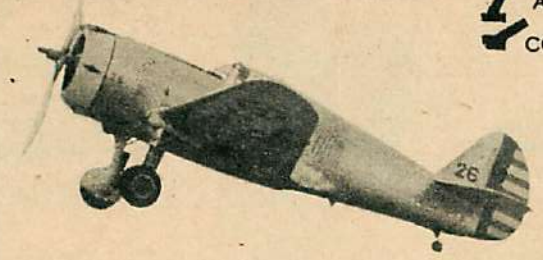
The Canal does a blackout. This shows the last few lights of the Zone just before it was lost in sea of blackness as test was run of its visibility at night. (View from Ancon Hill.)

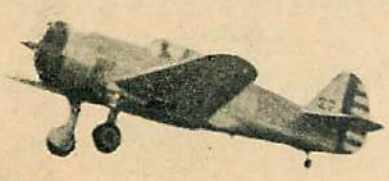


Bombers, too, guard the Canal. The B-18s above are part of several units. Below—Showing the types of defenses that thickly dot the ten-by-forty-mile strip of U. S.-owned land.

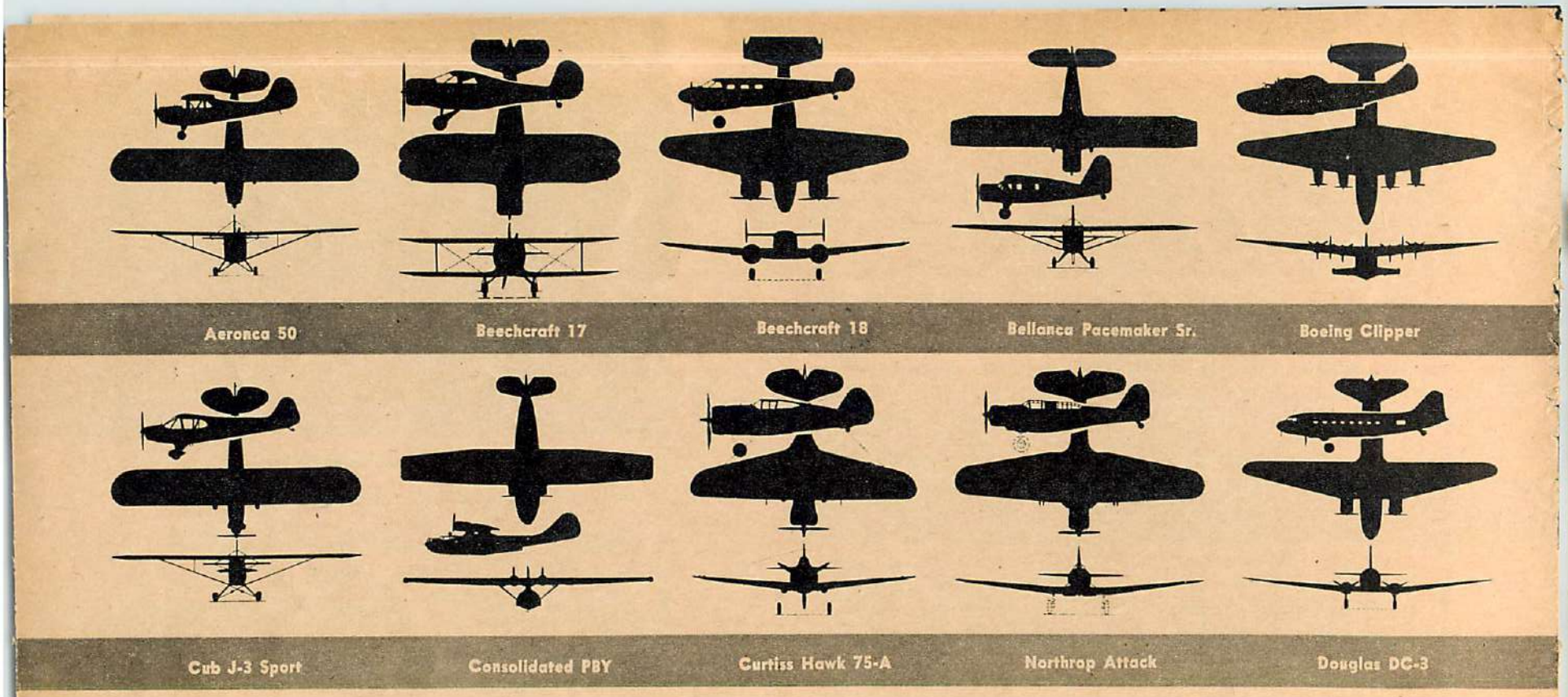


ANTIAIRCRAFT
COAST ARTILLERY
SEARCHLIGHTS
LISTENERS
PURSUIT PLANES
BOMBERS





Left—Searchlights and antiaircraft guns combined make a deadly unit. Right—P-36s take off on patrol.



WHAT SHIP IS THAT?

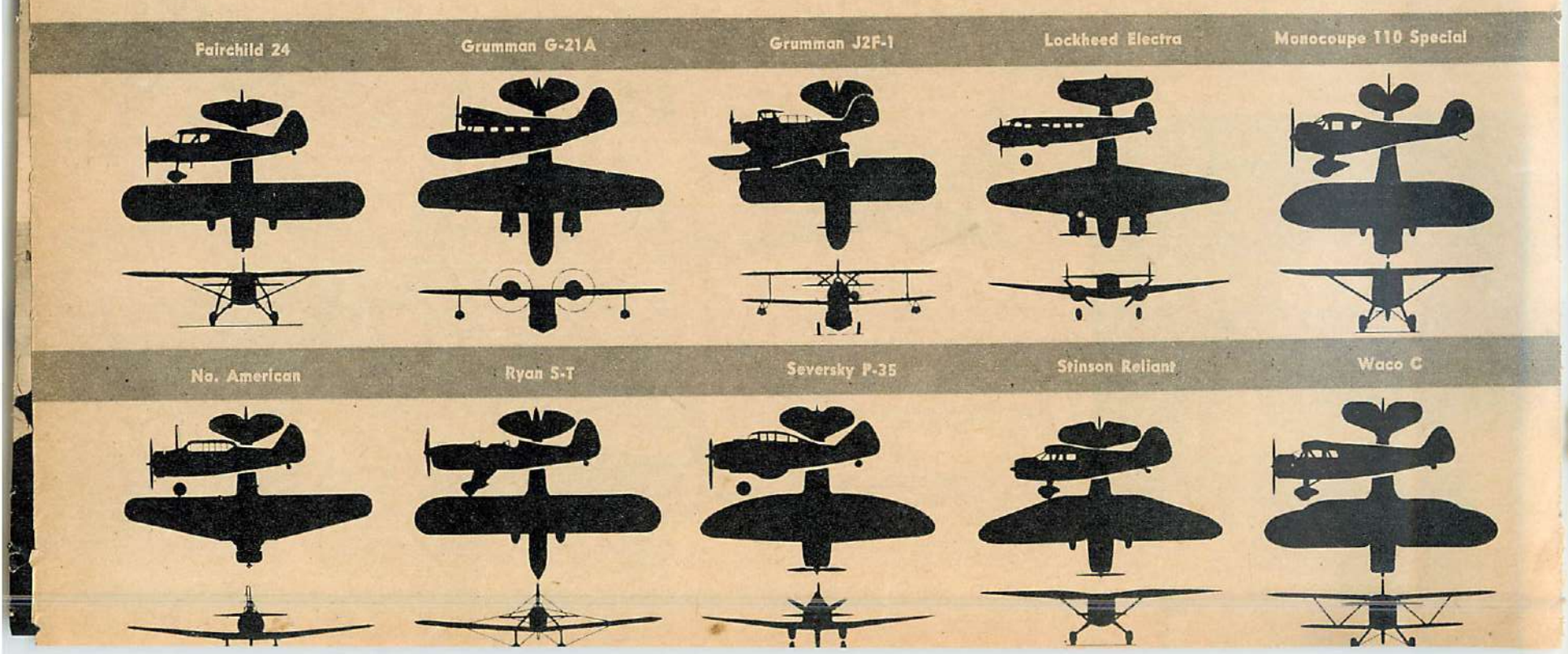
Here's a chance to learn the art of identifying planes in flight by looking for certain distinctive and unique characteristics.

BY FRANK TINSLEY

CAN you call off the model, or even the general type of that slowly moving airplane half a mile away and a couple of thousand feet above the rooftops? Hm-m-m, we were afraid of that. But cheer up, brother, not many people can. Even those aviation fans who consider themselves unusually well informed on the subject of aircraft find it pretty difficult to interpret form and proportion when seen in far-away silhouette.

The ability to identify aircraft in flight is not easily acquired. It is the result of experience and is based upon two essentials. The first is a comprehensive knowledge of airplane designs. The second is the knack, born of long practice, of picking out design features at a distance. This latter requirement is more difficult than you might think, for a moving plane, viewed by an observer on the ground, is seen at a constantly changing angle. These unusual angles can do queer things to the outlines of aircraft. When viewed in silhouette, for instance, the lower wings of an oncoming biplane overlap its tail surfaces, and at certain angles it is hard to say whether the approaching ship is a biplane or a high-wing monoplane. At certain other angles, those same lower wings of our biplane mask the wheel gear and give the ship the appearance of a seaplane.

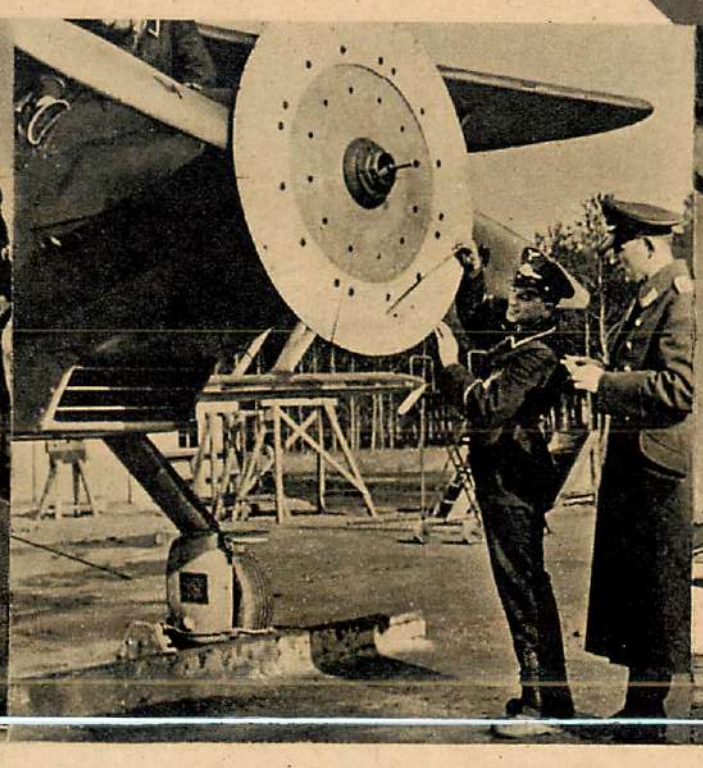
The ever-increasing use of retractable landing gear also helps to confuse the observer The fuselage contour of an airplane with tucked-up wheels closely resembles that of a flying-boat hull, and until an accurate sense of distance is developed it is hard for the tyro to distinguish between a comparatively small landplane and a larger, more distant flying boat. If the nearby ship is a biplane, the possibility of error is even greater, for at one side angle, when viewed from below, the *(Turn to page 56)*



GADGETS A LA SWASTIKA

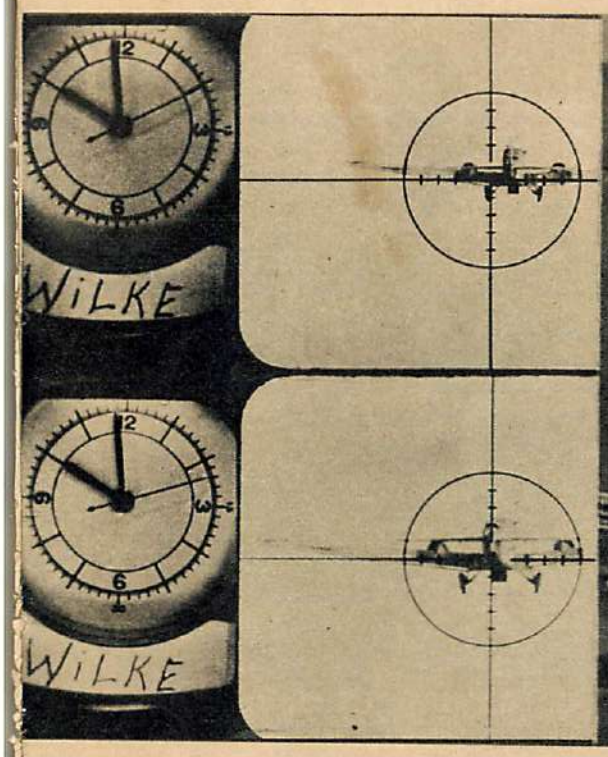
What the well-equipped German war flier carries. Here are some of the devices and accessories employed to aid him in his work.

German naval flier blows up. This sea-plane pilot tests his rubber life preserver before taking off. These are inflated with gas but may be emergency breath-inflated.



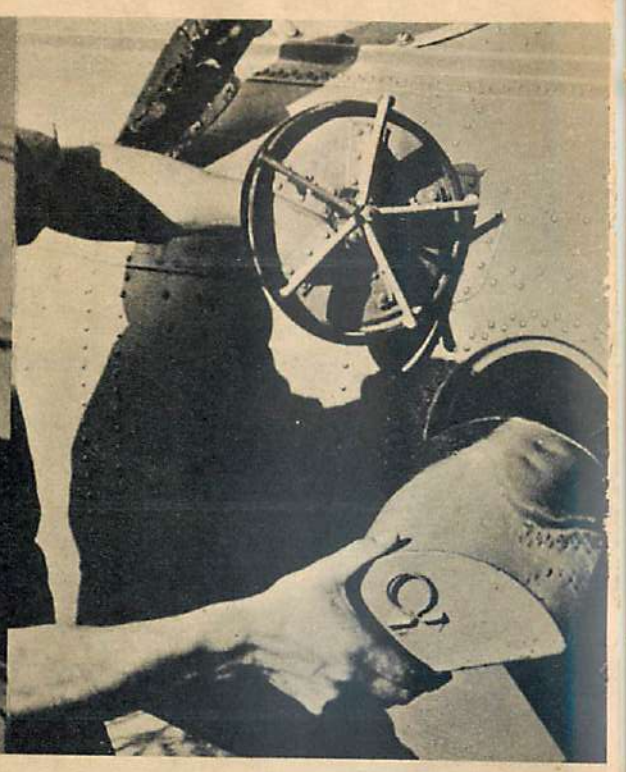
When a hit is a miss. German officer points to bullet holes in novel gadget to test aircraft machine guns. These guns are synchronized to fire through the whirling blades of propeller. This shows where the bullets hit disk.

A new slant on German bombing technique. These diagonal lines painted upon fuselage side are to aid the bombardier. Note plane is light below and dark above.



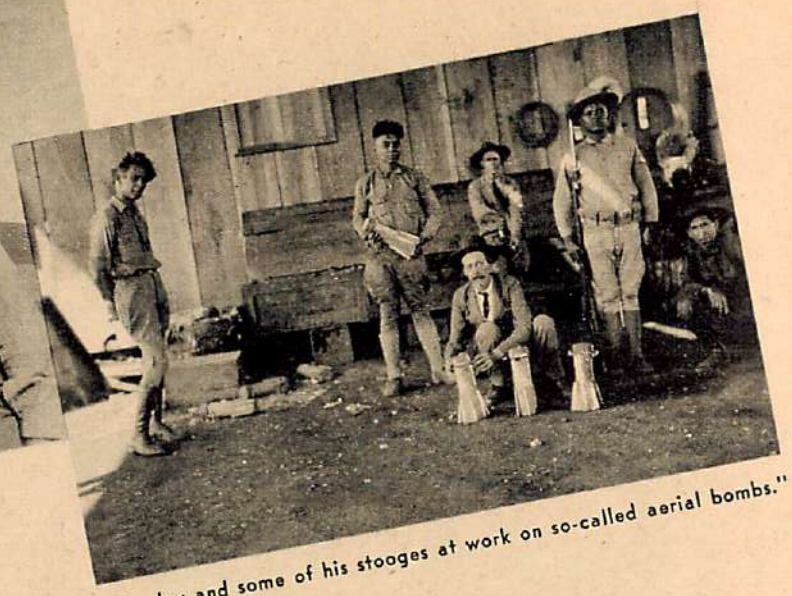
Two seconds to live. This photo-shooting of his target shows that within two seconds the pilot's aim was perfect, at least in training. Wonder how many misses?

Not a "thermal-sniffer" but a camera gun used to train pilots in the gentle art of aerial murder. This takes the pictures shown at left. The pilot is lining up his camera gun before take-off. After flight pictures are checked.



Down to the sea in tin cans go these emergency radio sets. Sealed in moisture-proof tin containers, they are carried by bombers in case of crash sea landings.

The air force: Col. Brooks, left, and Lee Mason, right.



"Charley and some of his stooges at work on so-called aerial bombs."

The trials and tribulations of the two-man air force which dropped homemade bombs more dangerous to itself than to the enemy.

LEE MASON and myself were having a perfectly grand time being the air force of the Republic of Nicaragua. The job paid well, we had fine quarters in which to live, plenty of servants and no opposition at all as far as aërial warfare was concerned. But we had our troubles just the same, troubles that might blow up in our faces almost any time, suddenly.

We had no aërial bombs; that is, the regulation bombs intended to be dropped from airplanes. Nor did we have our planes equipped with racks from which to drop bombs if we had them. Our two old Swallow planes had never been intended for any type of combat work, much less to be used as bombers. Fact of the matter was, our sole armament consisted of the revolvers we wore at our belts and a machete with which we were supposed to cut our way through the jungle in case of a forced landing, always gambling that we would be able to walk away from such a landing, with the odds about a hundred to one against it.

We had rigged up a sort of super-brain-child contraption that did pretty well as a defensive weapon—a hopper with a slide at the bottom. We filled this contraption with buckshot. If the rebels acted as we hoped, or at least as we thought they should act, we simply flew over them, checked up on their movements and reported back to Managua. If they had the temerity to fire on us while we were on patrol, we just opened the slide of the hopper a bit and let out a few pounds of buckshot. That usually did the work.

Then when everything was going fine and we were sure it was going to be a great war, some of the younger set of Managua—the capital of Nicaragua—discovered that there was honor waiting for the person who invented and built an aërial bomb. The trouble with these boys, though having the best intentions in the world, was that they knew nothing about aërial bombs, their construction, their component parts or the method of dropping them. All they knew was that a bomb was something you dropped on the enemy and it exploded with a loud bang, ending all activities of said enemy.

Forthwith there developed a great rivalry among the youths as to who could develop the best aërial bomb. Mason and I had done a little bomb making ourselves, of an experimental nature, with dynamite, nails and old scraps of iron packed in tin cans or green cowhide. They made respectable missiles. Trouble was, the only way we had of detonating them was by fuse, and we never knew whether they would explode on the ground or a thousand feet in the air.

The idea that something more than dynamite was needed in the bombs never seemed to penetrate the craniums of these youthful enthusiasts. They'd use a fifty-pound charge of explosive to fill an ash can and never think to put in nails or anything else. This scrap added to the bombs might not do any appreciable damage, but it sure made a horrible sound as it was blown through the air.

This bomb making would have been all right if there had been any way to test them, but as we were the whole air force we had to do all the testing ourselves, and the only way was to go out and drop them overboard. Did we kick? No! We couldn't afford to. Most of the bomb makers were sons of wealthy or politically influential families of Managua. Their parents approved of their patriotic thirst for glory, and if we did not co-operate, well, someone else would soon be dropping buckshot on Indian heads. We were making good money and wanted the jobs to last as long as possible, so we dropped bombs with our fingers crossed and our tongues in our cheeks.

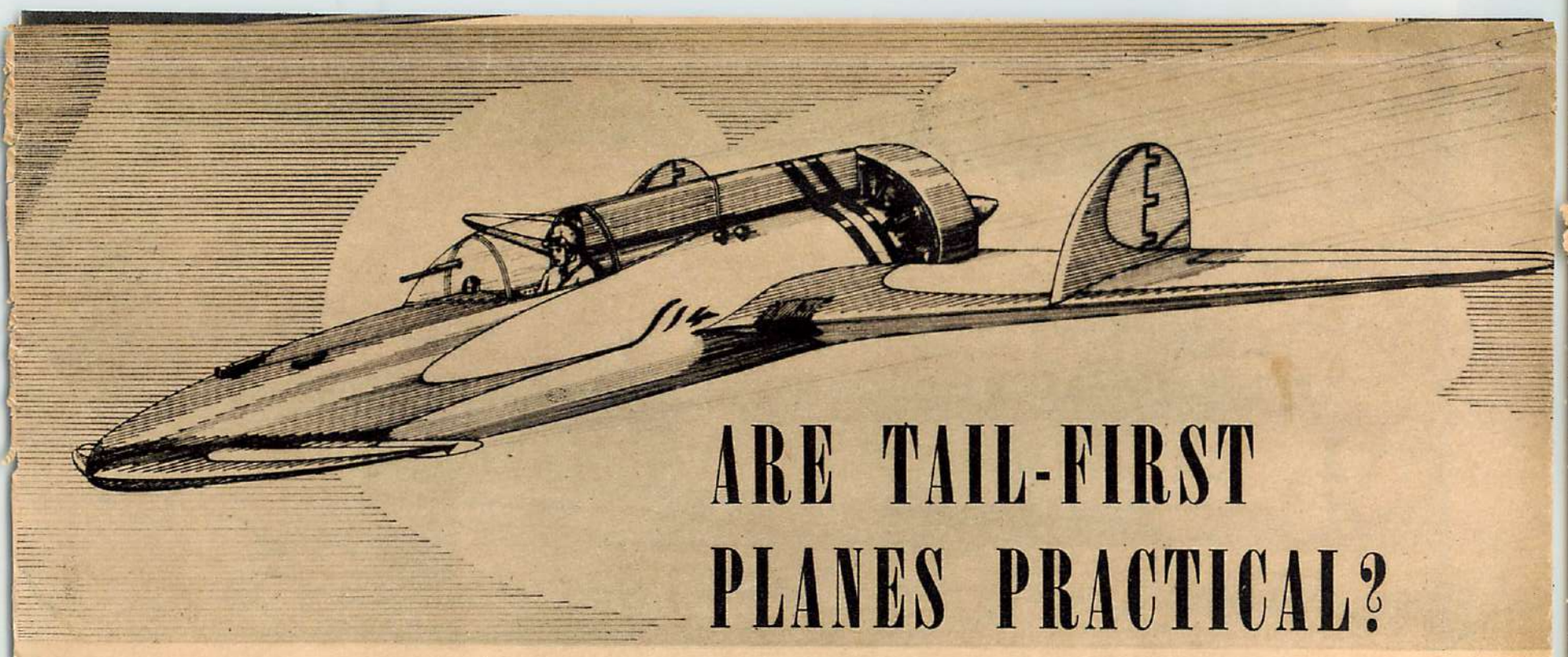
There were as many kinds of bombs as there were inventors. Big, little, round, square oil cans and one long one we called the barber-pole bomb. A fifteen-year-old coffee-colored, would-be savior of his country devised that one. Proudly he presented it to us at the air field. He didn't just give it to us as another aërial bomb; it was done in the style as such a great achievement deserved. The inventor came to the field in a carriage, holding a ten-foot slender barber pole in his hand, the base resting between his feet on the carriage floor. A score or more proud relatives followed in gayly decorated coaches.

With a polite patriotic speech he handed the May pole to Mason.

(Turn to page 57)

WE BOMBED NICARAGUA

BY COLONEL WILLIAM C. BROOKS as told to Tracy Richardson



ARE TAIL-FIRST PLANES PRACTICAL?

New versions of an old idea again bring up an interesting aërodynamical question.

THE aëronautical engineers of the world, in the seemingly endless search for an ideal, have tried almost every conceivable formula to make aircraft fly faster, farther and more safely. Recent news indicates that the Canard, aviation's ugly duckling, has made a comeback.

Wright, Curtiss and practically all of the early pioneers used designs with a stabilizer-before-wing formula and seemingly got quite good results. Even Granville, builder of the famed Gee-Bee racing planes, made one such tail-first ship, powered with a 40-horsepower Continental engine. The ship flew, but was not followed up by further designs of this type. Experiments have been made in Germany, France, England and Italy, with some interesting results being obtained in all cases. Focke-Wulf, in Germany, built the strange-looking *Ente,* or duck, some years ago which used two engines mounted beneath its tapered high wing. England's Westland-Hill Pterodactyls are little known, although they showed great promise at the time they were first flown. While not actually tail-first ships, they were tail-less in that the rudders are mounted on the wing tips.

Even Lockheed, builder of some of the most famed transport and commercial aircraft ever known, has done considerable experimental work on a large tail-first transport. Wind-tunnel tests were run on a model ship, the prototype of which would have a span of about one hundred feet. If the ship is actually built it should be sensational. Rumors of many bugs to be worked out persist, but something may come of the design in the next year or two.

Plans to make a small flying-scale test ship of the design, for actual air tests, have been considered. Many French and British manufacturers, and Martin in this country, have used this method of testing flying characteristics and performance of large ships without expensive full-scale aircraft actually taking the air.

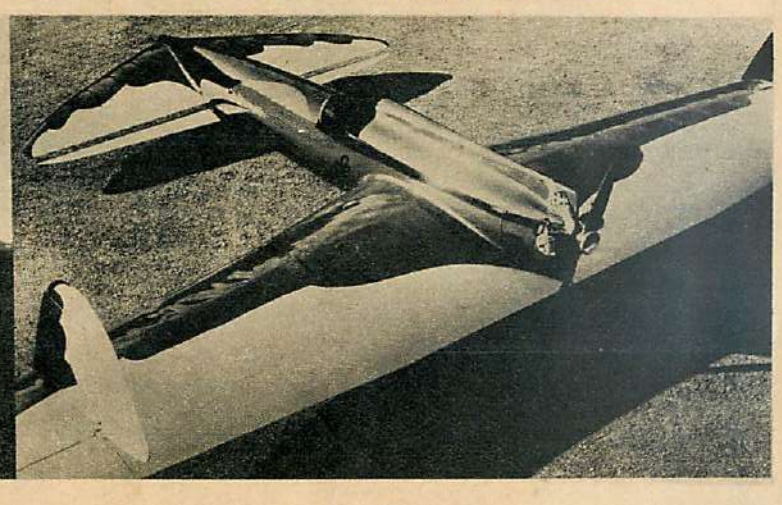
Wind-tunnel tests on the tail-first Lockheed brought out the fact that front-wing stalling troubles will have to be further examined. The Lockheed had its cantilever wing mounted about halfway back on the circular fuselage, with engines slung from the leading edge. On the tail end of the fuselage two rudders were attached at about sixty degrees to one another. In the nose was the horizontal stabilizer, or forward wing, provided with a conventional movable surface on the trailing edge. One trouble that will have to be overcome is the problem of ice formations cracking off this forward surface and smashing back into the whirling propellers. This same difficulty will have to be overcome in the Bell YFM-1 twin-engined pusher-fighter, and in other unconventional pusher designs now being built.

Although still in an experimental status, the series of Italian Steffanuti pusher Canards have been quite successful during the past three years. These unusual ships are all of the same general type, featuring a pusher engine, anterio *(Turn to page 60)*

BY GORDON SEAR WILLIAMS

An awkward-looking but successful tail-first plane of German design, the Focke-Wulf "Ente," powered with two air-cooled Siemens engines.

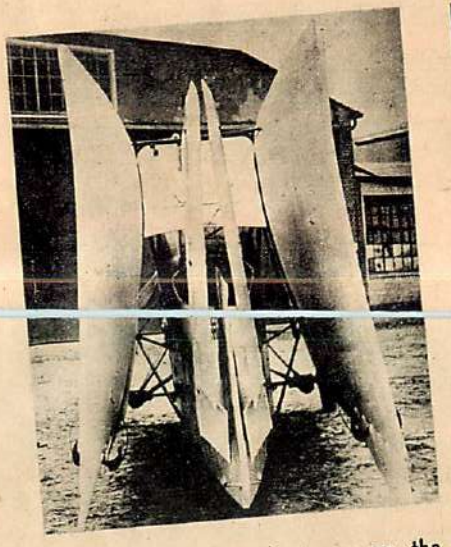
The Steffanuti SS-2 of Italian origin shows exceptionally clean lines for a Canard. At top of the page is projected SS-4 tail-first fighter.



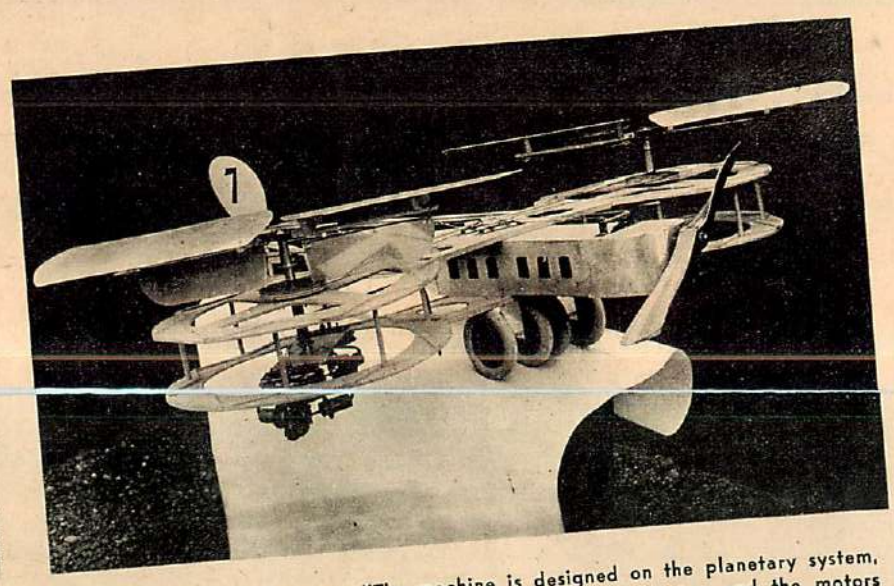
VOLUME II

from the FAMILY ALBUM

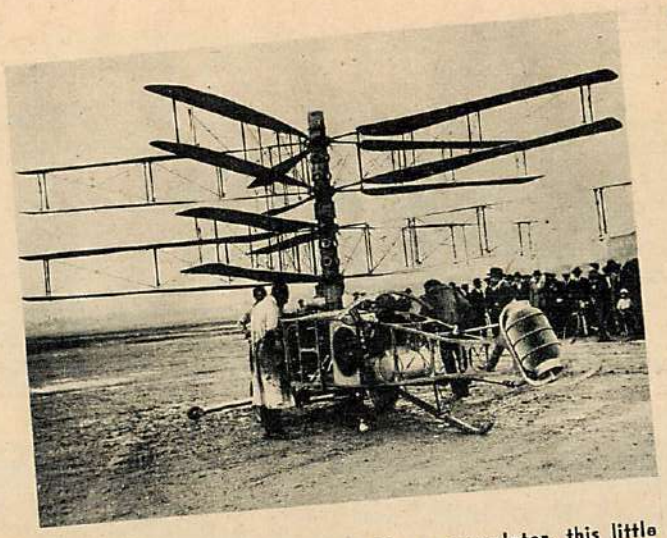
come these further pictures in our interesting series showing early flying machines—actual, projected, and unexpected.



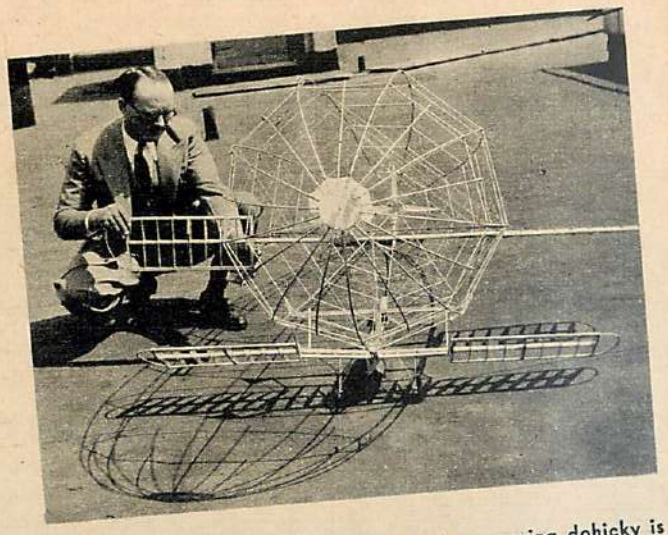
Don't look now but this is, or was, the smallest collapsible plane built. In flight it collapsed to an even smaller size.



According to the caption, "The machine is designed on the planetary system, the central axis of the lifting surfaces representing the sun and the motors and traction wheels the satellites." Apparently there was a total eclipse.

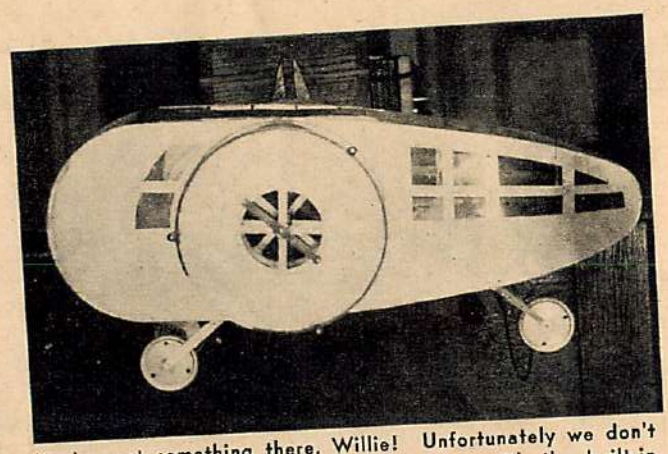


Capable of grinding for either drip or percolator, this little model created quite a sensation; that of sitting on the ground while your head was frantically fanned by a winged totem pole.

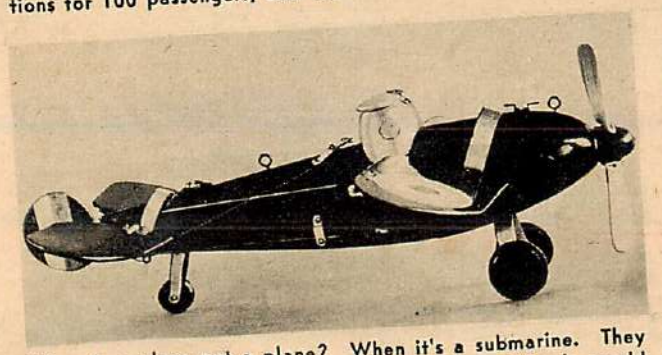


Stand back, spies! This flying-spiderweb-appearing dohicky is a model of a winged dirigible, a super-airship with many possibilities. The wings were intended to aid in vertical ascent.

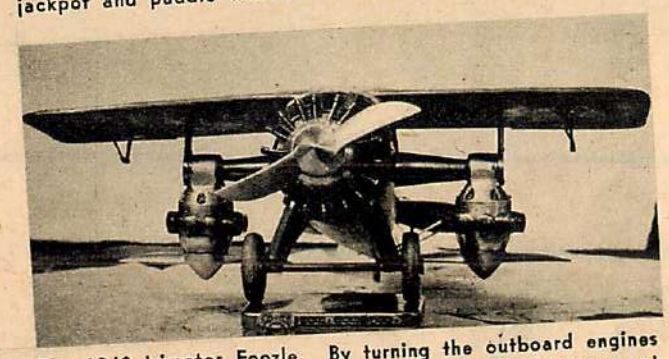
This is what happens when engineers can't agree as to where to put the wing. All four engineers won! It had accommodations for 100 passengers, and the little man who wasn't there.



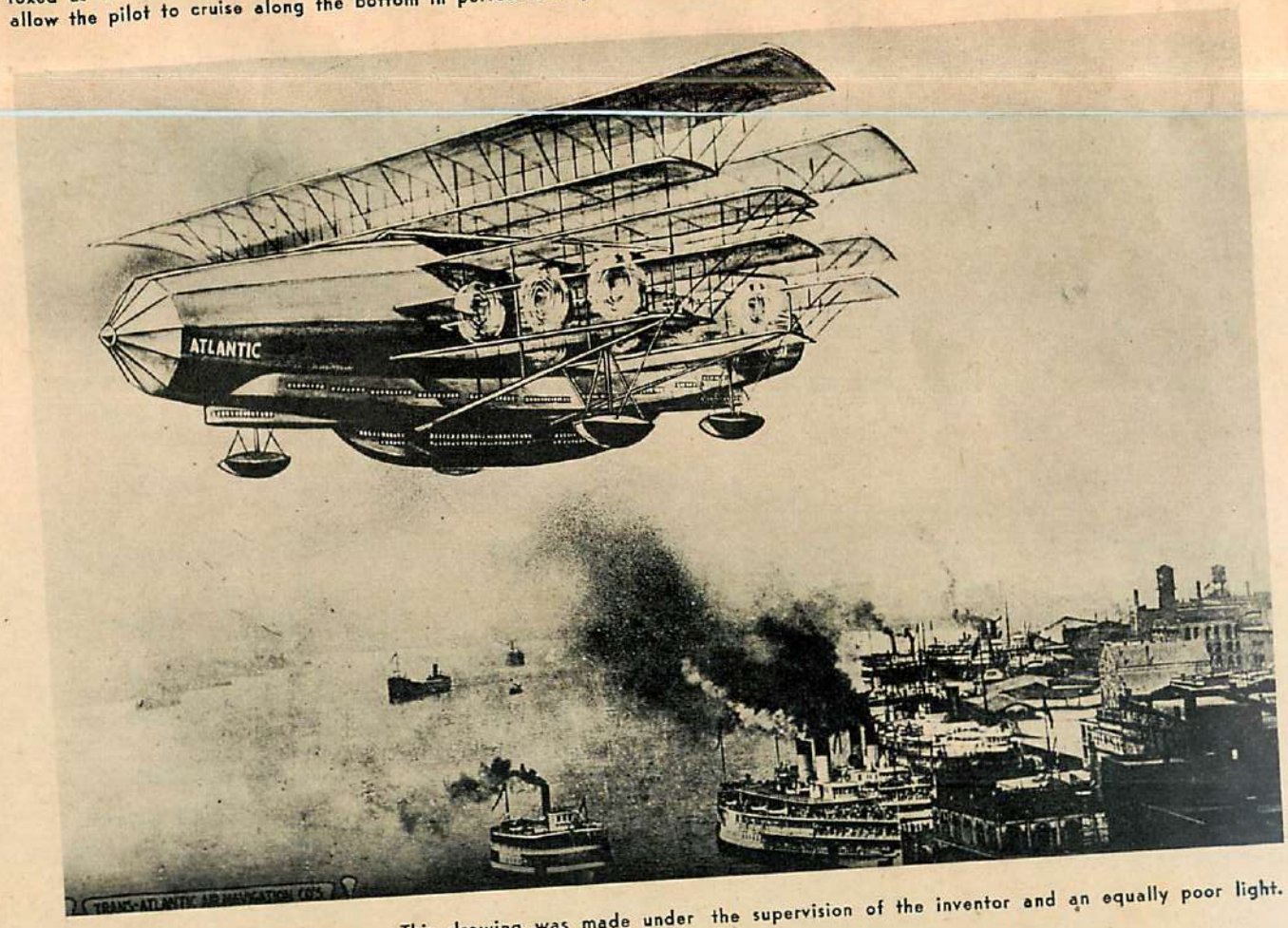
You've got something there, Willie! Unfortunately we don't just know what. This flying slot machine with the built-in jackpot and paddle wheels created lots of talk but no lift.



When is a plane not a plane? When it's a submarine. They foxed us on this one and combined the two. Wheels would allow the pilot to cruise along the bottom in perfect safety.



The 1940 trimotor Foozle. By turning the outboard engines down you went up, like a rocket. By turning them up you went down, for the last time. By turning one up and one down. . . .



See your oculist twice a year. This drawing was made under the supervision of the inventor and an equally poor light.

LIGHT PLANES DON'T HIBERNATE

On the contrary, with intelligent use, they are even more sporting fun in the winter.

BY ALMA HEFLIN

THERE'S a hoary joke that goes the rounds every winter started by an insurance company which sent out a solemn bulletin that said, "Winter is here, and you'll find it better to take off your pants right away."

And joke or no, comes winter and Swee' Pea, Shrdlu, Molly Cule, and the other light planes shed their wheel pants in a hurry.

That's one item in the winter care of the light plane which falls naturally into two classifications, preparation and operation. In winter the light plane takes its worst beating—lashing rain, rough air, freezing and melting ice, heated hangars and freezing skies, full-speed operations and long glides, increased taxiing hazards—and the fact that Joe Doakes may be flying his first plane. Until 1939 ten percent of light-plane owners were private fliers. The rest were students who droned around and around airports in dizzy circles while the operator insured his plane's safety chiefly by grounding it in bad weather. During '39, sales of the planes doubled and thirty-five percent of the purchasers were private owners who go farther and farther afield in cross-country flights. The care of the plane insuring its everyday dependability has become more important.

Suppose Joe Doakes is getting Swee' Pea ready for winter. The pants come off first. Left on, they may gather mud that may freeze and lock the wheels. Even if Joe escapes landing on his nose, he may find the pants ruined by having the rear bulkhead shoved loose. So off they come. Tires are good, but if they were thin they would be replaced, before they caused a nasty ground loop or messed wing tip from blowing out as a result of hitting a frozen rut in some rough field—and what's the advantage of a light plane if it can't be landed wherever the pilot desires? A little of the air out of the tires makes them ride the frozen ground easier, too.

Sometimes ice inside a longeron may split it. In a warm hangar where moisture will not be frozen, Joe looks for the small drainage holes just ahead of the tail post and skid. These, punched by the factory, may be clogged, so Joe pokes them out, and lowers the tail to drain out any water. Control cables, hinges, cotter keys, and hinge pins are presumably protected against rust, but Joe has flown Swee' Pea to the beach this summer, exposing it to salt air. If a seaplane, tubing would be protected inwardly by oil, outwardly by molten aluminum, wax, and leadfoil, but this one isn't, and Joe takes no chances. *(Turn to page 49)*

This striking silhouette on the snow typifies year-round light-plane flying.

The stinger in tail of Armstrong-Whitworth Whitley

STINGERS!

Beware the bomber's tail—no longer an easy, unprotected target.

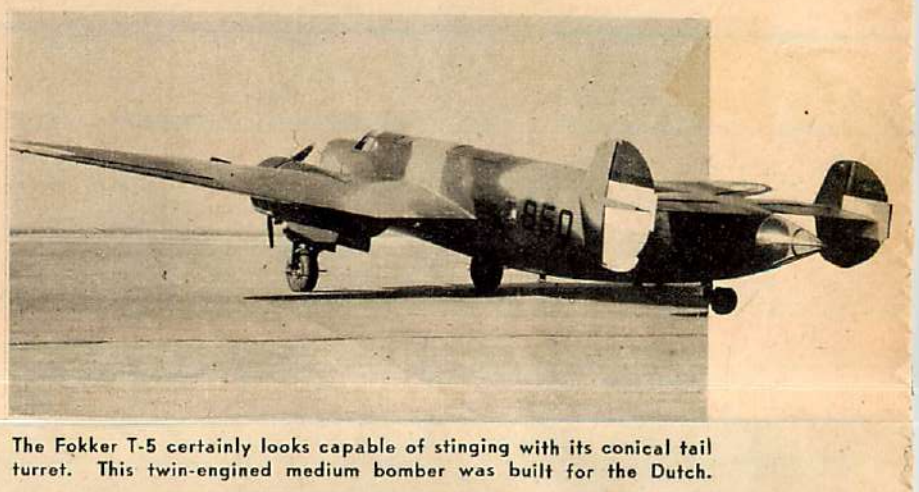
BY PAUL H. WILKINSON

WHEN two Handley Page V-1500 night bombers stood on a flying field "somewhere in France" in 1918 ready for long-distance bombing raids into Germany, they introduced a basic improvement which has had considerable influence upon the design of military aircraft. It was not the size of these fifteen-ton British bombers with their four 375-horsepower Rolls-Royce Eagle VIII engines, or their ability to carry sufficient fuel for fourteen hours' flight at a speed of ninety-five miles per hour, which distinguished them from other warplanes. An entirely new departure in defensive armament constituted the improvement—for in addition to the customary machine guns in the nose and amidships, these huge biplanes were equipped with machine-gun stations in their tails.

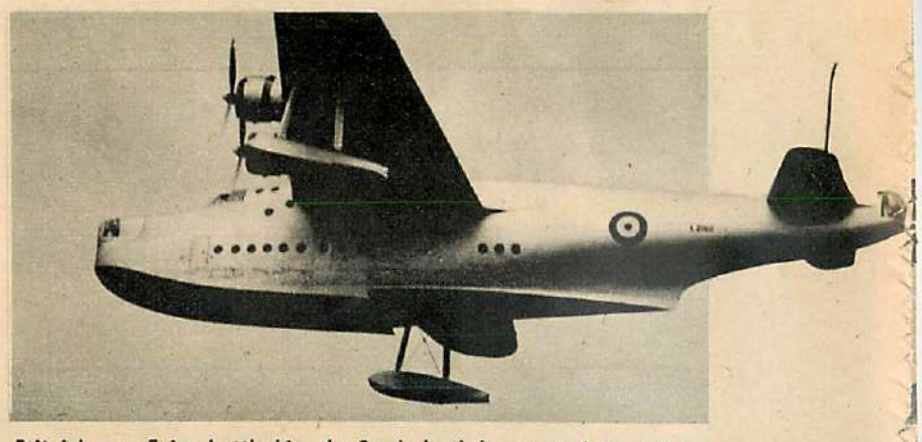
Although these Handley Page V-1500s of the Independent Air Force never went over the lines on a bombing mission due to the signing of the armistice, nevertheless, it was considered that their tail-gun armament warranted further development. It was realized that considerable research was necessary, however, inasmuch as the prototype plane had crashed while on a test flight and all of the occupants had been killed except the man in the tail. The problem which had to be solved was how to obtain the proper balance in an airplane containing a movable mass of considerable weight far from the center of gravity.

With much foresight, the British air ministry sponsored the development, but it was not until 1927 that the next tail-gun warplane appeared. This was the Vickers Virginia twin-engined bomber which had two Lewis guns on a scarf ring mounting in the tail cockpit. Subsequently, a number of Virginias were produced for bombing squadrons and it was with one of these nine-ton planes that some of the first catapulting experiments were carried out at the Royal Aircraft Establishment. Vickers also built a twin-engined night bomber known as the Vannock and a four-engined transport-bomber known as their 163 model, both of which were equipped with tail guns.

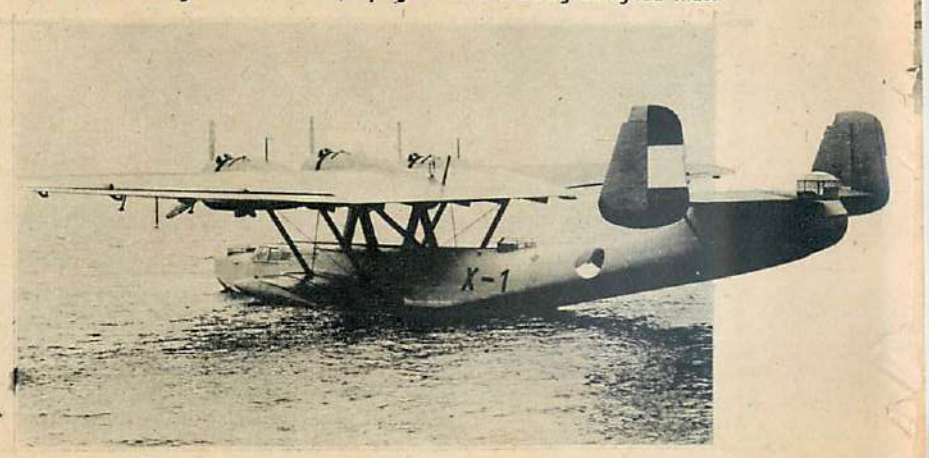
While these developments were being carried out with landplanes, Blackburn had been pioneering the tail gun on their three-engined patrol flying boats. After trying out installations on their Iris III and Iris IV planes, a number of Iris V and Iris VI flying boats were built for the Royal Air Force. Subsequently, some of these planes were formed into the No. 209 Flying Boat Squadron. Blackburn also tried out the tail gun on their Sydney monoplane and on their Perth *(Turn to page 60)*



The Fokker T-5 certainly looks capable of stinging with its conical tail turret. This twin-engined medium bomber was built for the Dutch.



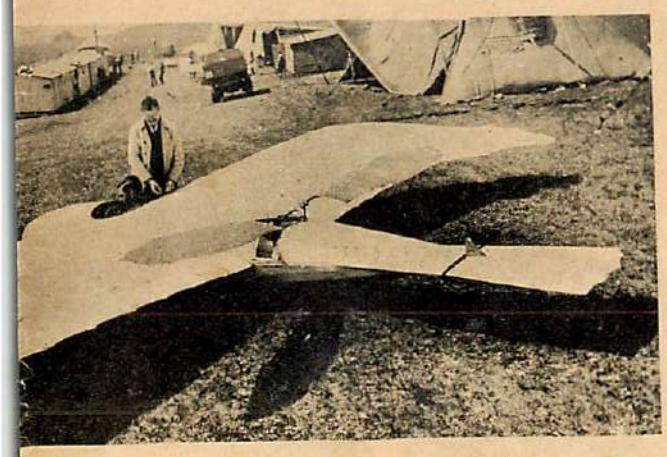
Britain's new flying battleship, the Sunderland, has a revolving tail turret aft of the huge rudder. Many flying boats are being designed thus.



This Dornier Do. 24 built for Holland is also used by the Germans. The tail turret between the twin rudders is inclosed and revolves on track.

CONDUCTED BY ALEXIS DAWYDOFF

GLIDING AND SOARING



An old-time German flapper. This early, er, sailplane was more or less—mostly less—assisted in flight by two foot-powered flapping wings.

Come on out, Hawley, we see you! And by the way, don't take any directions from that chap in the Albatross; it's "Wrongway" Corrigan.

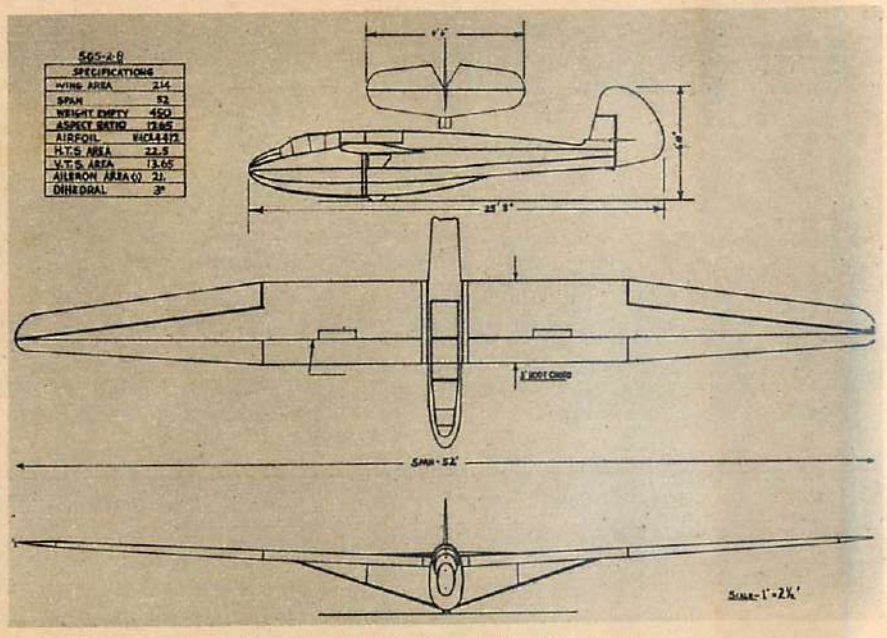
THE winter months are upon us and with them the gliding and soaring movement has gone into a partial hibernation. This period of inactivity should be taken advantage of, so that bigger and better plans for the coming season may be developed.

Planning for the movement as a whole is done by the Soaring Society of America, which calls ever so often a directors' meeting, and it falls on the shoulders of these men to evolve a suitable program for the forthcoming season. The main task of the society so far, it seems, has been to promote sufficient money to conduct the National Soaring Contest. Occasionally stabs have been made in the direction of governmental recognition. These have not quite gone astray, as the Civil Aëronautic Authority has taken cognizance of the fact that gliding and soaring is not a form of aëronautical insanity, but highly skilled pilotage involving a knowledge of navigation, blind flying and meteorology, and even the army and the navy, which hardly consider an airplane fliable unless it has at least a 425-horsepower engine, concede the fact that there is some advantage in motorless flight.

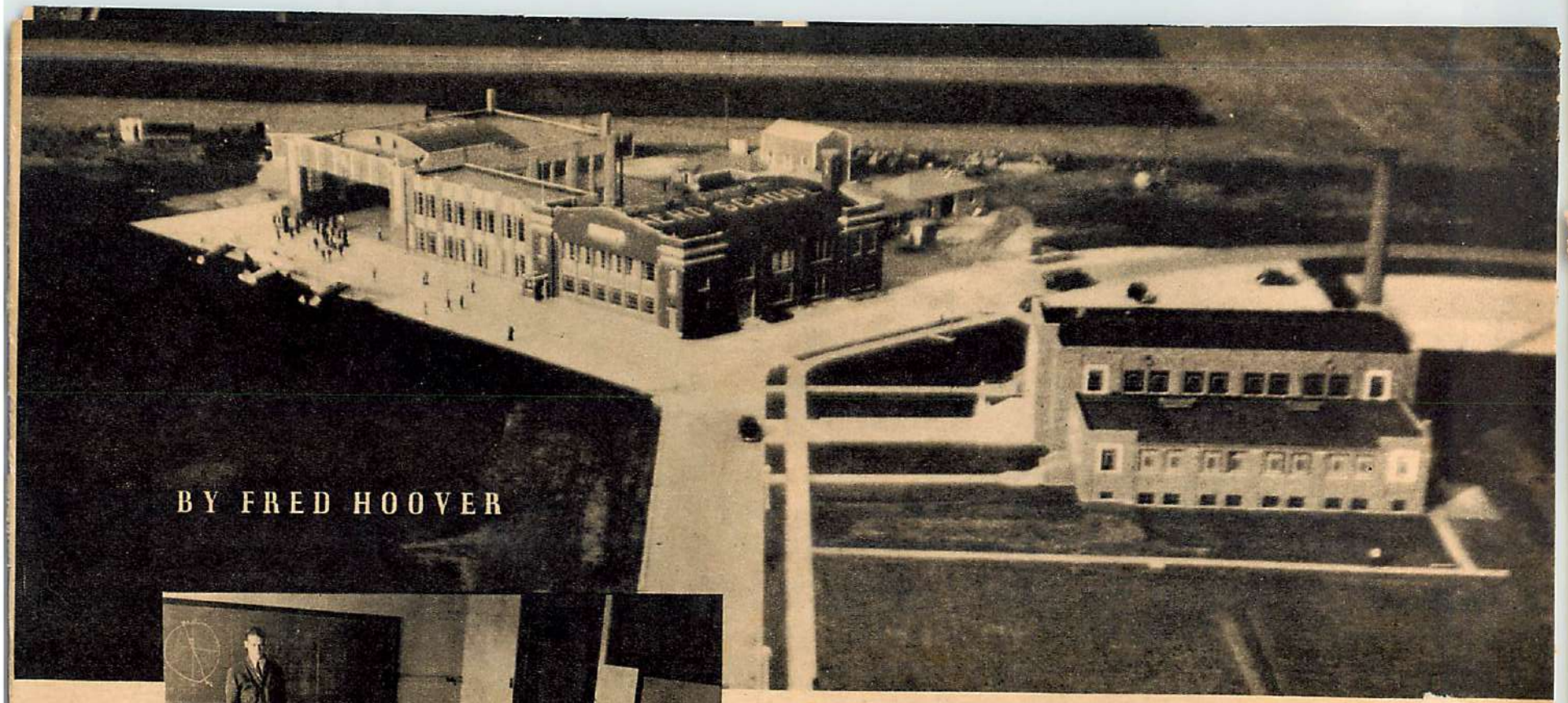
Furthermore, it is true that the National Contest sponsored by the Soaring Society of America has done a great deal to advance soaring to where it is now. Due to it, American high-performance sailplanes have been built. Because of foreign participation, the skill of our own pilots has developed to the extent that they are equal to any of the soaring aces overseas. Again, a part of the public no longer confuses a glider with the porch article of the same name. But now that the ball has started to roll and we have a number of big glider clubs well-equipped and well able to take care of themselves, how about giving a hand to the smaller fry? Let us start with the same National Contest. We feel that the prize distributed is definitely unfair. A number of lump-sum prizes are awarded each year for individual achievements such as altitude, distance, et cetera. The rest of the prize money goes into the points-award system, and the value of each point is determined by taking the total of all points aggregated during the meet and dividing the point-award money by the total of these points.

Now if it happens, as it did last year, that not much money was available, the point becomes worth *(Turn to page 53)*

From George P. Abrial, famous French silver "C" and power-plane test pilot, comes this interesting shot of a French utility used for airplane tow instruction.



In response to numerous requests we present the three-view plans for the Schweizer 2-place metal-construction sailplane.



BY FRED HOOVER

Above—The hangars and part of the school buildings with field at the left. These are well equipped and of latest type. Left—A glimpse into a first-year class showing the splendid type of students selected.

FREE AIR SCHOOL

A unique aviation school makes the underprivileged boy's dream come true.

ONE day last summer a thin-faced, graying little man stepped off an airliner at the Chicago Municipal Airport to be greeted by the winking flashlight bulbs of the photographers and a hundred questions tossed at him by reporters. His name, General Umberto Nobile, was well known to the newspaper and magazine-reading public of the United States. A leading figure in Italian and world aviation circles, General Nobile was famed as a dirigible commander, arctic explorer and outstanding expert on lighter-than-air aircraft.

"Why are you here, general?" one reporter asked.

"I am here to become dean of the School of Aëronautics at the Lewis Holy Name School of Aëronautics," the general replied. And these words, printed in the newspapers, gave the world in general, for the first time, an inkling that there was such an institution as the Lewis Holy Name School. It seems inconceivable that such an institution, with its radical changes in trade-school educational theories, should have escaped, the first few years of its existence, without a major fanfare of publicity. But such was the case.

So, to a beautiful campus at Lockport, Illinois, some thirty-five miles southwest of Chicago's Loop, we went to investigate. We found something new. A new idea in education, where under the watchful eye of an ex-grease monkey, the social worker's and psychologist's theory of juvenile crime prevention and social reform is being put into actual practice, with a degree of success that borders on the perfection mark.

The school is the idea and personal pet of Bishop Bernard J. Sheil of Chicago, the founder and great leader of the Catholic Youth Organization. It was begun in 1931 on a grant of land donated to the archdiocese by the late Michael Fitzpatrick, an Illinois farmer whose interest in young men was a paramount feature of his life.

Bishop Sheil's original idea, when the school was founded, was to create a nonprofit technical school for underprivileged boys from the Chicago archdiocese covering the high-school period. And although a college course has been added to the original four years of high-school training offered by the school, and the technical subjects have been limited to one subject—aëronautics—that idea has prevailed.

For the first time this fall a selected number of private students were admitted to the college classes, but the school still retains its original scholarship idea in so far as at no time, now or in the future, will paid students ever outnumber those deserving but underprivileged youth who are attending the school free of charge because circumstances prevent them from obtaining an education by other means.

Heading the school today and carrying out the wishes and policies of Bishop Sheil, is soft-spoken, heavy-set John H. Wilson, a beaming Irishman who has been in and out of aviation since 1918. When the school was founded and the idea formulated that the principal subject should be aëronautics, Wilson was selected from his position as mechanic with American Airlines in St. Louis to become the first paid instructor. By 1938 he had worked his way upward to the position of dean of studies. In that year he was offered the position of superintendent of the school, the position he now holds. Many of the ideas on both educational and social problems at the school are his own.

"We have one object here," Wilson told us. "And that is to rehabilitate, both in mind and body, under- *(Turn to page 48)*

THE DESIGNER IS A LADY!

More and more women are entering aviation. Meet an outstanding one.

THERE are two huge maps in the Aviation Building at the New York World's Fair. They are covered with lines crisscrossing in all directions. These colored lines represent established air routes. Some of them are illuminated with neon tubes; these are the main routes. The smaller air lines and the connecting lines are painted in.

One map shows the airways of the continental United States, the other the airways of the world. On the world map, bright neon lights mark the far-flung airways of the Pan American, from Argentina to Europe and to China. All the rest of the world's air lines are there, to scale, as correct as available data can make them. It's a revelation to the uninitiated to see how few of the earth's corners there are that are not serviced by aviation. One realizes what a tremendous task is being done by these flying men.

And it was a woman who compiled the data for the map. Mrs. E. S. (Peg) Kerwood, a member of the only architect firm in the country which devotes its time exclusively to things aviation.

Mrs. E. S. Kerwood, aviation architect.

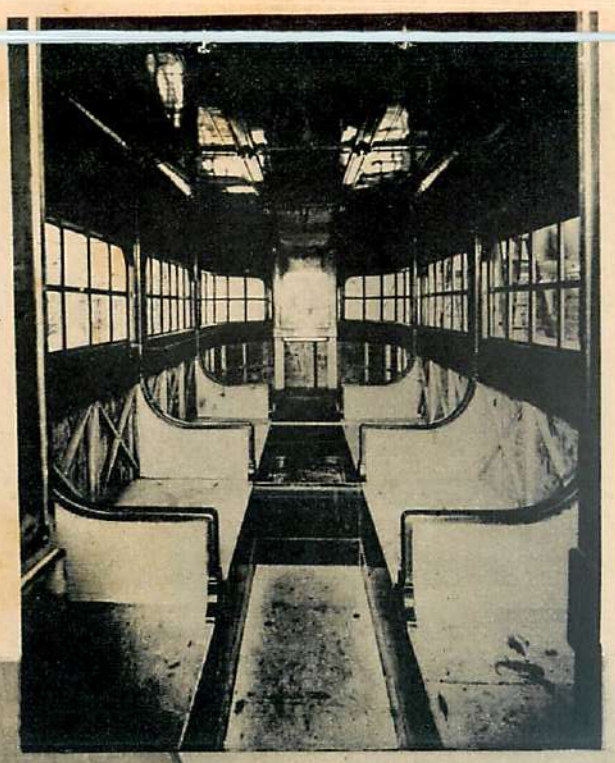
Architect LesCaz designed the Aviation Building at the Fair, and Mrs. Kerwood made the layouts for the interior. Compiling the information for the map was her hardest job. It took months of time and hundreds of letters to the air lines of the world before there was enough accurate information to start working. Finished, it is the perfect set-up for the tourist who's thinking of doing a "quickie" around the world. If he's the intensely patriotic kind, a glance at the map will show the lines using American planes and equipment, and which lines touch countries that are not cordial toward certain nationals. It's the only map of its kind ever made, and the most all-revealing, from the standpoint of aviation.

It wasn't an idle thought that started Mrs. Kerwood in the aviation-designing business. Behind her present interests lie thousands and thousands of miles flown with her aviator husband. She visited almost every country in the world by the air lines. Today she rides the luxury liners, but she has frozen and suffered from heat in the old open-cockpit jobs. While not a pilot, she knows the hardships of early-day passenger flying.

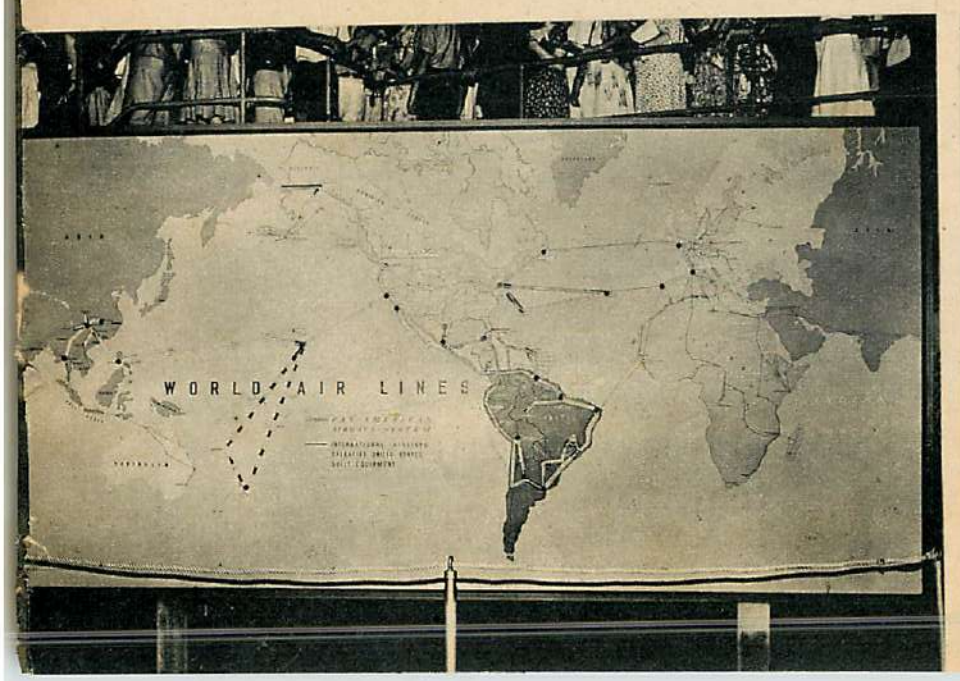
For a while the Kerwoods lived in Italy. There you buy an automobile chassis and design, or have it done for you, the body and finishings to suit your individual style or need. She designed two automobiles for herself and later that gave her the thought for airplanes.

She soon found that the thought alone was not enough. There were no old airplanes lying around to practice on. She realized it was necessary to study aircraft construction, functional interior design and cabin design, and then be good enough *(Turn to page 49)*

Changes represented between the interior of the early plane, above, and the modern sky lounge, below, show the effectiveness of her type of work. More comfort, et cetera!



The map described in the text designed by Mrs. Kerwood for the New York World's Fair. This map was laboriously made after months of study and correspondence with every part of the world to gain last-minute data on air lines. Pan American Airlines routes are illuminated in neon lights.



Once an Air Adventurer, always an Air Adventurer. You just can't outgrow it!

GREETINGS, Air Adventurers!

I was talking to a group of my Boy Scout friends the other night. They were just returning from a troop meeting. There was something different about this gang, and I sensed it at once. They did not greet me with the same boisterous enthusiasm, their anxious questions about the war in the air or what I thought about the German air raids on such-and-such a place. They seemed to slink past me with nothing more than an ordinary good night, and I wondered what had happened.

Now these lads are just normal, healthy American boys. There are no fake heroics about them. They are keen, sincere, and they play the game—and they're never quite sure what to do about the bird who doesn't.

All this puzzled me until some time later when one of them came in hounding me for some information on a composition he had to do for an aviation merit badge. I finally wormed out of him just what was wrong the night of their troop meeting.

"Aw," he floundered, "we had a patrol leader who—well, he kind of let us down. He was horsing around, when he should have been helping the new Tenderfoot guys to get their Second Class badges. The older guys have to do that, you know."

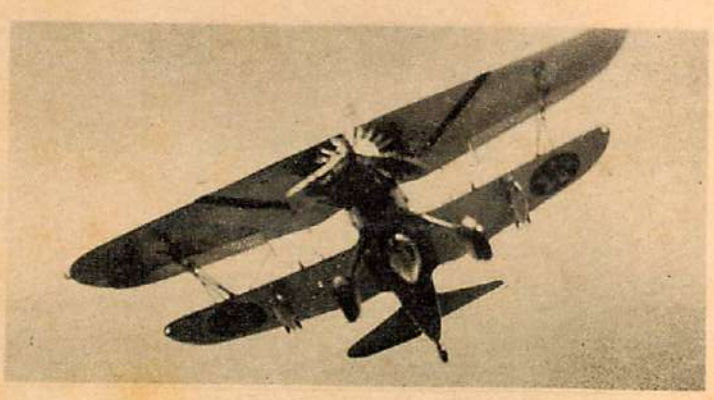
I admitted that I knew something about the Scout movement.

"Well, the scoutmaster stood it as long as he could, I guess. This guy had been horsing around for several weeks and just not—not playing the game, and so the scoutmaster decided that he ought to get it taken out of him. He only suggested that he run the paddle gantlet, just to see if that would straighten him up. You know how they do things in the Scouts, don't you? Well, this guy refused to take his licks!"

My Boy Scout friend let that sentence come out like a series of popping corks. Then he added quietly: "But you won't let it out, will you? Don't tell anyone, will you?"

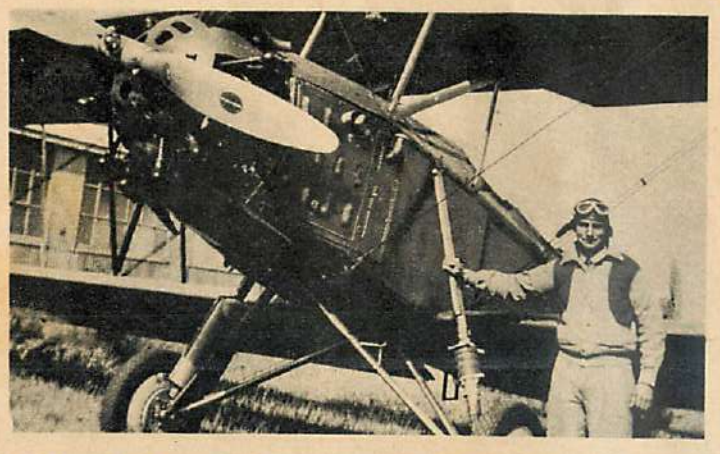
Getting the rest of the story straightened out, I learned that this lad had simply refused to take his punishment, slight as it was. He was much taller and stronger than most of the members of the troop, but he could not stand the ignominy of bending over and taking his licks, paying the penalty for his "crime" to the troop. He chucked it. Quit cold, and walked out of the troop quarters.

Personally, I do not agree with this sort of punishment, and I said so to my Boy Scout friend. He looked at me in amazement, and gave me a new slant on the game by saying: "But he had it coming to him. He was horsing around and not doing his job. He wouldn't take ordinary discipline. *(Turn to page 61)*

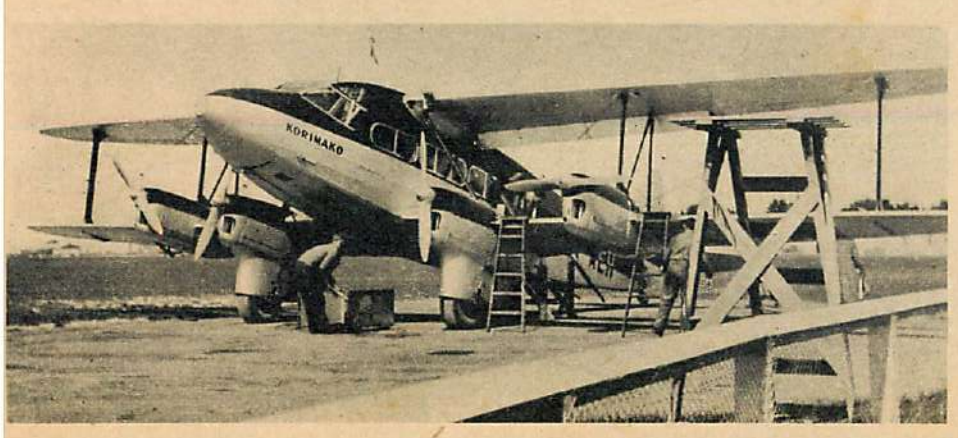


Built of aluminum salt-box spouts, this perfect Curtiss Navy Hawk model was made by Pvt. Robert Fix of the 14th Air Base Squadron.

Dreaming of the future. John Davis Pruett, of Jacksonville, Ala., is building his own Flea plane, and here pauses to think of flying it.



An Air Adventurer who looks the part. George Micari, of Sag Harbor, L. I., beside the plane in which he flies with Pilot Bill Schends.



All the way from New Zealand comes this shot of a four-engined D. H. 86, named the Korimako, taken by Air Adventurer W. J. Valentine of Bluff, N. Z.

Actual size of your Air Adventurers pin.

(MEMBERSHIP COUPON)

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79-89 Seventh Avenue, New York, N. Y.

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JUNIOR n.a.a. NEWS

PREPARED BY WILLIAM R. ENYART, Sec. N.A.A.

NO INACTIVE GROUPS, PLEASE

A NUMBER of model chapters which were chartered by the Model Division of the N. A. A. have been informed that it is necessary for them to send to National Headquarters a listing of their active club members holding N. A. A. model fliers' licenses, as well as the name and address of their sponsor, adviser or representative.

The reason for all this is that clubs frequently change secretaries, addresses, or just "fold up" and drift away without notifying headquarters, with the result that Washington continues to send each month copies of the N. A. A. magazine, *National Aëronautics*, and a copy of the monthly Model Division news sheet, the *Eagle*.

These publications which are sent out are the property of the club, and not of its representative, and should be turned over to the club or discussed during club meetings. In requesting the names and addresses of the club's personnel, the N. A. A. is protecting the club and checking up on its own files to make certain it is not carrying a lot of "dead" wood as far as expired chapters are concerned.

The fewer inactive groups the N. A. A. carries along, the more it can do for the active clubs!

CHARGE FOR SANCTION KITS

Effective early in 1940, a charge will be made by the N. A. A. for "sanction" kits which have been sent out with each N. A. A. contest sanction issued to contest directors. The practice of sanctioning meets and record trials *at no charge* will be continued; but the kits containing helpful materials for running a meet will be optional, with the minimum charge for small-size kits set at $1.

New kits are expected to contain armbands for field police, officials, contestants, guests, mechanics, et cetera. Special forms for tabulating results and scoring flights, as well as special flight-timing slips, are expected to be available. In addition, extra pieces of each inclosure will be available at cost.

The reason for the Model Division reverting to its original policy of making a charge for "sanction" kits partly to cover the cost of materials sent out in them, is that up to December 1, 1939, more than 222 competitions for all types of model planes had been sanctioned by the Washington office. It is said to be impossible to provide valuable contest aids in such large numbers unless part of the expense is borne by the clubs using and desiring the materials.

FOR MODEL DIVISION MEMBERS ONLY

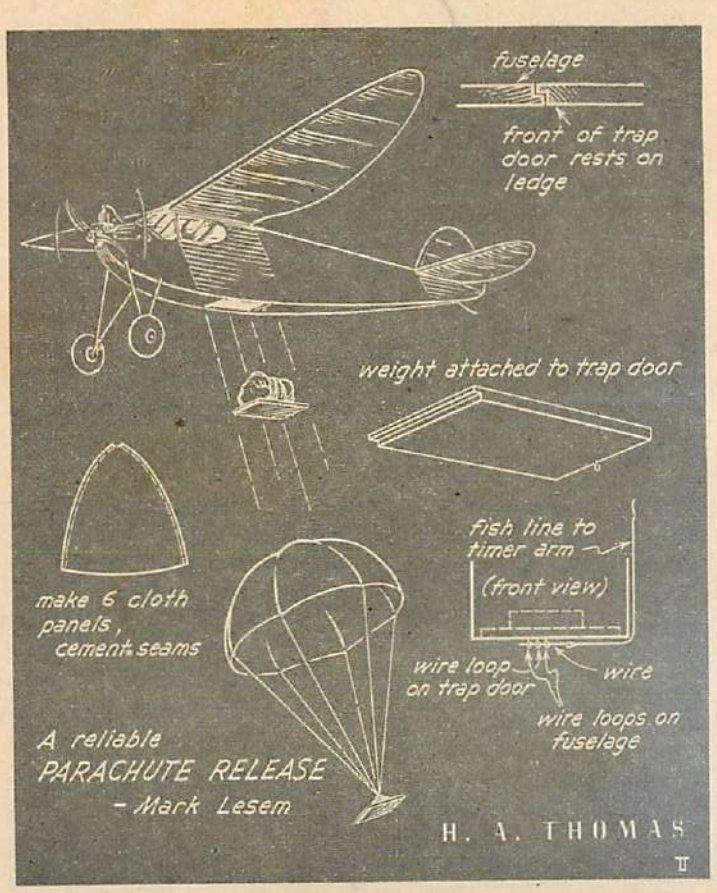
Effective November 1, 1939, the Contest Board of the N. A. A. announced that henceforth only N. A. A. Model Division members were eligible to compete in N. A. A.-sanctioned contests. This policy had not been strictly enforced in the past, and it was found in many sanctioned meets a large majority of the contestants were not N. A. A. members, and so unfamiliar with the rules and regulations governing such activity.

It was stated at the same time that no exceptions to this ruling would be tolerated. The Model Division has also sent a notice to all contest directors saying meet officials cannot compete in their own contests; that exact timing of gas-model engine runs must be carried on, and that every consideration must be given to contestants in N. A. A.-sanctioned competitions.

CANADIAN BOY MAKES GOOD

An item of special interest for the "model builder makes good" department is that Edward S. (Ted) Booth of Canadian aëromodeling circles is now editor of *Canadian Aviation*, after serving several years as a staff member.

The new *Canadian Aviation*, under Ted's guidance, has grown to be a large aëro monthly and presents a most interesting format, as well as extremely good articles. Ted proved that his model-competition days were not over during the past summer by snaring a place on the Canadian Wakefield team and then placing tenth in the finals with a three-flight average of 2 minutes, 5.8 seconds.



BECOME A MEMBER OF THE N. A. A. WRITE THE NATIONAL AERONAUTIC ASSOCIATION, DUPONT CIRCLE, WASHINGTON D. C.

MODEL BUILDING

AIR TRAILS MAGAZINE

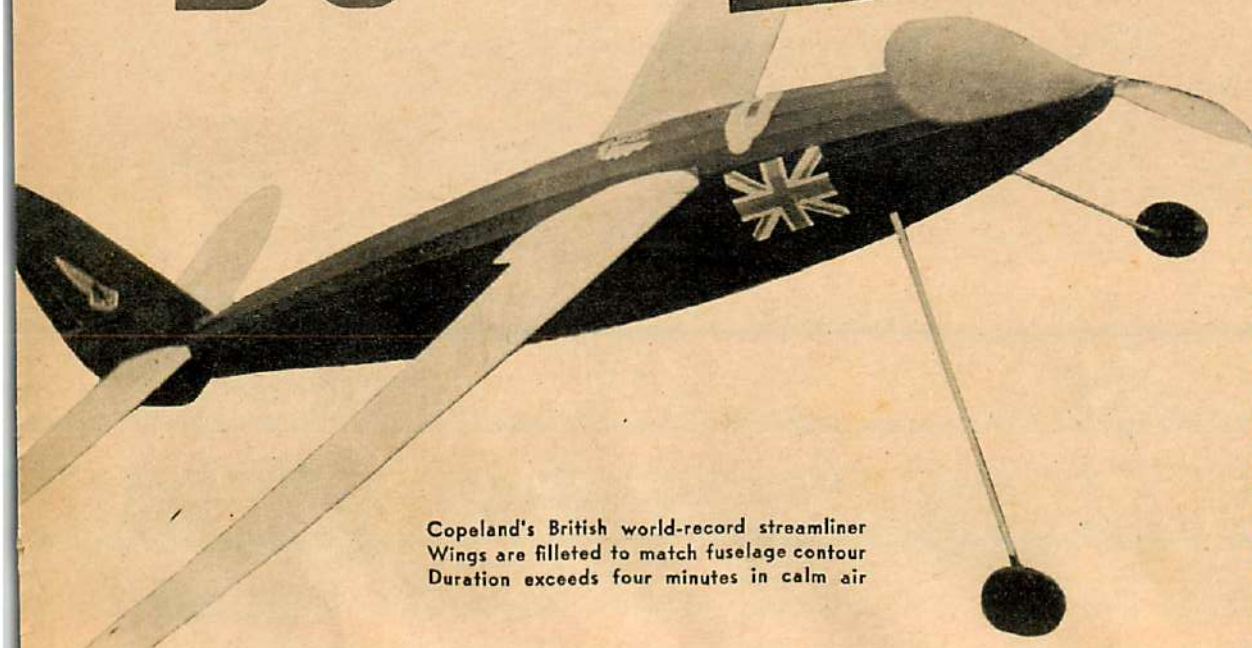
The Kingfisher, a gas job on floats • Cahill and Korda discuss streamlining • The 1939 Moffett Trophy Winner.

FEBRUARY **1940**

Just one corner of Brent Daniel's workshop in Washington, D. C. Daniel has experimented with and developed the pre-fabricated type of construction kit.

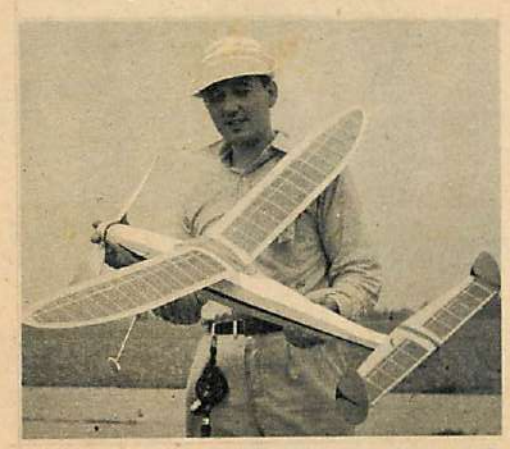
SAYS JIM CAHILL

DO TO STREAMLINE OR



Copeland's British world-record streamliner
Wings are filleted to match fuselage contour
Duration exceeds four minutes in calm air

Struck's latest illustrates improvements on a "diamond." Fuselage is made 8-sided by four extra stringers. Nose is rounded and prop folds.



Zaic used extra stringers to streamline a square fuselage. Nose is rounded and the prop spinner houses mechanism for the two-bladed folder.

WHY go to a lot of work to streamline a model? Once they're in a thermal all of them go up. True words, but remember it is not always so easy to catch that thermal. Streamlining has helped many a model to longer flights.

In recent years contest builders have lowered their standards of workmanship and pride in their own design so much that I have often wondered what satisfaction any of these pseudo model builders get out of winning a contest. It is indeed a rarity to see something showing originality at a contest today.

At many contests, other builders have asked me questions as to why certain features were put on my Wakefield model, *Clodhopper II,* and I think this model would be a good subject for the purpose of explaining the benefits of streamlining. Here is a short history of the model.

It was rushed to completion and first test-hopped in June, 1937, on the morning of the Moffett and Wakefield eliminations. On its second flight late in the afternoon it made a time of 13:45 to get me on the team. The next day, on its first flight, it flew for 15:05 on the only out-of-sight flight of the day. After four months in the open, a hunter found it and returned it to me.

After many repairs and complete recovering, I flew it in a local contest at Purdue. Its first flight of 6:30, in cloudy weather, was the longest flight in the contest. At the Nationals that year, on its second flight in the Wakefield eliminations, it flew out of sight again for 22:10. A month later, in Paris, on its first flight, *Clodhopper* again went out of sight for a time of 32:01. This year, at the eliminations during the Nationals, I broke the wing on the first take-off. I repaired it, made a test flight, and it broke again in a different place when it landed. I repaired it once more, and at three o'clock on the afternoon made my first flight of 8:15.

The net result of flying *Clodhopper* in these six contests was four firsts, one fifth, and one seventh place. It is interesting to note that in only two of these six contests was I forced to take a second flight to catch a thermal. The last contest I entered *Clodhopper* in was the Scripps-Howard Nationals. I decided to give it a little hand-wound test to get the right adjustment. After a circle and a half under power, the prop folded back, another of those thermals reached down to fifty feet, and it was lifted out of sight after fifteen minutes, which is the last I have seen of the model.

Now about the design. This was the first eight-ounce-weight-rule model I had seen, so I tried to make one that would last.

We didn't know then how high or how long we could get these eight-ounce jobs to go, so I decided to concentrate on the glide. Our old Brookside Model Airplane Club had held a few towline sailplane contests, and we had noticed that the sailplanes with the shorter moment arms seemed to behave better in the thermals, so I decided to use a comparatively short fuselage, putting slack in the motor if a long motor run was desired.

The British decided to time models from the field (a year before we did), so a high fuselage was used to get enough side area to enable the timer to keep the model in sight longer. Also, I wanted to put my wing inside the fuselage, and not on top, in order to get more effective wing area. I put the wing as low as I could without hitting the rubber motor. Considering the model from a front view, I wanted to put wing, elevator, and center of resistance as close together as possible, for I believe this condition makes for best soaring qualities.

Next came the question of the landing gear. We had always favored single-strut bamboo gears, but it seemed logical that a more rugged landing gear should be put on the heavier model. A single-strut music-wire landing gear with thin plywood wheels was used to keep resistance at a minimum. A certain maximum fuselage cross section was needed, so I stretched the belly of the fuselage down in order to get as short a length of landing gear as possible, both for structural and aërodynamic reasons. After this "bulge" in the fuselage, the portion toward the tail was reduced to as small a size as possible to reduce weight. It had to be large enough to accommodate *(Turn to page 62)*

NOT TO STREAMLINE DON'T

DICK KORDA SAYS

Korda's Wakefield, although a "box," shows attention to clean design. Nose is streamlined, chassis short; one-blade prop folds.

THE reason why so many people believe that streamlined models are far superior to the square ones can usually be accounted for by the fact that most of them use the real ships for their comparison. But when the actual models are used, the facts are quite a bit different. Although a properly built streamlined plane flown by an expert builder is superior to the other, the margin of superiority is not enough to warrant flying in the average weather encountered in this country. A damp, dreary day that is absolutely minus of any thermal or slope currents is the perfect day for a Class A-1 streamline ship.

This sounds a bit queer, but a good example was demonstrated by the visiting English team at the Wakefield contest this year. It seems that because of the location of the British Isles, the weather is usually on the bad side as far as American builders judge flying conditions. The average day at a contest over there seems to be entirely devoid of any currents. This makes the builder turn to superstreamline ships, employing very long motor runs that get their ships up just as high and in some instances much higher than the fast-climbing American model. On the motor run alone their ships gain close to a minute duration over ours, and the total flight is approximately four minutes, while not very many of the American models, including the streamline ships, average over three minutes.

However, the lack of streamline ships being built in this country is not due to the laziness of the builders, but can be attributed mainly to the weather and the type of rules governing the contest. With the exception of this year, the contest events were all decided by the longest of the three official flights. This naturally resulted in the fliers depending on getting one good flight out of three allowed.

Since the rules were changed this year to the average of three flights, the difference in the planes was very noticeable. More effort was concentrated on getting top performance on each flight. The trend toward streamline ships was not noticeable, but the cleaning up of all possible drag on square ships was very much in evidence. Various types of folding props were used in about as large a proportion as freewheeling props were several years ago. The amount of drag caused by a freewheeling prop cannot be realized unless one has been using its type for years and then switches over to a reliable folding prop. It's really a pleasure to watch the flat glide it is possible to obtain. Another improvement noticed was the minimum of badly adjusted planes. In the past it seems to have been the habit of builders to pack in a large amount of power in order to get a vertical climb for about forty seconds and hope for the best. The high speed attained with all this power made adjusting a touchy job, especially when the ship had been tested in calm weather and then ran into a strong breeze at the contest. When a ship piled in at top speed, it was out of the contest nine times out of ten. Another bad feature was that breaking rubber usually disintegrated a model in a most disturbing manner. Props also had the habit of going to pieces when they hit an object while still turning.

The 1939 editions of the square model had a tendency toward being an average-flight model, but still a fair-weather ship. It is the excellent weather we have that is really holding up the development of the streamlined planes. Most builders realize that even on an overcast day when no sun is shining there are currents strong enough to carry a rubber model out of sight. A very good demonstration of this type of weather was experienced at a contest in Akron, Ohio, on October 14, 1939. The day was so cold and windy the contestants were wearing overcoats and still shivering, and the wind was so strong some of the planes were going out of sight in three to four minutes. With absolutely no sun shining, one plane rode the wind currents for twenty-two miles before landing.

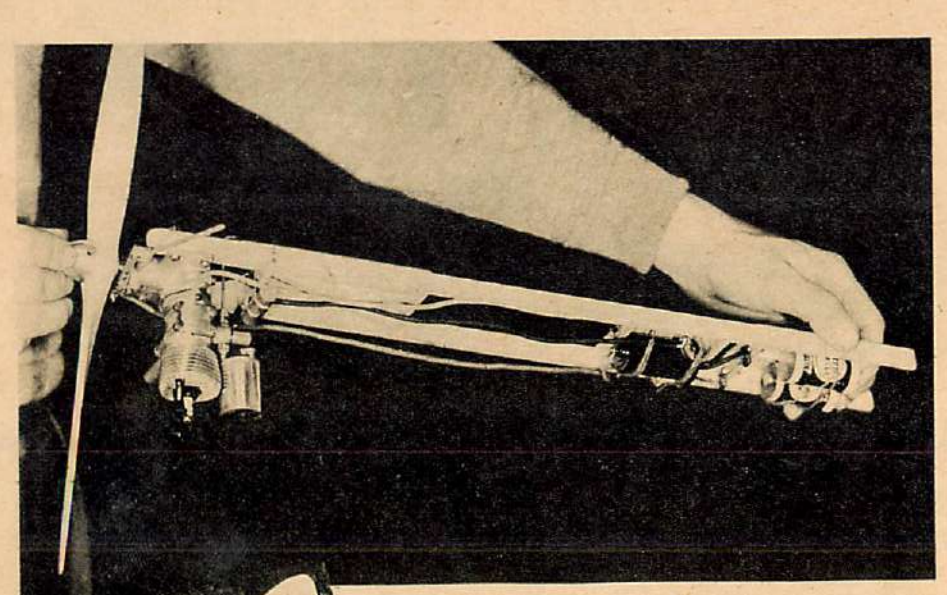
After seeing flights such as that, it's easy to understand why so few bother to build streamlined ships for the regular contests that are held throughout the country during the summer. If the weather is too bad for flying, the contest is *(Turn to page 62)*

Leo Bailey ignores streamlining yet won a first at Nationals. Bailey, like Korda, is expert at adjusting and gets the most out of a model.

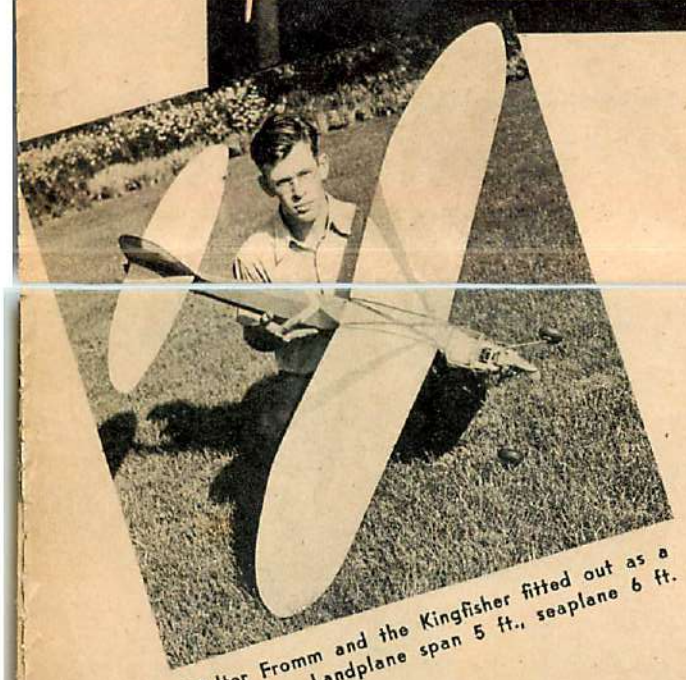
Baker, coast member of the Wakefield team, improved on his "diamond" by using a one-wheel, retractable landing gear and one-bladed folder.

THE KINGFISHER

Created for those who want a sturdy job for everyday flying, this ship was made for both wheels and floats.



The quickly detachable motor mount, showing the inverted Denny, condenser, coil, and batteries. Installation is sturdy.



Walter Fromm and the Kingfisher fitted out as a landplane. Landplane span 5 ft., seaplane 6 ft.

BY JOE OTT

THE Kingfisher is designed to serve a dual purpose—a land model and a seaplane model. The wing loading averages less than eleven ounces per square foot of area for either plane. The land model has a sixty-inch wing and the seaplane model has a seventy-two-inch spread. The construction throughout is exceptionally sturdy, and hard balsa is used for the most part. Hardwood veneer is used at three main sections of the fuselage. The first one is at Section No. 1, where the landing gear is firmly attached to the body. The second, at Section No. 2, where the leading edge of the wing is held against the top of the cabin, and the third strong point is at Section No. 6, which holds the rear wing hook and strengthens this part against the pressure of the rubber band holding the wing.

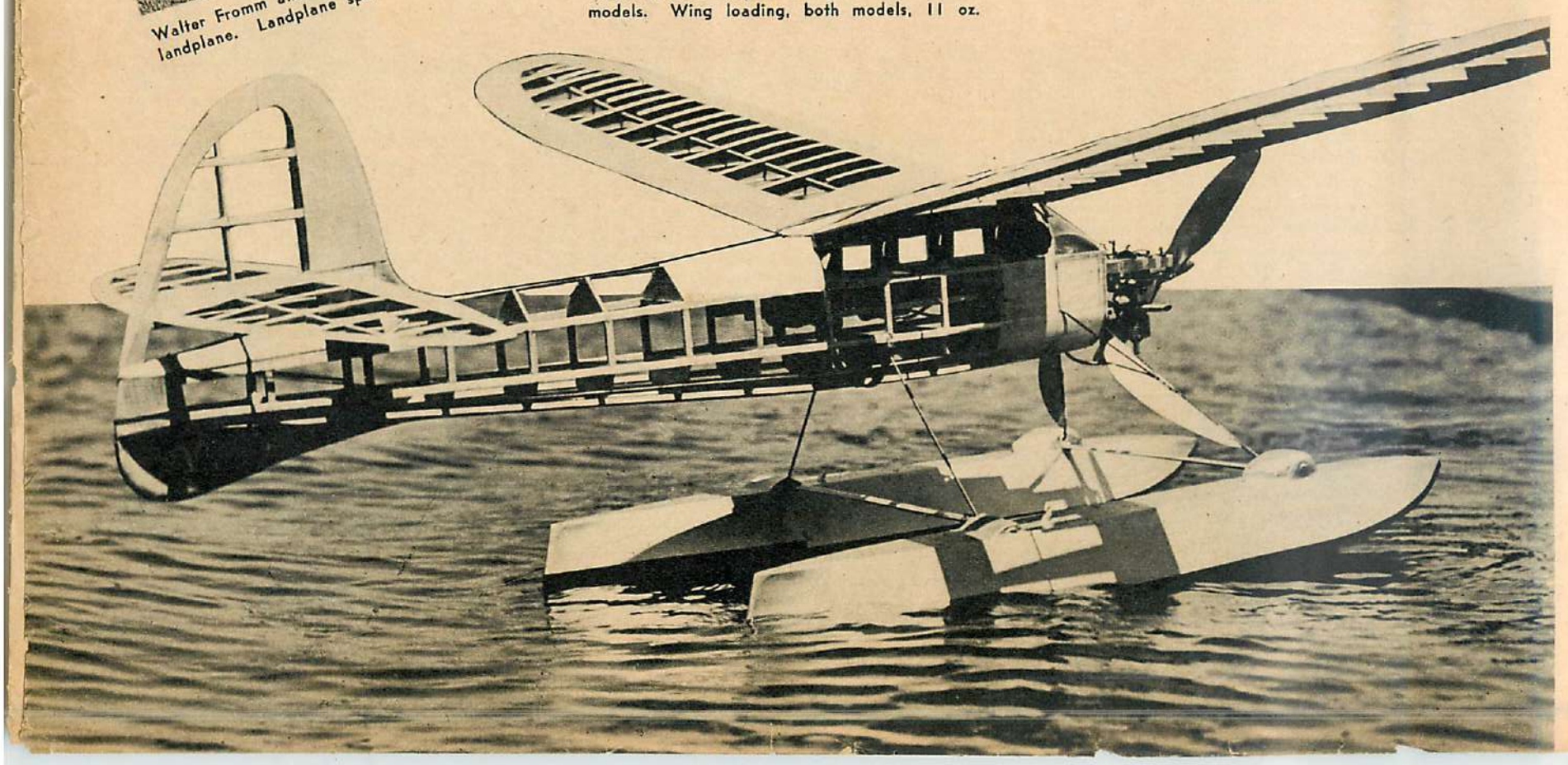
Four complete test models were built until the final shape and construction methods were decided upon. In the original design the wing loading was to be held at twelve ounces per square foot. This weight would give a little better stability on breezy days and the climbing angle of a heavier model would be more gradual and, in a sense, similar to that of a full-size airplane. The landing gear of a model of this weight must be strong enough to withstand the force of rough landings. By the use of a lifting stabilizer, longitudinal stability is slightly increased, since we have two points of suspension—the wing and the stabilizer, somewhat similar in a way to a tandem type of airplane. This style of lifting tail, or one along these lines, was employed a few years back on the Handley-Page bomber, and is common on most contest models. Of course, where the tail takes the place of a small wing, the center of pressure of the wing itself must be farther forward than usual, and this should be considered when balancing the model for flying. The position of the center of pressure should be one third back from the leading edge.

BODY CONSTRUCTION

Material:

Longerons, $^5/_{32}$ x $^3/_{16}$" sq., hard balsa
Stringers, $^1/_8$" sq., hard balsa
Formers, $^1/_{16}$" balsa sheet, medium

The body construction begins with the assembly of a rectangular section as illustrated by the heavy lines of the drawing. This method simplifies the starting of a model and permits easy and fast construction. Two identical sides are constructed first of $^5/_{32}$ x $^3/_{16}$" balsa. The framework is 2½" deep from Formers 1 to 6. From Former 6 the depth decreases to 1½" at Former 14. Since the top of this framework is perfectly flat, it is easiest to construct the fuselage when in an inverted position on a flat surface. The cross braces should not be cemented in place



Floats were developed through a series of test models. Wing loading, both models, 11 oz.

until all the fuselage formers have been cut to shape. The length of the cross braces is had by deducting $^5/_{16}$" from the width of the bulkhead. In so doing, the two $^5/_{32}$" thick longerons will fit flush against the outside of the bulkheads.

All material sizes for each part are listed separately. The lower part of the fuselage is built up of formers and longitudinal stringers. Former No. 1, holding the landing gear, is reinforced with ⅛" hard balsa over the veneer former. Note the construction of the rear end of model including the balance box.

LANDING GEAR

Material:

1 heavy spring wire, .125 dia. x 24" long
1 each medium spring wire, .096 dia. x 24" long
3 each metal straps, ⅜ x 1½ x .020" long
3 sets bolts and nuts, 2-56 x ½" brass round head
2 each 3" airwheels

The landing gear is bent to the shape illustrated in the perspective sketch, and is bolted firmly through Former No. 1 with metal straps. The reinforcing strut of the landing gear is soldered as illustrated in the side view and firmly anchored to the bottom of the longeron at Section No. 2. The streamlined section of the landing gear should be made from bass or pine, and is not only ornamental, but will actually prevent the main section of the landing gear from unnecessary bending. In addition, it is best to wrap heavy thread in at least two or four places around the landing-gear wire and the streamlined section, applying a generous amount of cement at all times.

WING

Material:

1 pc. ¼ x ¼ x 40" long, hard balsa, leading edge
1 pc. ⅛ x ⅜ x 40" long, extra hard balsa, trailing edge
4 pcs. ⅛ x $^3/_{16}$ x 40" long, hard balsa, spars
8 pcs. $^3/_{64}$ x 3 x 24", hard balsa, balsa sheeting
6 sheets $^1/_{16}$ x 4 x 24", medium balsa, rib stock
6 pcs. $^1/_{16}$ x $^3/_{16}$ x 40", medium balsa, cap strips

The sketches illustrate the construction of the wing, and it should be noticed that the trailing edge is built (box fashion) similar to that of the leading edge. This type of construction guarantees a very rigid and straight leading and trailing edge, which will not warp under the tension of silk and dope. The trailing edge should be sanded to a very sharp edge and the leading edge should be sanded to a fairly sharp edge before the balsa sheeting is cemented in place. Cap strips may be left off the ribs; however, an allowance for the space otherwise taken up by them should be made.

STABILIZER RUDDER

Material:

1 pc. ⅛ x ½ x 40", hard balsa, spars
1 pc. (same) ⅛ x ⅜", hard balsa, rear spars
2 pcs. $^3/_{64}$ x 3 x 24", medium balsa sheet
1 pc. $^3/_{16}$" sheet, hard balsa, trailing edge
2 pcs. $^1/_{16}$ x $^3/_{16}$ x 40" medium balsa, cap strip

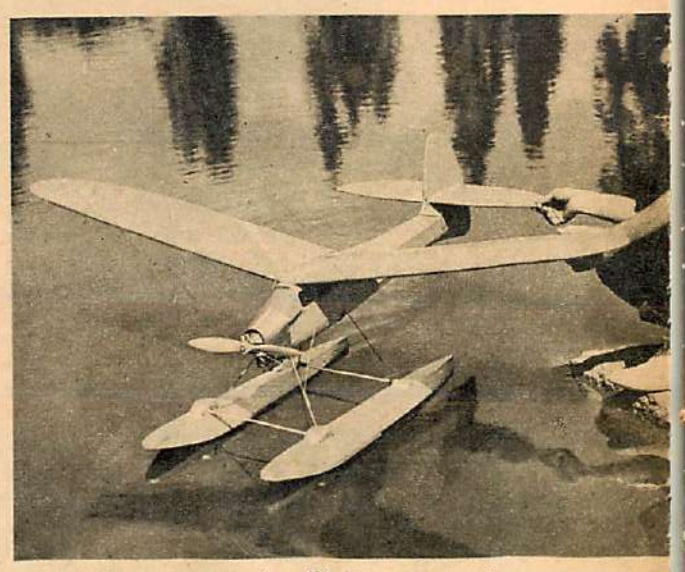
The leading edges of the rudder and stabilizer are constructed similar to those of the wing. Refer to the perspective sketches illustrating method of assembly. Note in particular that the stabilizer is completed first and that the rudder spars remain in one full piece and are glued against the stabilizer spars. In this way a complete two-unit, rigid assembly is made. The height of the stabilizer can be checked on the side view.

FIN

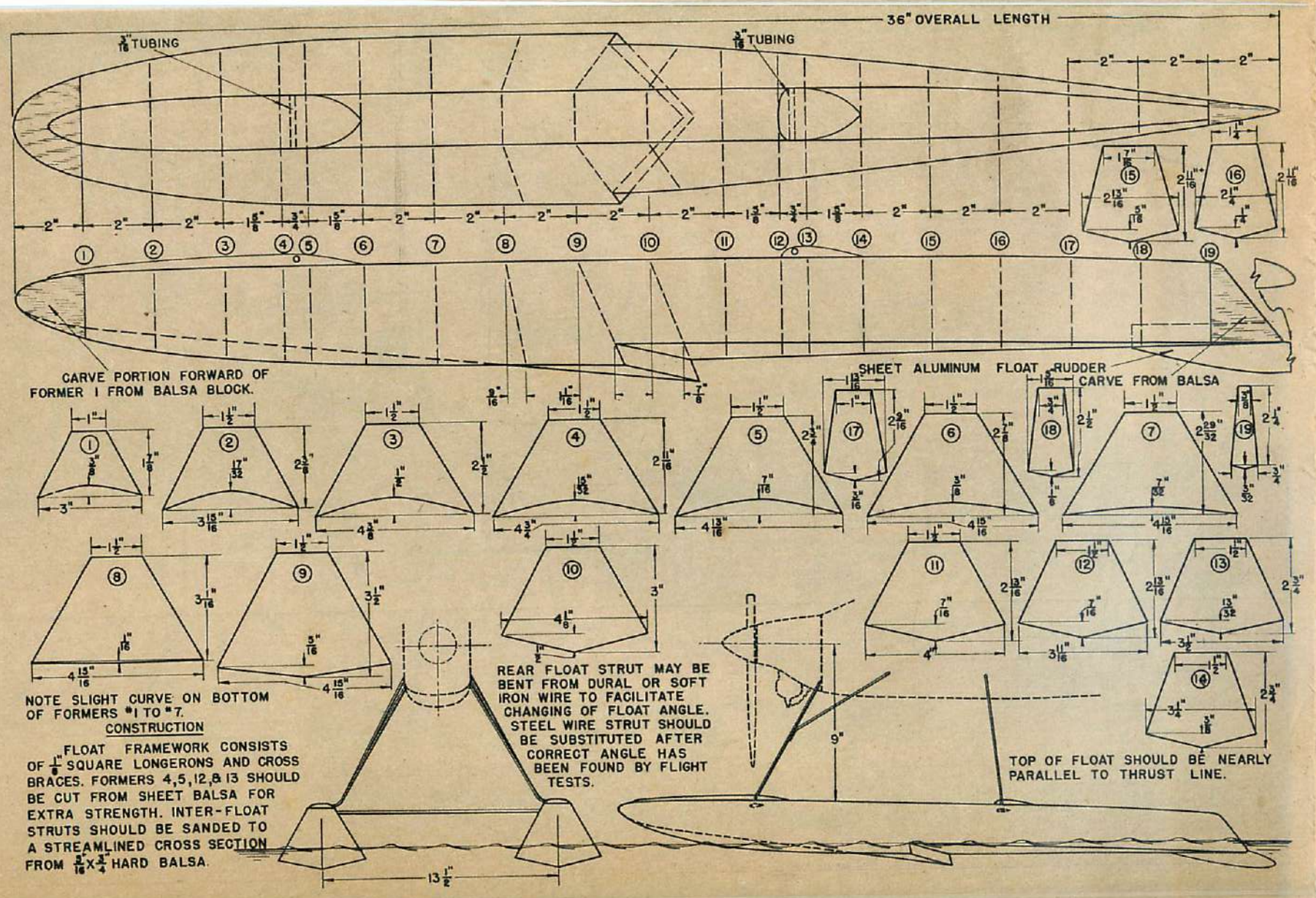
Material:

1 pc. $^3/_{16}$ x 8" hard balsa sheet
1 pc. $^1/_{16}$" veneer sheet

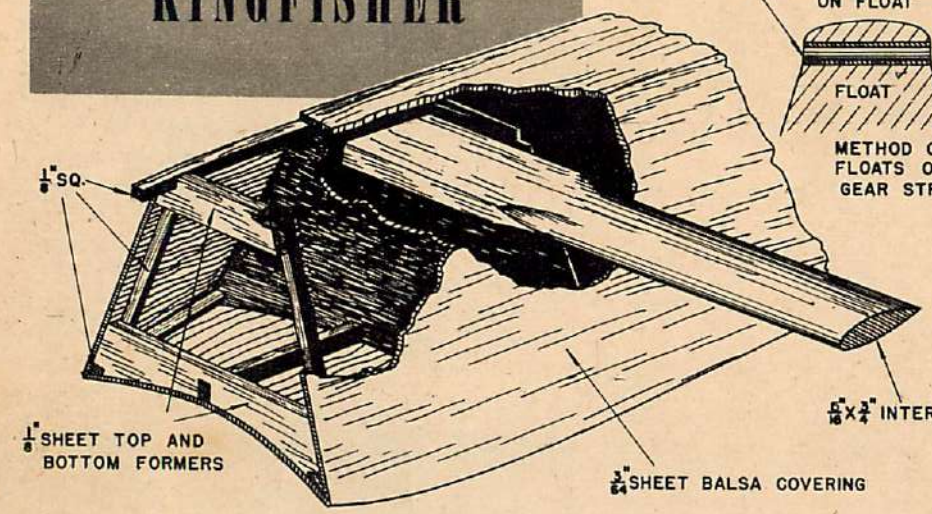
The fin is a continuation *(Turn to page 55)*

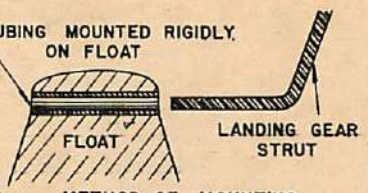


All set for a snappy take-off! Best of models get occasional ducking, so cover with silk.

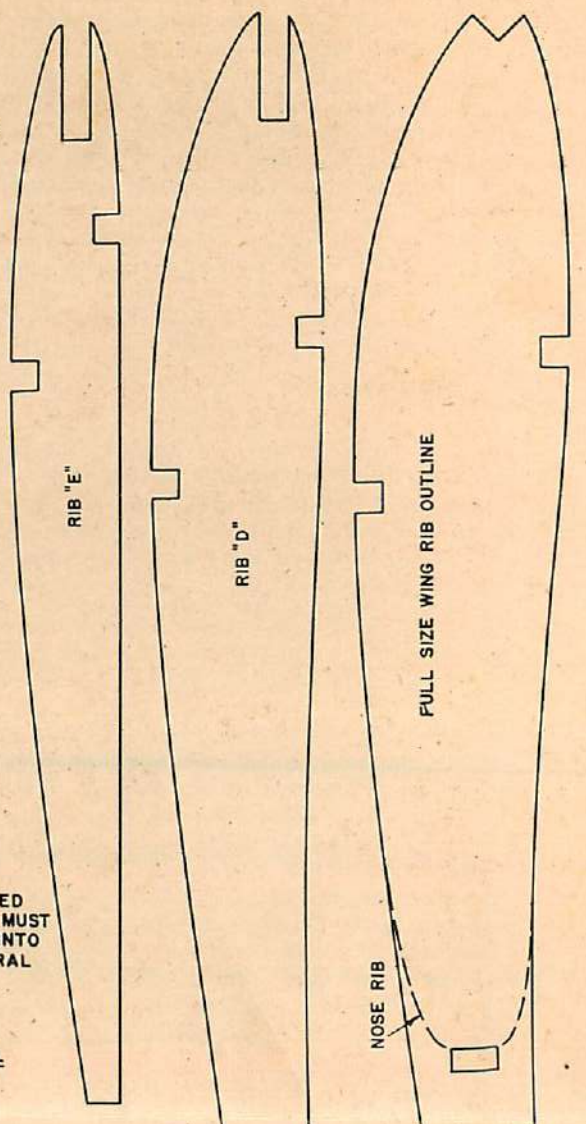


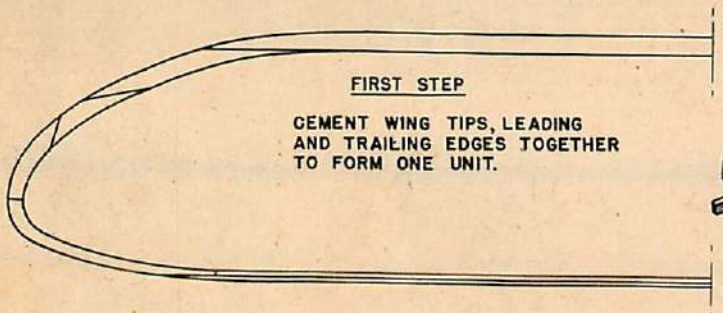
THE KINGFISHER



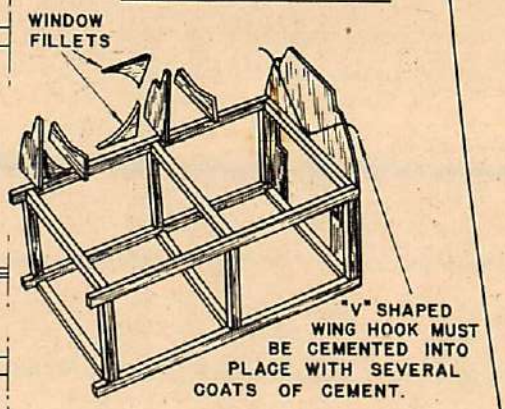


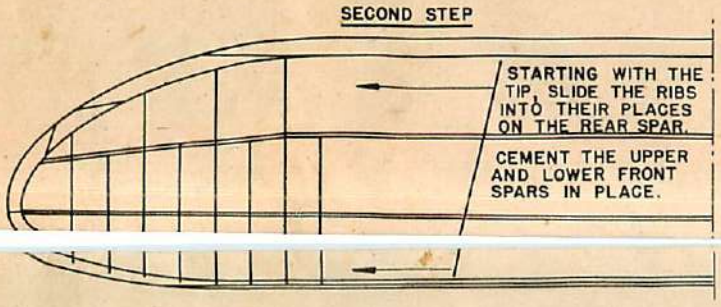
METHOD OF MOUNTING FLOATS ON LANDING GEAR STRUTS.

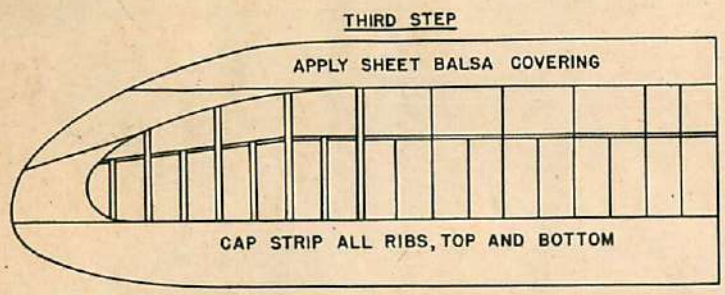




FUSELAGE FRAME DETAIL

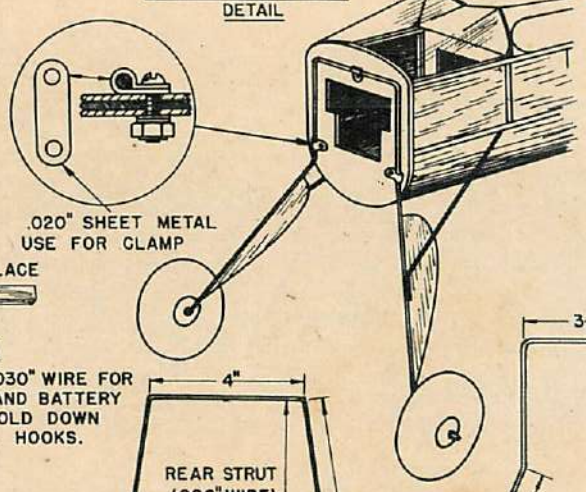






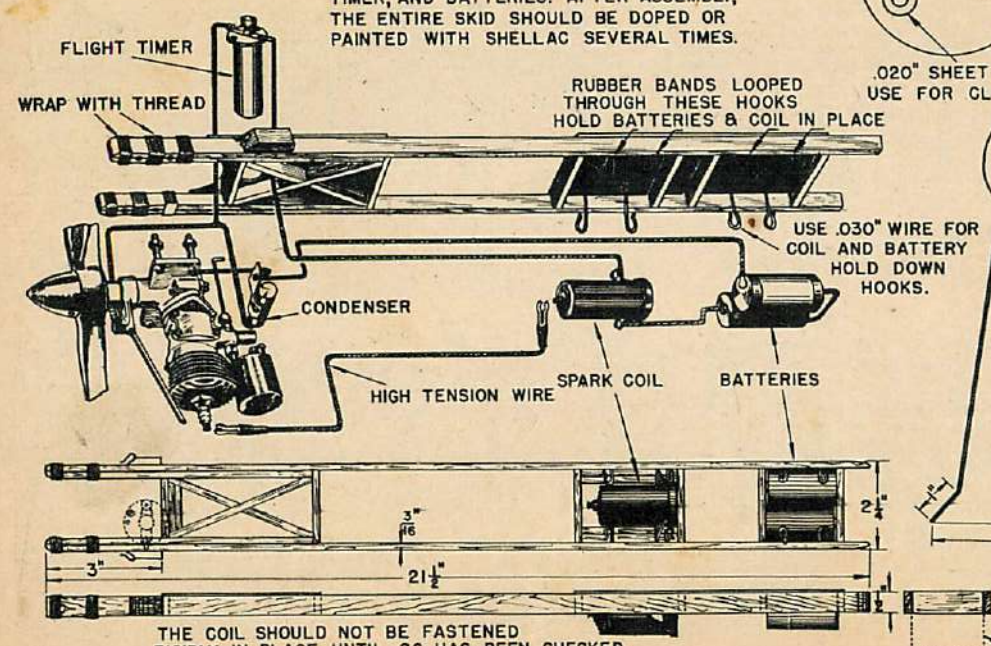
WING CENTER SECTION DETAIL

LANDING GEAR CLAMP DETAIL

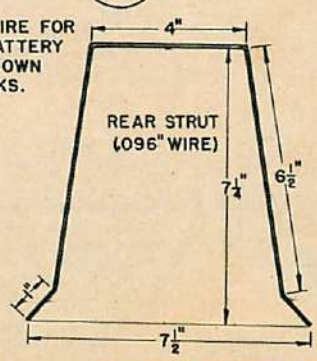


MOTOR SKID DETAIL

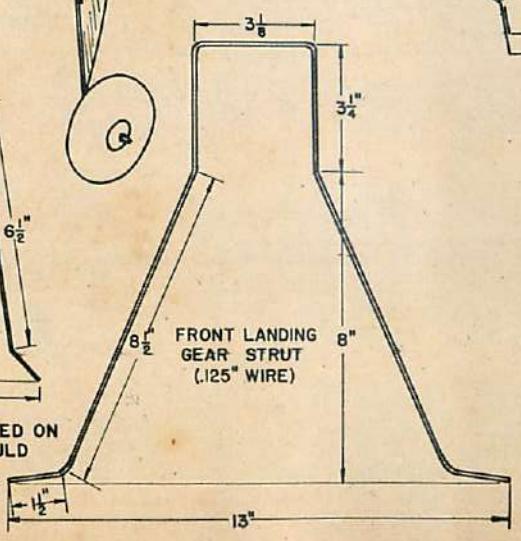
PERSPECTIVE SKETCH SHOWS POSITION OF ENGINE, COIL, CONDENSER, TIMER, AND BATTERIES. AFTER ASSEMBLY, THE ENTIRE SKID SHOULD BE DOPED OR PAINTED WITH SHELLAC SEVERAL TIMES.



THE COIL SHOULD NOT BE FASTENED RIGIDLY IN PLACE UNTIL C.G. HAS BEEN CHECKED.



NO PARTS MOUNTED ON MOTOR SKID SHOULD EXTEND OUTSIDE OF THESE LIMITS



THE KINGFISHER

WING SPAN – – – – – 60"
CHORD – – – – – – – 10 1/2"
WING AREA – – – – 504 sq in
AIRFOIL – MODIFIED RAF 32

LENGTH – – – – – – – 46"
TOTAL WEIGHT – – – 47 OZ.
POWER – – – – – – 1/5 H.P.
PROPELLER – 14" – – 5" PITCH

SCALE 1/4" = 1"

BEFORE THE CELLULOID WINDSHIELD IS APPLIED, DOPE THE INSIDE OF THE FUSELAGE FRAMEWORK 2 OR 3 TIMES TO PROTECT THE WOOD FROM OIL THAT WILL EVENTUALLY SEEP IN FROM THE ENGINE EXHAUST.

SUGGESTED COWLING OUTLINE

RUBBER BANDS

CENTER OF GRAVITY

1/16" SHEET COVERING

3/32" X 1/4" STRINGER

1/16" SHEET BALSA COVERING

SOLDER FRONT AND REAR LANDING GEAR STRUTS TOGETHER AT THIS POINT.

2 1/2" OR 3" AIRWHEEL

DENNYMITE ENGINE

AUSTIN FLIGHT TIMER

THREAD BINDING

RUBBER BAN

NOTE:– TO PREVENT CRUSHING OF TRAILING EDGE OF WING BY RUBBER BAND, THE TRAILING EDGE, AT THE CENTER SECTION, SHOULD BE COVERED WITH ALUMINUM.

6" OR 7" DIHEDRAL

NEEDLE VALVE

NOTE ELBOW IN VENT TUBE

FILLER TUBE EXTENDS TO BOTTOM OF TANK

SUGGESTED FUEL TANK DESIGN FOR INVERTED ENGINES. USE DISCARDED SALVE CAN ABOUT 1 1/2" DIAMETER.

3" 3" 3" 3" 3" 3" 3" 3" 3" 3"

E D C B A A A A A A A

TAIL ASSEMBLY DETAIL

1/16" SHEET COVERING

1/16" X 1/4" CAP STRIPS

3/32" X 1/2" SPAR

3/32" X 3/8" SPAR

WIRE SKID

BALANCE BOX

STRINGERS ALONG FUSELAGE BOTTOM ARE 5/32" SQUARE

DETAIL OF REAR PORTION OF FUSELAGE

WIRE HOOKS

5/32" X 1/4" MAIN LONGERONS AND CROSS BRACES.

RIGHT HALF OF TOP VIEW OF FUSELAGE SHOWS BASIC FUSELAGE FRAMEWORK.

1/16" BALSA SHEET COVERING

3/32" X 1/2" FRONT SPAR

3/32" X 3/8" REAR SPAR

1/16" X 1/4" CAP STRIPS

RIB "F"

RIB "G"

RIB "H"

RIB "J"

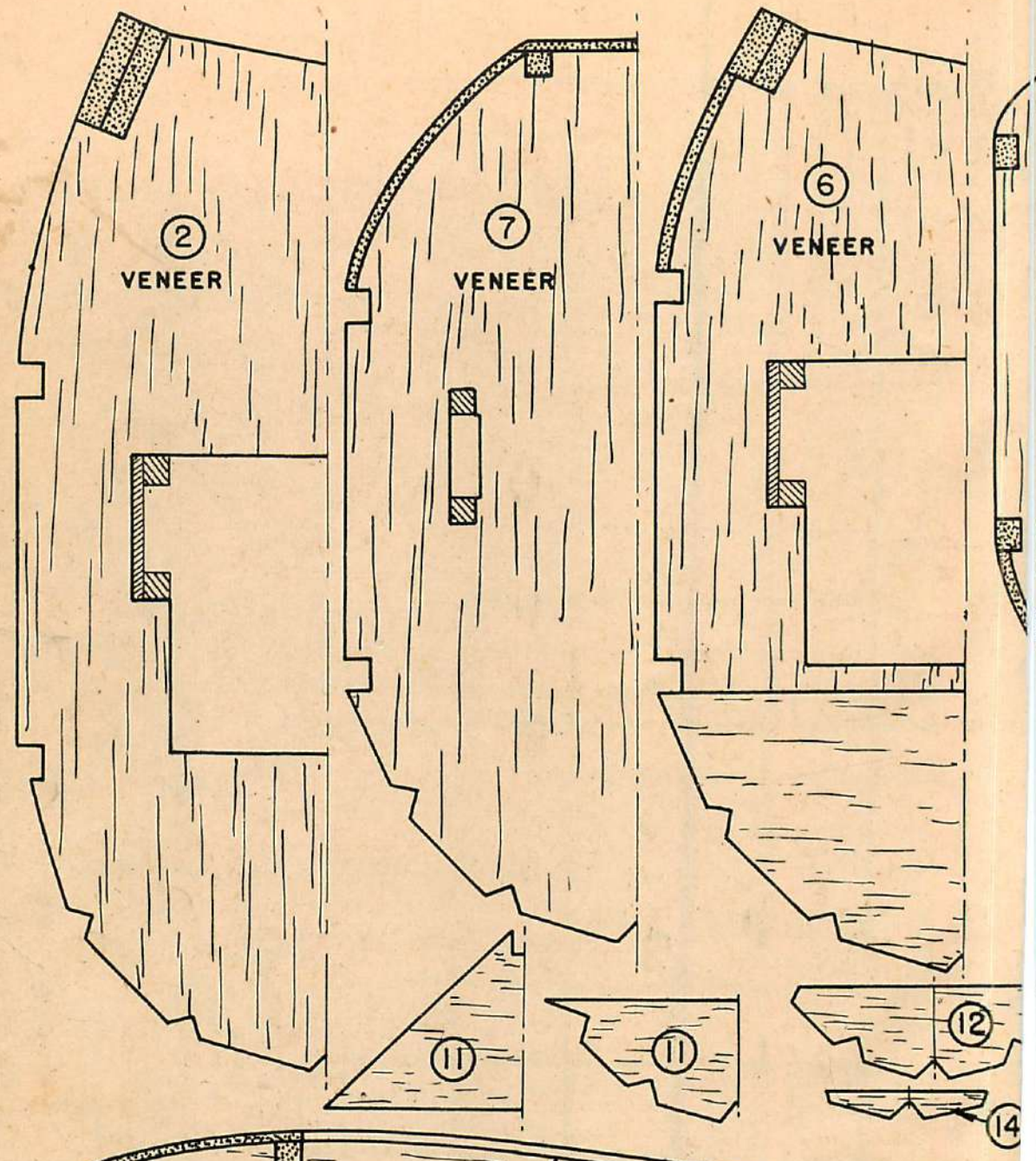
RIB "K"

WING SHOWN 1/8 ACTUAL SIZE

60"

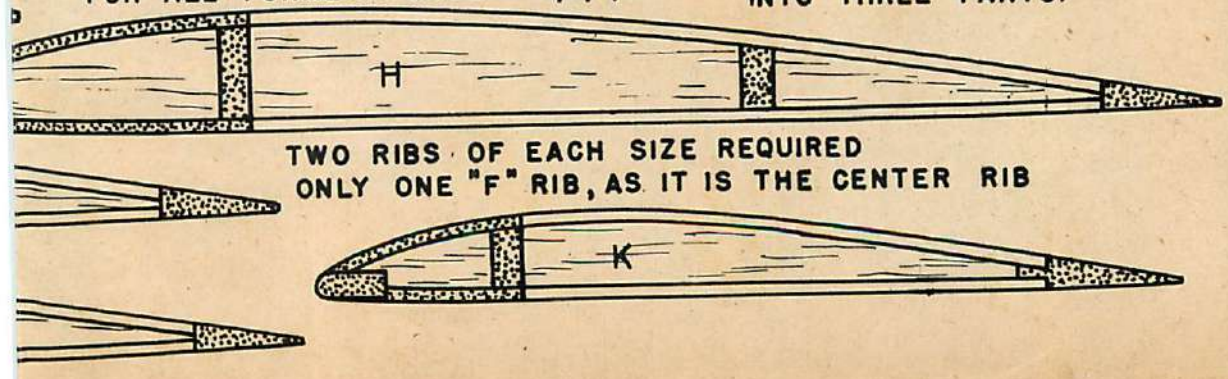
30"

NOSE RIBS



ALL FUSELAGE FORMERS ARE GIVEN FULL SIZE. BALSA USED FOR ALL FORMERS EXCEPT 1,2,6,7.

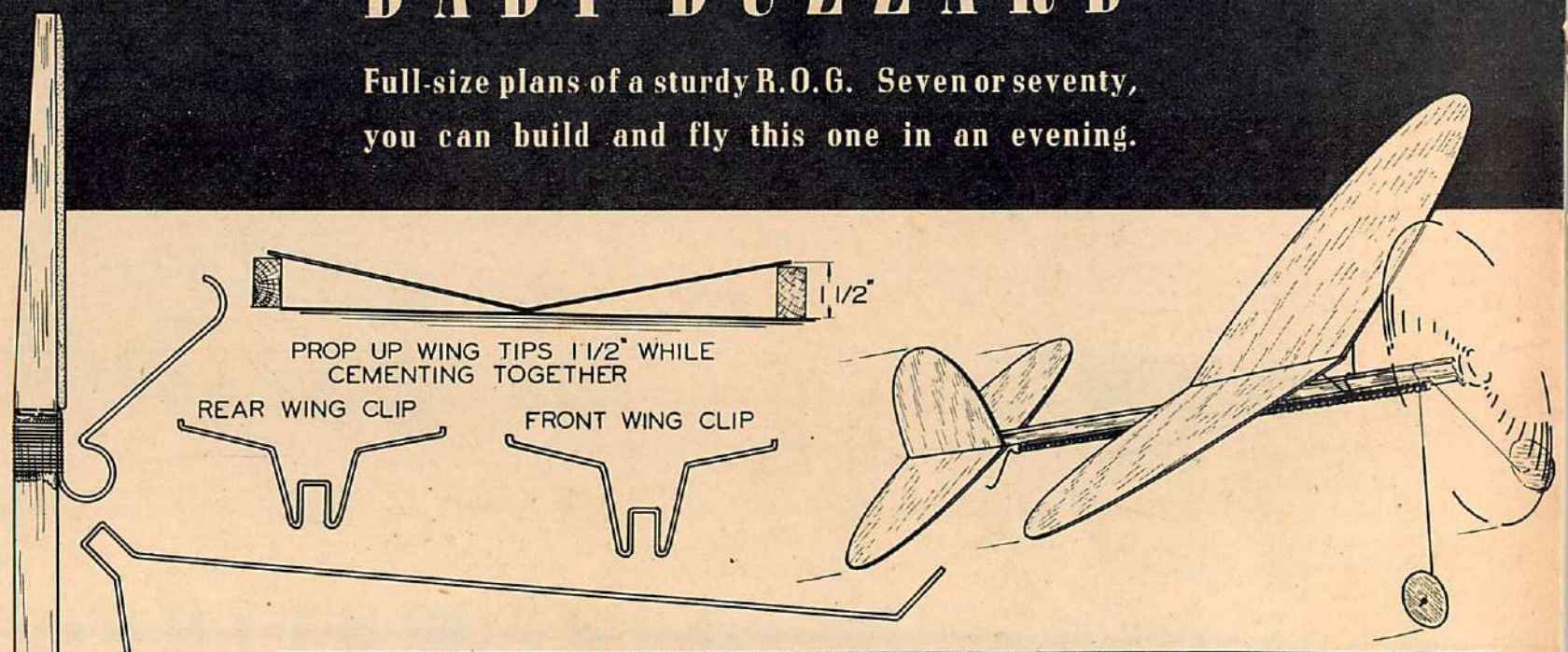
NOTE THAT FULL DEPTH SPARS SEPARATE RIBS INTO THREE PARTS.

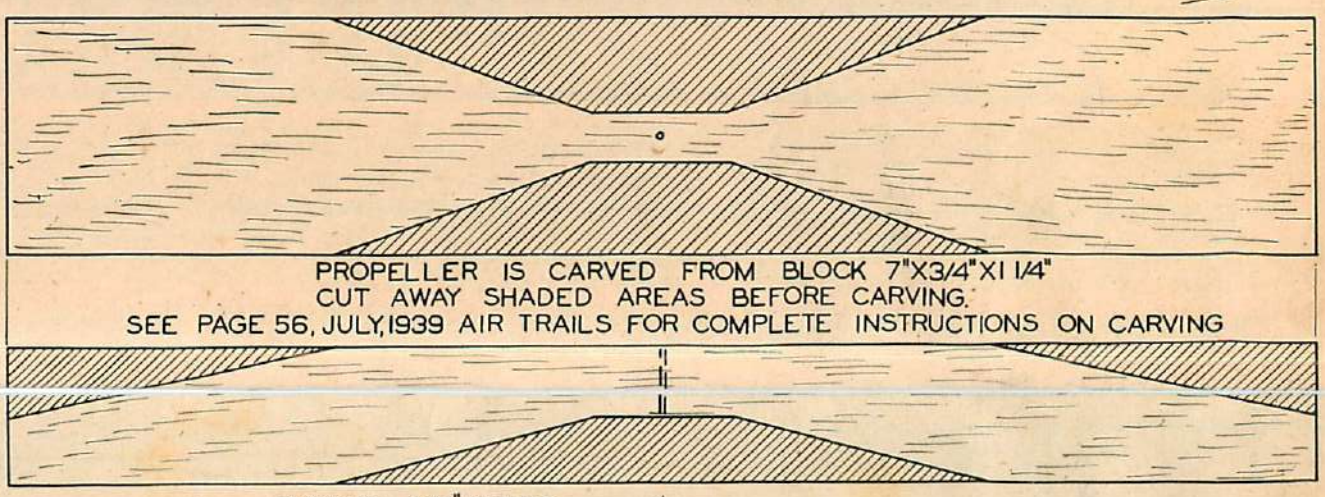


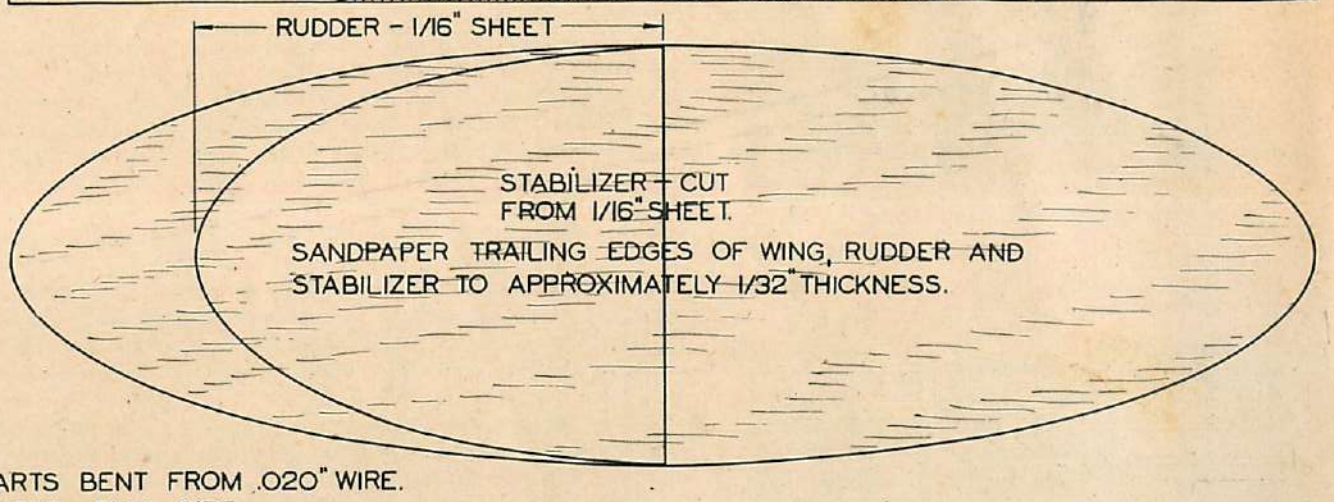
TWO RIBS OF EACH SIZE REQUIRED
ONLY ONE "F" RIB, AS IT IS THE CENTER RIB

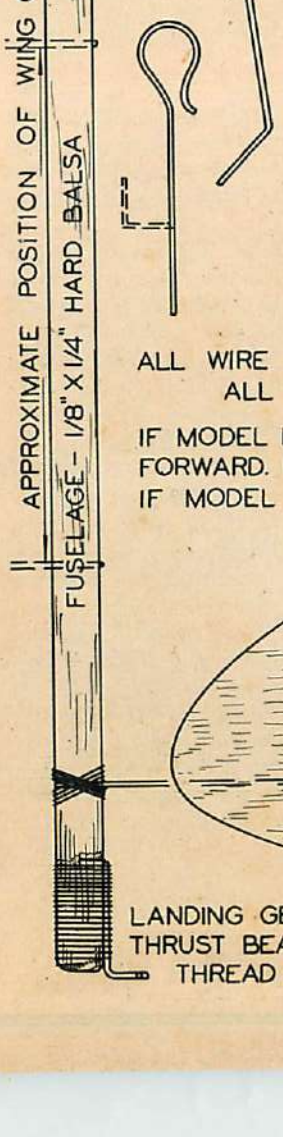
BABY BUZZARD

Full-size plans of a sturdy R.O.G. Seven or seventy, you can build and fly this one in an evening.



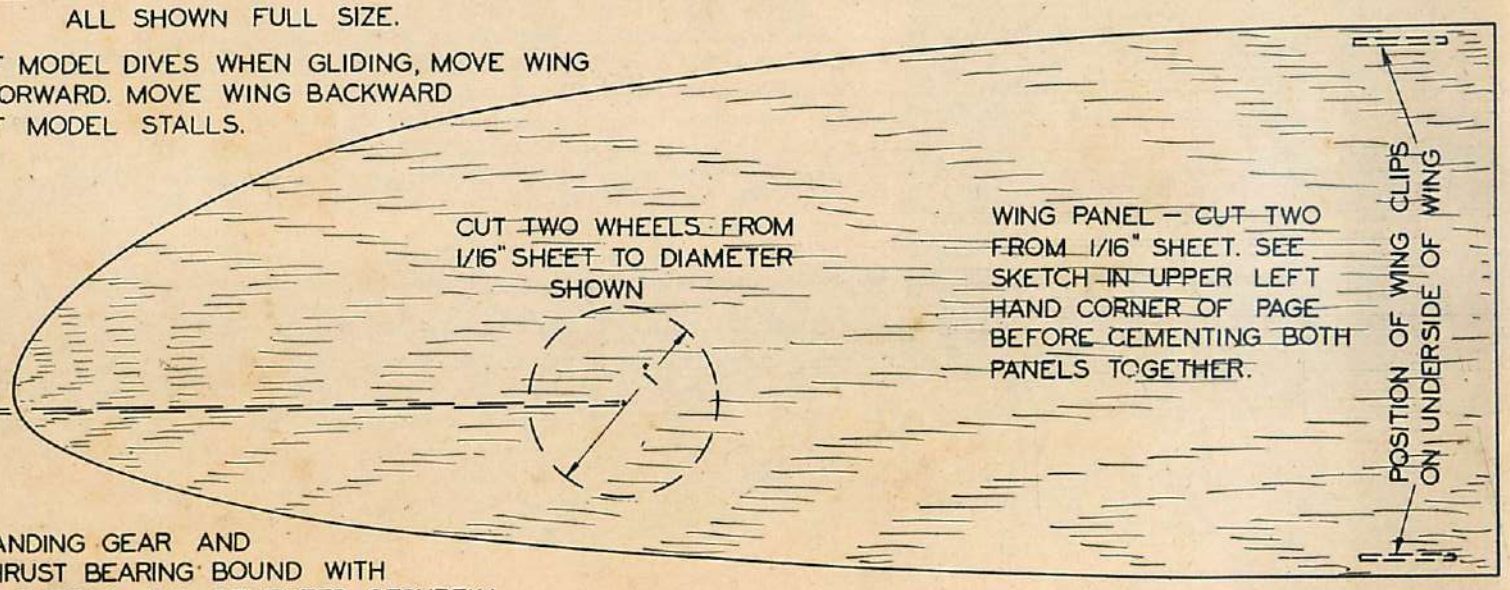




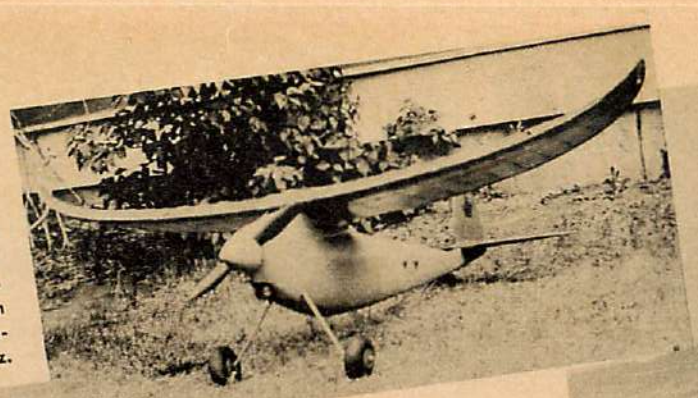


ALL WIRE PARTS BENT FROM .020" WIRE.
ALL SHOWN FULL SIZE.

IF MODEL DIVES WHEN GLIDING, MOVE WING FORWARD. MOVE WING BACKWARD IF MODEL STALLS.



LANDING GEAR AND THRUST BEARING BOUND WITH THREAD AND CEMENTED SECURELY.

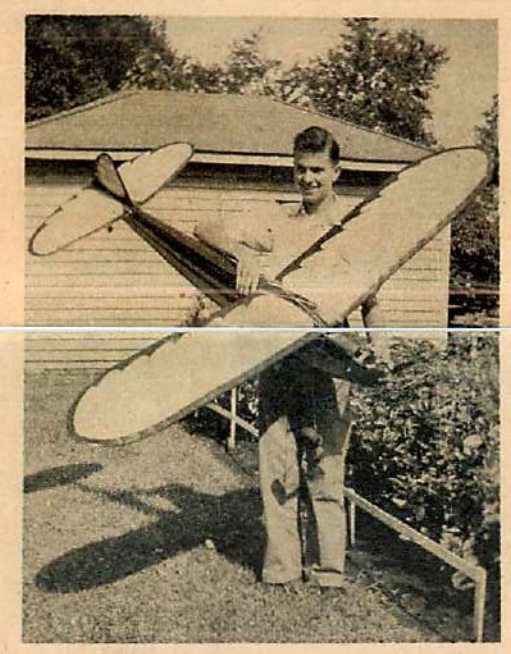


56" Ohlsson-powered job by Lowrie McLarty, Sask. Fuselage is monocoque, plan form and dihedral elliptical. Wt. 28½ oz.

Right—H. P. Snyder, Portland, Oregon, and Ryan ST, a perfect duplicate of Rankin's famous stunt job.

¾"-scale Boeing P26-A, winner California Fair. Built by Ralph Guernsey, model has detailed cockpit.

Model matters



Dale Root, Galesburg, Ill., and his first gas job, a Zenith (Jan. & Feb., '39, issues).

Albert Carlson, Salt Lake City, set N. A. A. record of 15:35, Cl. C., Sr., with this Zipper.

THE DOPE CAN. (By Gordon S. Light.) Good news is the confirming of the rumor that the 1940 National Meet will be held in Chicago the first week in July under the joint sponsorship of the Chicago *Daily Times* and the Chicago Park District. The list of events has not been officially decided. We join in the cry for the return of a stick event with the Mulvihill Trophy for the winner. Unfortunately it was squeezed out of the 1939 national program under the pressure of other events. But the criticism which followed should be definite proof of the stick's popularity.

Bad news was the indefinite postponement of the Wakefield International Contest until the end of the war. This was the announcement from the Society of Model Aëronautical Engineers in England who control the fate of the Wakefield Trophy. The news from Canada, France and England indicates that all able-bodied model builders are either in the air force or working double time in aircraft factories—which doesn't leave much time for Wakefield models. Postponement of the Wakefield leaves the Moffett Trophy contest as the only international event scheduled for 1940 in this country. And unless entries are encouraged from the neutral countries, this contest will lose its international flavor because of the war.

A considerable number of model builders have been taken into the National Advisory Committee for Aëronautics for work in the research laboratories. Model building for the test tunnels constitutes the bulk of their work. However, they have been tried at a variety of other jobs—all with pleasing results. The boys are enthusiastic, hard workers, and resourceful.

Readers of the *American Magazine* who have a model interest were certainly pleased to see Ben Shereshaw looking at them from a full-page photo on Page 98, December issue. Titled "Gasoleer," the brief paragraph explained that Ben was one of the leading figures in the hobby. A few of his activities listed were director of the Kresge (Newark, N. J.) Aëro Club, designer of the Bantam motor, and creator of many gas jobs. Unfortunately no mention was made of another distinction—that he is the owner of Buster, the most intelligent dog in the model hobby today. If only half of Buster's reported accomplishments are true, he should be a scientific member of the Academy of Model Aëronautics.

Columbia Aero Midgets (Columbia, S. C.) continue to hold their monthly city-wide meets throughout the winter. School work has cut into the model builders' activities to some extent. Teachers used to accuse us of reversing the old saying—"When work interferes with pleasure, cut out the pleasure." Would students neglect their school work in favor of algebra and history if model building was made the compulsory curriculum? Can't imagine it!

A State-wide contest sponsored by the Aëro Midgets is promised for early in 1940. A Columbia merchant has promised several trophies—one of which is permanent and is to be given to the winner of this yearly State-wide contest.

A banquet held late in October put an official close to the summer and fall season of the Buffalo Model Airplane Club. President Howard Ruth was master of ceremonies. Spencer Rice of American Airlines and Morris Knowles of Penn-Central Airlines were guest speakers. Prizes were awarded to the high-point winners throughout the season of flying.

A remarkable record was the new Class C gas-powered flight of 15:35 (average) with a Denny-powered Zipper set by Albert Carlson of Salt Lake City. Most recent listing of N. A. A. records shows his record has been beaten by Jerry Heller, of San Antonio, Texas, with 23:08 (average). But Carlson's flight was made from a launching point almost a mile above sea level. Models really settle fast at this altitude. Utahans start out with two strikes when they try to crack a record. Carlson was the first in his State to hold a national mark— *(Turn to page 63)*

1939 MOFFETT TROPHY WINNER

A consistent model that won the Moffett and Scripps-Howard contest with 3:02 and 8:30 average times.

Ed Naudzius and the model. The design is simple, light, and will average 3:00. Power run lasts about a minute.

BY ED NAUDZIUS

It was just before the Moffett finals. We were chatting with Ed Naudzius, who had earned a place on the six-man team the day before. "I'm not worried," he told us. "I know the model will average three minutes."

You know the rest. Naudzius won the Moffett with a three-flight average of 3:02! And to further prove its consistency, the Moffett winner then took first place in the Scripps-Howard Junior Aviator races with an average of 8:30. Naudzius credits the model's consistency to simple construction. The ship is lighter than most Class C fuselage models. The weight saved is used in a larger motor. The glide is good and the climb long, lasting about a minute. An interesting side light to the contest record of the ship is that it has never suffered a broken motor.

CONSTRUCTION

THE fuselage is drawn half size, making it an easy matter to double the size of the plans for a full-size layout. (Maybe in another year Air Trails will be so large that you'll be spared the agony (?) of scaling up plans altogether.) Since the actual construction is detailed on the plans, no difficulty should be encountered while the model is being built. There is one part, however, that may not be clear to some. On the part of the fuselage that the wing rests, the tops of the outside longerons are flush with the $^1/_{16} \times ^1/_8$" bamboo strips which are used to hold the wing down. This means that the cross pieces will have to be cemented to the uprights in the fuselage sides $^1/_8$" lower than the longerons. The alignment of the fuselage should be as good as you can possibly make it. Remember that the incidences of the wing and stabilizer depend on the accuracy with which you build the fuselage. A little care exercised during construction will prevent the loss of time caused by poor work and resultant poor flights. You can't dash through the job and yet expect real performance.

The nose plug should be a snug fit, so that it doesn't slip out after the rubber unwinds. The rear hook is a $^3/_{16}$" square hardwood plug which is rounded in the center so that it doesn't cut the rubber. The tips are left square, so that they fit tightly in the $^3/_{16}$" square hole in the rear of the fuselage. Note that the rear of one side is left open, to give access to the rubber motor. There are no warps in either the wing or stabilizer, so if any parts warp, they should be corrected as soon as noticed.

FLYING

As in any contest model, the primary aim is to get a near-perfect glide and a good climb to utilize the glide. While a "good" model can do time due to its gliding qualities, the same model can do much better time if the power run is extended. This idea has been used to get good time under conditions unfavorable to soaring flights. The model should be hand-launched without any turns in the motor to determine the gliding trim. If it dives, the wing should be moved forward, and if it stalls, the wing should be moved back slightly. Since the wing is held down with rubber bands around the wing and bamboo wing runners, shifting the wing should be easy. After the glide has been trimmed to the point where the model is nearly stalling, a paper covering should be placed over the wing to preserve the lines of the fuselage. (No pun intended.) The model should be hand wound from fifty to seventy-five turns, so that the glide may be watched from a distance to make sure the model is descending at the slowest speed possible.

As more turns are given, the model might have a slight tendency to stall under power. This can be remedied by a little right thrust, which will tighten the circle and eliminate the stall. If the stall is excessive under full power, downthrust may have to be added also. On the original, one degree of right and one degree of downthrust produced the best results. The model should climb and glide in about two-hundred-degree circles. A thousand turns may be safely stored in the motor if it has been broken in and is at least a week old. Although some model builders may not know it, most of the motors that broke during the Nationals were too fresh, having been bought just before the meet. To play safe, it is best to buy fresh rubber and store it in a dark and cool place for about a month before you intend to use it.

Note that when winding up with a winder the prop shaft slips forward and disengages from the prop. This allows rapid winding without having the prop spin around. The prop should fold against side of fuselage.

The Moffett winner illustrates several suggestions by Jim Cahill in his arguments for streamlining in an article to be found elsewhere in this issue.—The Editor.

1939 MOFFETT TROPHY WINNER

FULL SIZE LANDING GEAR STRUT - MAKE TWO FROM BAMBOO $\frac{1}{16}$" THICK

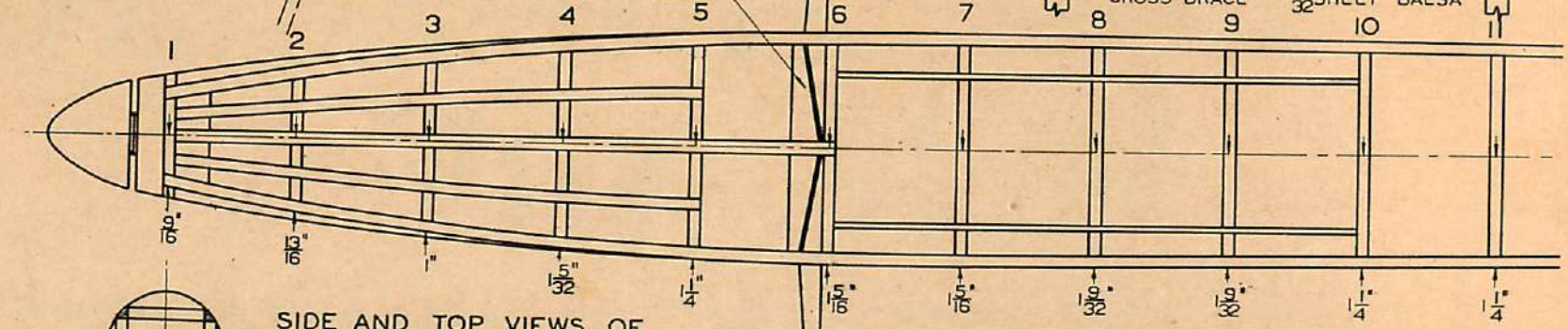
LANDING GEAR FILLER PIECE -FULL SIZE-

CROSS SECTION OF UPPER PORTION OF FUSELAGE AT STATION 8.

BAMBOO WING SUPPORTS

CROSS BRACE

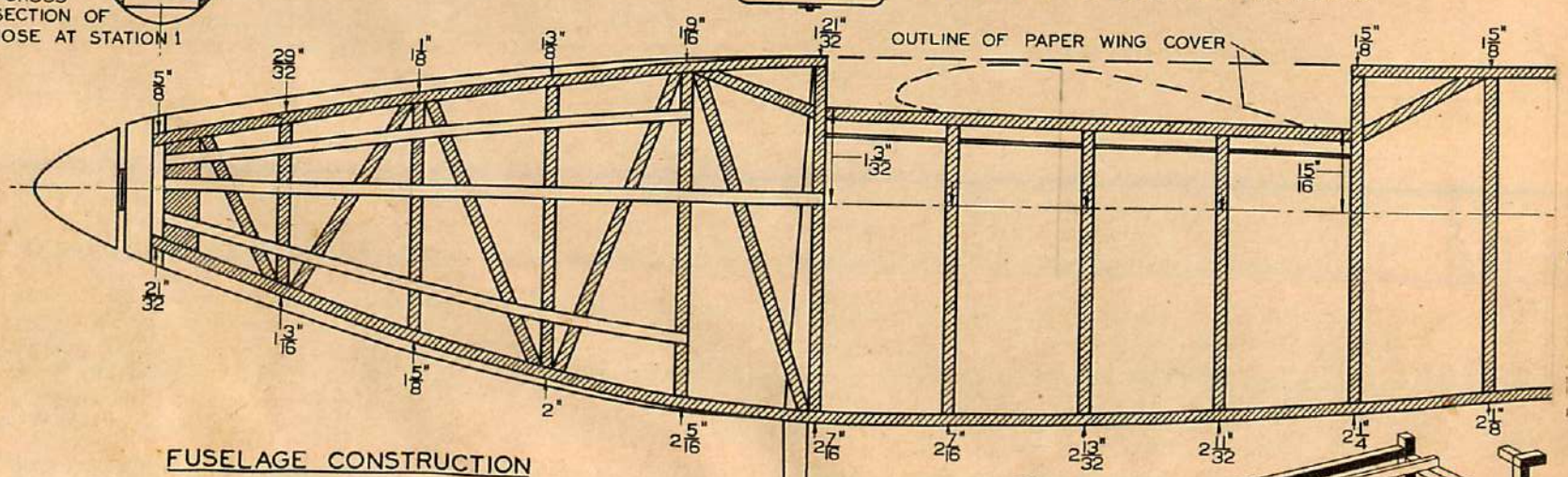
$\frac{1}{32}$" SHEET BALSA



SIDE AND TOP VIEWS OF FUSELAGE ARE GIVEN ONE-HALF ACTUAL SIZE.

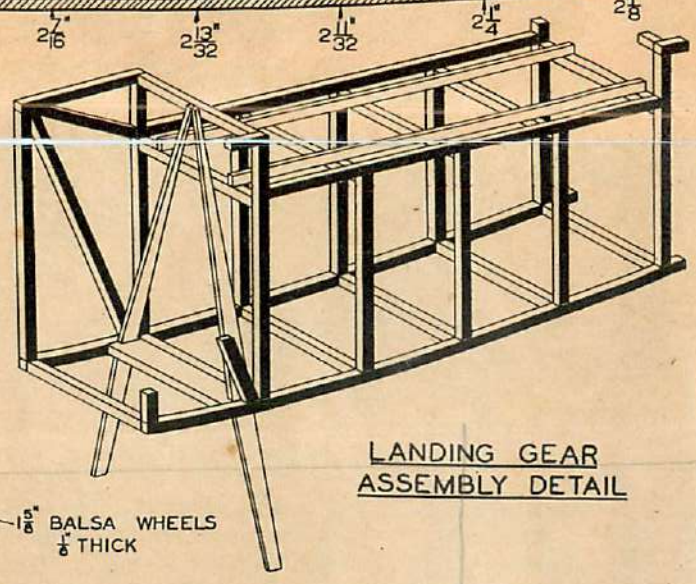
DIMENSIONS GIVEN FOR HEIGHT AND WIDTH OF BASIC FUSELAGE FRAME ALL REFER FROM CENTERLINE TO OUTSIDE OF LONGERON.

CROSS SECTION OF NOSE AT STATION 1



FUSELAGE CONSTRUCTION

MAKE TWO FUSELAGE SIDES, USING HARD BALSA LONGERONS AND MEDIUM BALSA UPRIGHTS. BASIC FUSELAGE SIDES ARE SHADED FOR CLARITY. WHEN FRAMEWORK HAS DRIED REMOVE FROM PLANS AND CEMENT CROSS BRACES IN PLACE. START AT THE WIDEST POINT (STATIONS 6 TO 10), AND WORK TOWARDS TAIL. KEEP FUSELAGE IN INVERTED POSITION ON WORKBENCH SO THAT SQUARENESS MAY BE CHECKED BY PLACING DRAWING TRIANGLE AGAINST IT. RUBBER BANDS STRETCHED AROUND THE NOSE AND TAIL ENDS OF THE FUSELAGE WILL KEEP THE TWO SIDES FROM SPRINGING APART. CROSS BRACES MAY THEN BE INSERTED WITHOUT DIFFICULTY. THE LANDING GEAR STRUTS SHOULD BE CEMENTED IN PLACE AT STATION 6 AND THEN THE TAPERED NOSE FAIRING STRIPS WHICH EXTEND FROM NOSE TO STATIONS 5 AND 6. THE LANDING GEAR FILLER PIECE SHOWN AT TOP OF THIS PAGE SHOULD BE CEMENTED IN PLACE WITH TWO OR THREE SUCCESSIVE COATS OF CEMENT.



LANDING GEAR ASSEMBLY DETAIL

NOTE "V" SHAPED GROOVE FOR LEADING EDGE

1 5/8" BALSA WHEELS 1/8" THICK

FULL SIZE MAIN RIB

21 REQUIRED

TWO #2 REQUIRED

AFTER CUTTING OUT 23 MAIN RIBS, CUT TWO SHORT THIS AMOUNT TO OBTAIN TWO #2 RIBS

WING AND STABILIZER TIPS CUT TO SHAPE FROM 1/8 SOFT SHEET BALSA

#3 — 2 REQUIRED

#4 — 2 REQUIRED

#5 — 2 REQUIRED

#6 — 2 REQUIRED

ALL WING AND STABILIZER RIBS GIVEN FULL SIZE

CUT STABILIZER AND WING RIBS FROM 1/20 SHEET

.040" WIRE

SOLDER TWO WASHERS TO AXLE. ONE ON EACH SIDE OF WHEEL

#3 — 2 REQUIRED

#1 & #2

#1

#2

2 #2 RIBS REQUIRED

11 #1 RIBS REQUIRED

FULL SIZE STABILIZER AND WING TIPS

P.

FULL SIZE WING SPAR TIP

~WING DIHEDRAL DETAIL- $\frac{1}{8}$ FULL SIZE ~

AFTER THE LEADING EDGE AND SPAR HAVE BEEN CRACKED FOR DIHEDRAL, REINFORCE THOSE JOINTS WITH TWO OR THREE COATS OF CEMENT.

12 13 14 15 16 17 18 19 20

NOTE HOW TRAILING EDGE IS PROPPED UP WITH SCRAP $\frac{1}{20}$ SHEET BALSA.

R1 R2 R3 R4

$\frac{1}{8}$"X$\frac{1}{8}$"

$\frac{1}{8}$"X$\frac{3}{8}$" SPAR.

$\frac{1}{8}$" SQ.

40" SPAN WITHOUT DIHEDRAL

REAR PLUG IS KEPT IN PLACE WITH A FEW DROPS OF CEMENT

.040" WIRE HINGE IS SOLDERED TO TWO OUTSIDE METAL FITTINGS.

NOTE HOW REAR PLUG IS ROUNDED AT CENTER

DETAIL OF REAR PLUG ATTACHMENT. -SHOULD BE A SNUG FIT.

FULL SIZE STABILIZER SPAR TIP

FULL SIZE DRAWINGS ARE NOT NEEDED FOR WING CONSTRUCTION. MARK OFF $1\frac{1}{4}$" SPACING FOR RIBS ON SPAR, LEADING, AND TRAILING EDGES. SLIDE RIBS INTO PROPER SPACE ON SPAR AND CEMENT LIGHTLY. FRAMEWORK SHOULD NOW BE PINNED TO A FLAT SURFACE. LEADING AND TRAILING EDGES ARE CEMENTED IN PLACE NEXT. THE FRONT OF THE TRAILING EDGE SHOULD BE PROPPED UP WITH SMALL SCRAPS OF $\frac{1}{16}$ SHEET. CUT WING TIPS FROM SOFT $\frac{1}{8}$ SHEET AND CEMENT IN PLACE. STABILIZER MADE IN THE SAME MANNER AS THE WING.

$\frac{1}{8}$"X$\frac{1}{2}$" TRAILING EDGE

$\frac{1}{8}$"X$\frac{5}{16}$" TRAILING EDGE

$\frac{1}{8}$"X$\frac{1}{4}$" SPAR $\frac{1}{8}$" SQ. L.E.

HOOK IS COVERED WITH TAPE TO KEEP PROP SHAFT FROM CUTTING RUBBER

.028" BRASS BUSHINGS

SPINNER IS CARVED FROM HARD BALSA

$2\frac{1}{2}$" LENGTH OF .040" STEEL WIRE

MOLD FOR COUNTERWEIGHT IS MADE BY WRAPPING A PIECE OF PAPER AROUND A PENCIL AND CEMENTING THE SEAM. PLUG UP ONE END WITH A ROUNDED PIECE OF BALSA. POUR IN LEAD AFTER WIRE HAS BEEN INSERTED. MAKE C.W. LARGER THAN SHOWN TO ALLOW TRIMMING FOR FINAL BALANCE WHEN ENTIRE PROP ASSEMBLY HAS BEEN COMPLETED.

USE $\frac{1}{16}$" OR $\frac{3}{32}$" BALSA FOR THIS PORTION OF THE RUDDER

FULL SIZE WING AND STABILIZER TIP OUTLINES GIVEN ON OPPOSITE PAGE

FULL SIZE RUDDER LEADING EDGE

CUT R1, R2, R3, AND R4 FROM SOFT $\frac{1}{8}$" SHEET.

FULL SIZE RUDDER TAB AND BASE. USE BALSA THAT IS EASY TO WARP FOR ADJUSTMENTS.

Wing Slots for Gas Models

Higher climb and better glide result from novel experiment.

Conrad J. Morgan and the test ship. Wing loading was 20 oz./sq. ft., yet climb over 200 ft./min.

BY CONRAD J. MORGAN

FIXED slots are nothing new in aëronautics, but to my knowledge I am the first to apply them to gas models, and, I might add, the results are amazing.

My test ship is of conventional construction with a five-foot span and 575 square inches of wing area. The section used is the M6, with a wing loading of twenty ounces per square foot. The gross weight of the model is five pounds, and a Brown is used for power. The slots are made of $^1/_{32}$" sheet balsa secured to the leading edge of the wing at every other rib with a piece of $^1/_{16}$" balsa with both the front and rear edges cut to the exact curvature of the leading edge. The width of the slots is equal to one eighth of the chord and are placed one tenth of the chord ahead of the wing and so that the lower edge of the slots are even with the reference line of the airfoil. With this arrangement they follow the exact curvature of the wing and just ahead of it.

The performance, considering the model's weight, is excellent. It has climbed in tight circles to two thousand feet on a throttled motor at better than two hundred feet per minute. It always lands three point, upwind or down, can be made to land tail wheel first without stalling, and has never broken a prop in landing.

It might all be summed up something like this. Slots greatly increase the performance and stability, there is no doubt of that. I don't know how they would do on a contest model, but I believe they'd be worth a try. The increase in weight is nil. The range of C. G. locations is so great that large errors may be made without cracking up the model. The effect of warped wings isn't nearly so noticeable. Quicker take-offs and slower landings are a natural result, because of the increased lift coefficient. The CL maximum (maximum lift coefficient) for the basic airfoil is 1.4, while with slots it is 2.1 The maximum angle of attack for the basic airfoil is seventeen degrees, while with slots it is thirty degrees. So you get results you couldn't get with twice the wing area, and, of course, not nearly so much dihedral is needed. You also get fewer nose-overs and broken props because the model glides with the tail low. And slots do add a certain businesslike appearance to the ship. Well, to be frank, I won't fly without them.

N. A. C. A. Prop Tests

Wind-tunnel results of interest to gas modelers.

MODEL-AIRPLANE designers are aware that technical data compiled by wind-tunnel tests for large airplanes cannot be applied accurately to model designs. Wind-tunnel tests are generally made at speeds much too high for model purposes. However, the N. A. C. A. had reason to run a series of propeller tests which, because of the size of props used and the fairly low airspeed, afforded results of interest to gas-model builders.

The propeller shown in the drawing was developed by a series of tests to determine the ideal propeller shape. Ordinates given are in terms of the propeller diameter. This means that ordinates for propeller sections are not percentages of the chord of the section but rather of the propeller's diameter. For example, the diameter of the prop illustrated is seventeen inches, and the maximum thickness of the first section out from the hub is .01420, which, when multiplied (17 x .01420) gives .2414 inches.

Mr. Fred E. Weick, formerly of the N. A. C. A. and now with Engineering and Research Corporation, wrote that the gas-model propeller dimensions are in the same range as many of the model propeller tests made in wind tunnels, and therefore curves of efficiency, power and thrust coefficients would apply to gas-model propellers. However, on the basis of experience of model builders, he thought a slightly wider blade and a deeper section than the propeller shown might prove slightly more efficient.

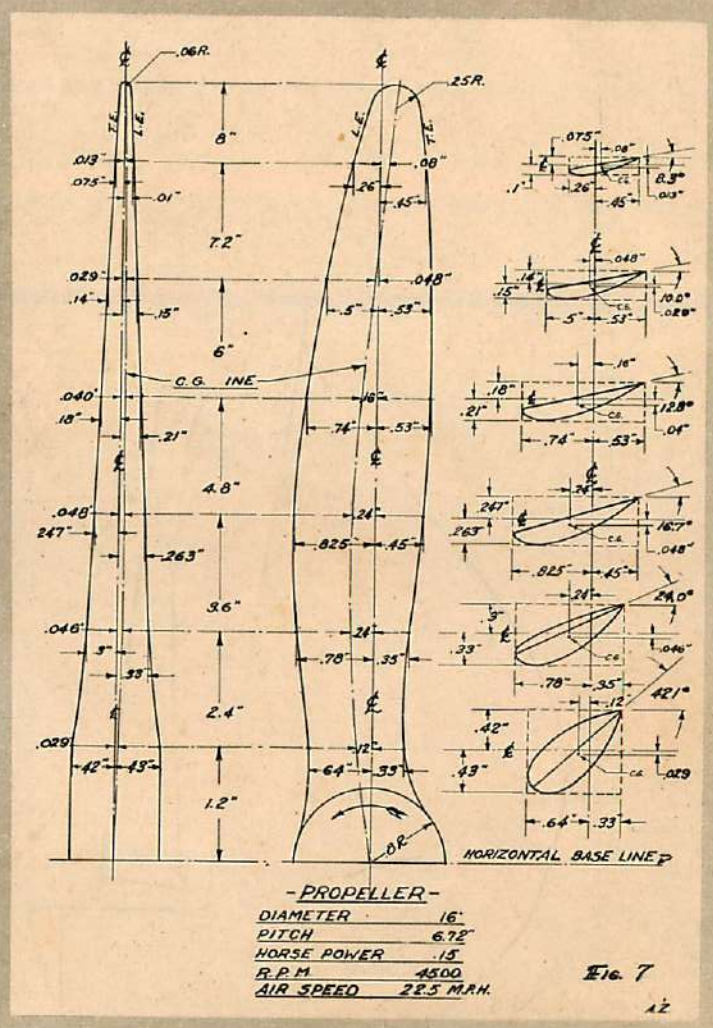
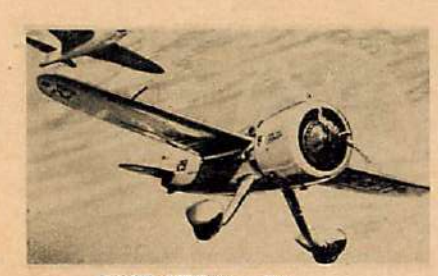


Fig. 7



PESCO SPECIAL — 25c

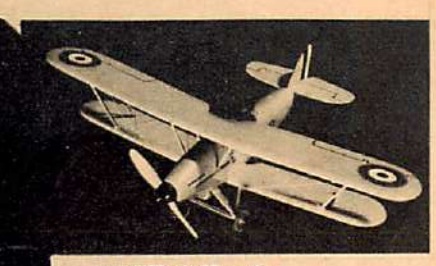
GEE BEE 1931 — 25c

HAWK AIRPLANES

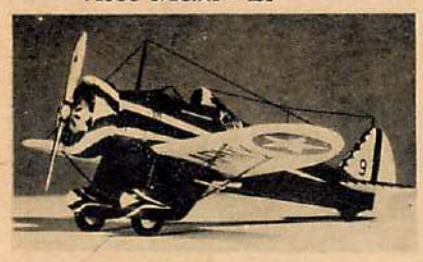
25c - 35c - 40c - 45c - 50c

★ SOLID WOOD KITS ★
★ 1/4" SCALE MODELS ★

★ ARMY PURSUIT
★ THOMPSON
★ TROPHY WINNERS
★ FOREIGN FIGHTERS



HAWKER HART — 45c



BOEING P-26A — 40c

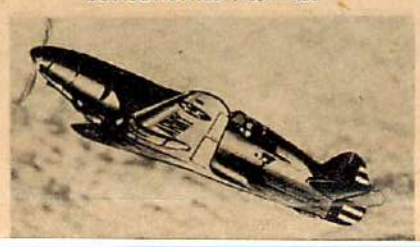
GEE BEE 1932 — 25c

BRISTOL BULLDOG — 40c

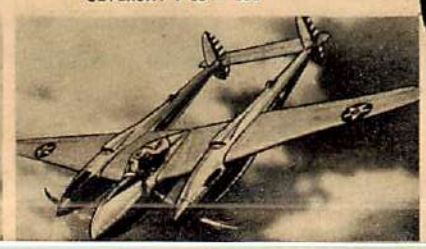
CONSOLIDATED P-30 — 40c

SEVERSKY P-35 — 35c

SUPERMARINE — 40c



CURTISS P-37 — 35c



LOCKHEED P-38 — 50c

HAWKER HURRICANE — 35c

LAIRD SOLUTION — 25c

MISTER MULLIGAN — 25c

VOUGHT 65 — 45c

MYSTERY SHIP — 25c

FOLKERTS SPECIAL — 25c

HAWKER FURY — 35c

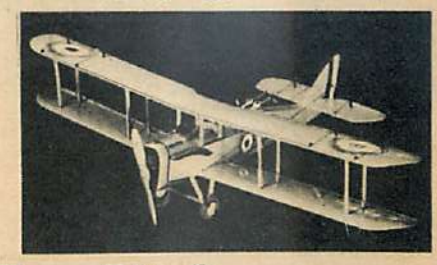
WEDELL WILLIAMS 44 — 25c

F.E.B.2 — 45c

BELL P-39 — 35c

B/J-OJ-2 — 45c

WEDELL WILLIAMS 57 — 25c



DE H-4 — 45c

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Elevator Cut To Shape	Rudder Cut To Shape
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The World's Antiaircraft Guns

(Continued from page 14)

ing plane's speed, a needle is set at the indicated range and by means of a slow-motion screw keeping a pair of crossed lines bearing upon the target. The action of the operator in moving it to keep its widely spaced crosshairs squarely on the target actuates, through the mechanism of the predictor, the gun-pointing equipment.

The director is easily one of the most extraordinary of all calculating machines. It has a mere 3,500 parts! Its main task is to "predict" continuously the plane's position so that the guns may be pointed ahead of its objective to give the shell time to get up and explode its shower of death and destruction. In digesting the data from the range finder and working out from it the instructions for the guns it is well-nigh infallible. Someone once remarked that the director does in a second a computation that would take a Harvard man two hours to do.

During the World War, France developed a crude mechanical fire director, but the directions had to be telephoned to the batteries with a resultant loss of valuable time. Until 1930 the only existing director was a type made by Vickers of England, for whom Maxim developed the mechanism. Some of the Vickers directors still are in use in the British, French and American armies. In 1930 the British turned the director over to the Sperry Gyroscope Co. for further development. Some experimental models were turned out in 1937 and a number disposed of to the British army. Shortly afterward, the war office suddenly began ordering large quantities of the machine, and Congress howled. It developed that Sperry had vastly improved upon the original director, and the story goes that this was due to secrets of the new German apparatus which United States army intelligence officers brought back from the Spanish Civil War. Anyway, the army boasted that the new director was the best in the world and export of the device with the secret improvements was promptly forbidden.

However, critics of the A. A. guns say that with all this apparent wizardry they still have to show their stuff on a substantial scale. But so have the bombers. The much-vaunted "waves" of Heinkels and Dorniers have as yet to materialize. I think that the A. A. guns made a better than creditable showing in Spain. Much improvement has been made meantime in both guns and equipment. Almost every day reports from the Western Front and from England give mute testimony of the potential deadliness of modern batteries. French and British A. A. gunfire is so terrific above the Maginot Line that Berlin has admitted more than once that this is the reason why Nazi reconnaissance planes have failed to penetrate far into France.

It can safely be said, nothwithstanding the early "pathetic" appraisal of Europe's A. A. batteries by returning American observers, that a warplane flying below 12,000 feet in fair weather will be bagged by the new guns within fifteen shots. Their deadliest range is between 12,000 and 15,000 feet, the best bombing levels. Driven to higher ceilings, the bomber finds his work becomes increasingly difficult; ground objects grow bewilderingly blurred and aims are more and more matters of guesswork. Even so, the bomber finds no peace, for A. A. guns, with somewhat less effectiveness, possess ranges up to 28,000 feet, some of the fixed-typed weapons up to 40,000 feet.

The predicting system of firing worked out to harry and destroy is part of the subtle art of the A. A. gun. The gunners are not foolish enough to think that they are going to make direct hits, though they often do by the law of averages. And it isn't necessary. A bomber at normal egg-sowing height is within range for only three and one half miles—less than sixty seconds—before it passes above the battery. By the time the shell gets up there the plane will have flown one and one half miles beyond. What the batteries attempt to do, therefore, is to fill the forefront of its course with an explosion of whining steel and convulsing air waves. This is accomplished by delicate fuses timed to explode at the exact altitude of the target.

The guns do their deadly work in groups of fours and eights. They do not converge upon a target, but work so that their effective fields of burst are contingent. The result is an overlapping of fire which fills the immediate area with a blast of fireworks. The exploding shells have the same effect as a depth bomb in the sea. A burst of flying shrapnel within fifty yards can deal out a horrible toll. Geoffrey Shakespeare, British parliamentary secretary of the admiralty, speaking in the House of Commons in March, 1939, said that the volume of fire created by an A. A. gun on a battleship was 200 times greater than the size of the chamber in which he stood. This gives some idea of what the German bombers run into in raiding the Grand Fleet and explains why so many of them fail to return to their bases.

Thanks largely to its record in the Spanish War, the A. A. gun commands prime respect in all the world's armies today. Countless numbers of them ring every important city and industrial center in England, France and Germany. England probably has the best equipment in Europe. Being on the defensive, this is only natural. About 100,000 men man her variety of A. A. guns. Germany's equipment is much overrated, somewhat clumsy. France's matériel is good but old. The United States boasts the finest equipment of all, but here, as elsewhere, wartime secrecy leaves details in the dark.

On January 26, 1939, Lord Privy Seal Sir Samuel Hoare told the House of Commons that Britain had the most modern and effective A. A. guns in the world. Friends of mine just back from London believe every word of this. London is destined to get 1,000 guns alone. Currently the 3.7-in. is still the tight little isle's foremost weapon. It fires twelve rounds a minute and can wreck a plane at 35,000 feet. One gunner is in charge, two men work the sights, two others set the fuses, two more bring up the shells to a loading tray and a final one rams it home with a wire-operated ramming device. The breech closes automatically and the actual firing is accomplished by a firing lever. The barrel recoils about three feet and is automatically returned to the loading position by means of compressed air stored in the recuperator. The dials of the sights for the line and elevation of the gun are automatically set by a range finder and director.

But the British ordnance office was not content with this rifle; it wanted something even more powerful. On November 1, 1938, a parliamentary query brought out the fact that experiments to this end had developed a 4.5-in. gun. This weapon is still much of a mystery, but it is said to outclass and outrange and outshoot anything hitherto existing. My own impression is that the gun most successfully used so far in the European War by Britain is the 88-mm. Bofors. This is the gun that made all Europe gape in wonder during the Spanish War. It is the product of the great Bofors ordnance factory in Stockholm, Sweden, which incidentally also manufactures a crackerjack 1.6-in. gun that fills in nicely between the machine gun (for *vol à rasé* punishment) and the big fellows. And it was the Germans who used it experimentally in the south and made it famous.

Until the 88-mm. arrived in Spain the antiquated French guns were making feeble thrusts against the sky, in the hands of the Loyalists, of course. Hooked up to the new German fire directors, the Swedish rifles picked off the Russian bombers magically, even at a vertical range of 30,000 feet! At 12,000 feet the gun completely dominated the air. The Spanish Insurgents said that seventy percent of the planes they brought down were with the Bofors weapon. It remained for the British war office, however, in a cunning Disraelilike coup, to outbid the Germans and buy up Bofors' entire production of the gun for three years. Naturally, the Germans had bought some of the patents and it is reported they are manufacturing the type in vast quantities.

Britain's own production of A. A. guns is at present enormous. Not only has every last vital spot in the United Kingdom been studded with batteries, but all the ships at sea are heavily armed. The efficiency of these guns, as well as their number, has saved the Grand Fleet time and again. Britain also has created a new antiaircraft cruiser, a new type of warship, and is building escort vessels with complete A. A. equipment for convoy duty. On these as on the big battleships the multiple pom-poms are heavily relied upon, for the bomber at sea must depend largely upon dives to achieve its deadliest accuracy. At present, Britain is seek-

ing to improve the accuracy of all A. A. guns by shooting at radio-controlled planes.

In Germany the A. A. defense was started, as in the case of the offense, years in advance of Britain's and France's programs. Air Marshal Goering unified the service and accomplished thereby something which still is nonexistent elsewhere. Germany's A. A. equipment is heavy and requires up to thirteen men in the crews, but there is a variety of effective small and large guns. In 1937 it was reported that the Rhine-Metall-Borzig was producing one-battery of 88-mms. a day; but like everything else in German rearmament all figures are at once too high and too fantastic, smacking of Goebbels' slippery arts and crafts. But it is known that the Germans have developed an effective double-barreled gun and in addition a light gun in between a machine gun and a 3-in. weapon for heavy-duty work. The former is a 20-mm. piece which fires shells of high explosive at the rate of 360 rounds (with tracers) a minute. Each projectile contains a supersensitive fuse that will explode on contact with a plane's fabric.

Perhaps the most backward of all nations in A. A. defense has been the United States, despite the fact that it possesses undoubtedly the best equipment in the world. It was only last year that any effort was made to build up regiments and production. In October, 1938, the army boasted only about fifty to sixty modern guns —hardly enough to defend New York. There were only about fifteen partly equipped regiments against 100 regiments of more for England and Germany. By last summer, however, it was hoped to have at least thirty-four full A. A. regiments and from 340 to 400 modern guns. Possibly by the end of 1940 the army will have 1,000 guns, which even then would be about a fifth of the nation's real needs. The flights of the commercial Clippers across the Atlantic and such recent 2,000-odd-mile hops of the army's Flying Fortresses have dramatically emphasized the threat to the nation's coastlines by a foreign foe, and America can be expected to marshal a formidable host of attack bombers and A. A. guns in the next five years.

Despite the frowns of some civilian critics, the army is standing pat on its new 3-in. A. A. gun, and recent tests at the Aberdeen Proving Grounds appear to justify this confidence. The 3-incher fires twenty-five 12.7-pound projectiles a minute at a muzzle velocity of 2,800 feet a second. Its vertical range is 29,100 feet, and horizontal, 42,000 feet. The shell has a fuse so timed that upon bursting it scatters clusters of fragments 125 yards ahead and fifty yards on either side. Highly mobile, the gun is toted on pneumatic tires behind a truck at a breath-taking speed for a weapon of its weight.

The army has other guns, too. Of the fixed type there is the powerful 105-mm. weapon for seacoast and Canal defense which fires fifteen 33-pound shells a minute 36,000 feet vertically and 57,000 feet horizontally. Best-known gun is perhaps the 37-mm. full automatic which fires 120 1½-pound projectiles of the explosive variety a minute in clips of five and ten, but it is said to be too heavy to fire automatically with any consistent effectiveness. For defense against dive attacks—particularly on A. A. batteries—the army's faith still rests in the .50-caliber machine gun, which fires 450 rounds a minute up to 12,000 feet. It must be remembered, however, that machine guns proved a poor defense against metal-clad bombers in the Spanish War. What the army needs most now, according to some of its admirers, is a small deadly piece of ordnance such as the Bofors 1.6-in. And army ordnance experts are understood to be working assiduously toward development of this type.

Probably in no field of ordnance are the experts so busy as in the A. A. gunnery. The bomber is admittedly the greatest threat in the military world today. The interceptor cannot block it for speed and other reasons. New A. A. improvements are therefore the order of the day. The most important of these is undoubtedly the photoelectric cell which was invented in 1939 by Mauritz Vos and is being made, incidentally, by Bofors in Stockholm. It seems destined to play a rôle comparable to that of the new German supposedly magnetic mine. The nose of the A. A. shell is fitted with a cartridge of magnesium or aluminum powder that burns with a bright light during the shell's trajectory. The light streams out through radial openings in the shell's casing. When a light beam hits a plane it is reflected back to the shell and focussed by lens on the photocells. The effect of this is to generate an electric current which operates a relay to close an electric circuit. Completion of the circuit sets off an electric spark which detonates the shell. The resulting concussion in the air does its deadly work. The ordinary clockwork fuse of a shell is eliminated and the explosion is assured at the instant, e. g., when it is within the effective destroying area of the target. As only the photoelectric cell is sensitive to reflected light rays, the explosive cannot be set off by sunlight or daylight.

What the A. A. guns will actually do in the present war when and if they are brought fully into play is conjectural, naturally. But the fact remains that to date no power has cared to test their effectiveness on a wholesale scale, which to my way of thinking speaks eloquently for their virtue. It is undeniable that wherever there has been a concentration of powerful A. A. guns the bombers have steered clear or high-tailed for home upon their sudden discovery.

There is no question that the A. A. gun's fear hazard is terrific. The bomber, no matter how big or small, cannot dodge while aiming. Furthermore, it must fly in a straight line for three quarters of a minute before releasing its eggs. Its vulnerability to the ground batteries is sickening to the invader far from home. It has to be plenty fast to keep out of the way of the spitting guns and that means a tendency to overreach the target. Then, finally, the A. A. gun releases fighter squadrons which formerly had to be kept close to key

bases and now can zoom out and engage the visitor.

Here's the way it looks to me: The bomber has reached its maximum point of efficiency. New types of bombs, such as the reported flying torpedo which is dropped thirty miles from its target, are bound to be invented. The new Sperry bomb sight, which permits such marksmanship as hitting a well with a bull's-eye at 20,000 feet may considerably alter the present picture of aërial warfare for a while. I am confident that counter devices eventually will be forthcoming in accordance with the principle set forth at the beginning of this article. So much for bombs and bombers. The A. A. gun, on the other hand, is only in its half-development stage. It will get more and more accurate, more and more deadly. It will force its quarry up into the stratosphere, where bombing will have to be done by secret guidance from the ground. I think that any way you look at it the bomber is in for it, and until this is shown otherwise, for my money the archie, 1940 style, is the best bet for active and passive aërial defense.

Free Air School

(Continued from page 27)

privileged youths and at the same time give them an education which will turn them out as aëronautical engineers capable of applying practical experience to theoretical knowledge obtained through experimentation."

How is this accomplished?

Each year the parish priests in Chicago nominate more than 750 youths, most of them from the slums, to take the competitive examinations for entrance to the school. From these applications some thirty-five youths are selected for admission to the freshman high-school class annually. By the time this group of thirty-five has completed one year of work and study, at least ten of them have been weeded out for various reasons—so that twenty-five are in the second-year class.

This figure remains about even during the remaining period of the high-school training. Thus there are always approximately 110 high-school students in the school; thirty-five in the freshman class and twenty-five each in the sophomore, junior and senior classes. Wilson hopes to keep this average figure for the college classes as well, selecting each year twelve or fourteen promising high-school seniors to continue on with the college work free of charge, along with the thirty paid students accepted for each class.

Wilson, a flier himself, maintains his home near the school and its doors are open to the students at any time for advice or help. His wife plays house mother to the entire student body, and many is the time, we were told, that a homesick youth goes to her for consolation. On winter nights, when the snow lies heavy over the Illinois countryside, the huge living room of the rambling Wilson home is always alight, and inside can be found anywhere from a handful to a double score of youths, laughing, playing games—and enjoying refreshments.

There is about the student body at the school something that is hard to describe. If you have ever walked on the plain above the Hudson at West Point, or watched the faces of the midshipmen at Annapolis when they break formation, you would have an inkling of the atmosphere that prevails at the Lewis Holy Name School of Aëronautics.

Our first visit to the school was late one afternoon of a summer day. There were no regular classes in session; only a handful of boys there for the summer. Mr. Wilson, whom we came to see, was in the southern part of the State, and as we left his office we stopped to gaze down at the Des Plaines River which flows at the foot of the sloping ground on which the school is located. A youth in his late teens approached from around the corner of a building. He asked if we had seen the school.

When we told him we were making our first visit he insisted on escorting us through the shops, classrooms, athletic fields, dormitories, recreation rooms, dining rooms and down the clean concrete sidewalks in front of the military-spick-and-span buildings. Intelligent, affable, polite, he made us live the atmosphere of the school during our tour.

It was only when we were ready to depart that we learned he had kept a tennis date waiting while he showed us around.

These lads are passionately proud of their school, consider its welfare a personal charge.

On a later visit we learned the story of our first guide. The son of poor parents, residing in the tenement district of Chicago's sprawling West Side, he had taken the entrance examinations to the school in 1932 on the advice and recommendation of his parish priest. He had passed these with high honors and continued on to Lockport, where he is now entering his junior year in the college. He has specialized in aëronautical instrument work and plans on continuing in that field when he graduates. Mr. Wilson praised him as a "model" student, of the type that may aid greatly the future development of aviation.

Not all the students continue on in aviation, however. Last year one of the prize high-school graduates was asked to continue on with his studies, gratis, in the college. He declined, saying that he did not feel his particular talents were best suited for that type of work, and much as he would welcome the opportunity of receiving a college education, he did not feel that he should take the place of some other deserving youth with a more direct ambition to succeed in the aviation world. Officials at the school tell me that youth went back to his home in Chicago, in the slum area; later succeeded in getting a messenger's job in a local bank, largely through recommendations and references supplied by the school, and is now well on his way, after an advancement to a minor clerical position, toward achieving a career in another business.

Aëronautical training, Wilson believes, can be roughly divided into two classes. First, that which is offered by existing universities of recognized standing, and second, the nationally advertised trade school. The universities produce excellent theoretical engineers, but men lacking the extensive mechanical, flight and business training necessary in any aëronautical organization. The trade schools offer practical training condensed into the shortest possible time.

It has been Wilson's aim, which he has achieved, to combine both types of education into one complete correlated unit which requires more time than either of the above types. The curriculum at the school is designed to produce a graduate bearing, when he leaves, an engineering degree, whose mechanical, business and flight training will permit him to obtain a position in any branch of the aëronautical industry. Those students graduating from the college course will receive a Bachelor of Science degree in aëronautical engineering. In addition, they will have a C. A. A. airplane engine and mechanic's license and a private pilot's license.

The school student body is managed on a semimilitary basis. The students are divided into three platoons, with the college students acting as officers. While there are no uniforms or arms, one hour of close-order drill is held each week. A merit system, based on the one used at West Point and modified to meet the school's needs, is employed in the regulation of discipline.

And while the school was founded and is run by the Catholic Church, there are no compulsory regulations for attending church. Father Kaerin O'Hara is the resident chaplain and instructor in ethics and religion at the school.

A routine day for the student personnel is as follows:

6:25 a. m.—Reville .
6:30 a. m.—Assembly Call
6:30-6:35—Inspection
6:35-7:00—Housework (making beds, etc.)
7:00—Church Call (not compulsory)
7:30-8:00—Breakfast
8:00-8:30—Free Period
8:30-11:50—Classes
11:55—Lunch Assembly
12:45-4:15—Classes
4:15-5:55—Free Time (recreation, housework)
5:55-6:30—Dinner
6:30-8:00—Free Period
8:00-9:00—Study Period

In general, a well-rounded education as well as technical training is offered the students. And while the practical side of the education granted at the school can be listed by subjects, it is hard to outline the good being done to rebuild the minds and bodies of slum-reared, underprivileged boys. That purpose is its highest and most noble ambition.

The Designer Is A Lady

(Continued from page 28)

to sell the idea of the necessity for such work. After having her designs accepted for two-passenger air liners, she decided that the real business lay with private owners, and has since confined most of her work to that line.

Her work, she explains, is to create an illusion. Strength must never be sacrificed to comfort. The most important feature is to induce quiet and restfulness while in the air. This is done by the arrangement of the fixtures, the coloring of the furnishings and the lighting effects. By the arrangement of the interior of the cabin and controlled lighting, the illusion of size is created. Color has a great deal to do with excitement. Cheerful but soothing colors lend themselves to alleviate tense nerves and the excitement of flying. If it's warm, cozy and comfortable inside the cabin the average passenger will not notice the clouds that may close in or the rough terrain over which he is flying. Soft individual lights induce people to read or sleep.

Her greatest difficulty is with the engineers; they subordinate comfort to the practical. Most aviation engineers preach safety and speed over and above comfort. Peg Kerwood is proving to them that they can have their safety, their strength and their speed and at the same time enhance their business by making passengers more comfortable. By better lighting and more color scientifically selected, she proves she can give the interior of the plane more eye appeal and more comfort. She works on the theory that if a passenger is comfortable he usually feels secure.

An increasing number of women are traveling by air, and women demand comfort. The railroads redesigned their trains to make them more eye-appealing. They air-conditioned their cars, installed bars, increased and improved service. By making their passengers more comfortable they almost doubled their business. That's what Kerwood is doing for aviation.

There are today many women fliers, others occupy executive positions with the aviation industry, and out in war-torn China, Charlie Day's wife has developed into an efficient engineer and helps her husband build airplanes for China. But Mrs. Kerwood is the only woman in the country actively engaged in designing the interiors of airplanes, and she's responsible for a lot of the comfort you'll appreciate on your next flight, be it on an air liner or a private airplane. Another important point of interest to the women of America is she has proven that the door of aviation is not closed to women.

Light Planes Don't Hibernate

(Continued from page 24)

Over the exhaust manifold, a metal shroud draws in the cold air and heats it for carburetor intake and cabin heater. These are removed and the manifold is examined for thin spots or holes burned by corrosive gases. Carbon monoxide drawn into the cabin is odorless, certain death.

Ignition wires, timer, and magneto are all examined, and Joe pulls the propeller through to see if compression is equal on every valve.

Brackets are fastened to the struts for easy tying down on fields without hangars, and Joe puts about twenty feet of three-eighths-inch manila rope in the baggage compartment for that purpose. Stakes are pieces of fuselage tubing, stiffened with a liner. About two feet long, these need less room than wooden stakes, and are handy traveling cross-country. Two small brackets under the instrument panel carry them safely, but they cause a little compass deviation, so he makes some adjustment and notes the headings in order to be sure of his course even when visibility is poor on hazy days or in sudden rain.

Two large soft cloths are folded in the map pocket—first aid in clearing frost or snow off the wings before early-morning take-offs. A film so thin as to be barely visible will change airflow enough to cause a stall, possibly a crash on take-off. A small can of mixed glycerine and alcohol, properly labeled, will come in handy to wipe the windshield to delay icing—and icing occurs well above thirty-two degrees since the speed of the ship contributes to extra cooling of the air that strikes its cold surface. Another small can of gas and ether goes in too. A teaspoonful of this, not more, dropped into a cylinder through a spark-plug hole on an icy morning at Aunt Jane's farm, where no heat is available, will start the motor quickly. Then cautious Joe adds matches to his first-aid kit equipment. He doesn't expect forced landings, but he intends to have a fire at least. Last, he checks the fire extinguisher.

Summer oil is drained out, and the tank is filled with very light oil (S. A. E. 10 or 15) and the motor run at idling, until the light oil has flushed all the parts. Then he drains that, too, and refills with winter oil as specified for his engine.

If a ship has been in a warm hangar, it is well, before starting the motor for a flight, to drain a little gas from the gasculator, the lowest point of the line, and from the sump, to be sure that no condensed moisture is collected there to freeze and choke off gasoline in the air. Some extra protection is afforded by filling the tank immediately on landing. Air pressure is less as you climb, and its capacity to hold moisture in suspension is greater. On landing and bringing the ship into the hangar, this moisture drawn into the gas tank will condense. If the tank is immediately filled, however, the water vapor is driven out with the air.

Carburetor icing is now a minor problem in the transport field, thanks to special heating devices. For light

planes, the shroud over the exhaust manifold draws the air over hot metal, heating it before it reaches the intake. A butterfly shutter makes it possible to feed cold air if dropping r.p.m. show that the air is too warm for effective mixture. Starting out on cold days with shutter closed is a good idea, and if the motor seems sluggish the shutter may be partially or completely opened in the air.

A few pilots use a fine screen over the air intake to prevent flames from backfires in case of overpriming, but then less air enters the intake and the result is an overrich mixture, sluggish pick-ups, increased gas consumption, and a tendency to carburetor icing.

Joe, like most pilots, gets his fire protection by tailing the ship into the wind before starting. If he overprimes and causes backfire, the wind will blow the flame away from the fuselage. With a big motor, he would need the cooling wind on its nose, but with the small one he needs merely to remember not to idle it too long.

He lets oil pressure build up with the motor idling slowly. R.p.m. slowly creep up even though he has hardly more than cracked the throttle. In ten minutes or so, the gauge registers the temperature specified in the manual for his engine. Taken off too cold, at best parts will be strained by friction, gummed instead of aided by cold, viscid oil. At worst, Joe will have an excellent chance to test his skill and his plane's performance while he maneuvers to a dead-stick landing among the obstructions at the end of the field.

It is the cow-pasture pilot who has the real problems in starting. Unprimed, his motor won't start. Overprimed until gas drips from the carburetor air intake, it won't start. If that—overpriming—occurs, the cylinders may be dried by turning the propeller backward. This drives the gasoline vapor out, and draws air in through the exhaust. When the mixture is equalized, the motor will start when the propeller is turned normally. If the vapor has condensed on the cold spark plug points, however, they will be insulated and cannot throw a spark. Turning the propeller backward will help little then, and the air is too cold to evaporate quickly.

Out with the trusty spark-plug wrench. Out with the plugs. A lighted match held to their points—*puff!*—and they are dry. A match flame held at the spark-plug hole in the cylinder will burn the fumes there too. Then, plugs replaced, the motor starts.

Sometimes plugs are removed, laid in the lid of a can or on a hub cap, drowned in gasoline which is lighted. With the points heated that way, the motor snaps to life, but this method may crack the porcelain on the plugs. Heating in an oven is better if possible, or a teaspoonful of gas and ether dropped into the cylinder will do the job.

Whatever the method, quick oil circulation is necessary. If the pump cannot lift the low or cold oil and pressure stays at zero, the pilot thanks his stars that he isn't flying a Douglas, lifts the tail off the ground, and lets the oil slosh up within reach of the pump.

Take-off in winter is better than in warm weather, since the air is dense and provides better lift. Of course, full power is needed, and either mixture or temperature can prevent full delivery. Setting the mixture at full lean, there will be high-pitched backfires through the carburetor. Moving the control to rich, the engine will gradually step up to maximum performance, gradually become sluggish with slow acceleration, then backfire through the exhaust, throwing black smoke. Then, backing up to maximum, power will be easy.

Cylinder temperature is checked by the same trial method by the light-plane pilot who has only the oil temperature gauge which, after all, does serve as a warning of extremes. In winter, if r.p.m. drop, too-low temperature is a probable reason. The new closed cowlings provide a more even temperature, but Joe Doakes could buy a new plane almost as cheaply as he could get the necessary welding and fitting to put them on an older ship. On the tandem, too, a closed cowling would make the nose too broad. On such ships—which many think have some advantages outweighing closed cowlings!—and on old models, some pilots tie a screen around intake manifolds, around the cylinders, or both, but such a device should be O. K.'d by the nearest C.A.A. inspector. Continental provides approved baffles that fit underneath the cylinder to shut off part of the cowl opening and thus warm the intake manifold.

On the whole, light-plane performance in winter is dependable and easily maintained. The plane is small and light enough to be shifted around, the engine within easy reach without stepladders, mechanical tinkering simple. The complex instruments of heavy ships are lacking. In every sense, the plane is so much easier to maintain in good winter condition that the temptation is great to be a bit careless.

One disadvantage of the light plane should loom mountain-high in winter: its restricted cruising range. In summer distances are what they seem on the map. In winter, they may be suddenly doubled by the necessity of going around a storm, or by straying off the course in hazy weather. In summer it may be no great bother if one does need to sit down in a field somewhere to hunt gas at the nearest service station. In winter not only is it a cold and disagreeable walk, but wind and storm may make handling the plane alone a problem. More than one pilot has hung desperately on a strut and prayed while a raging wind has lifted him off his feet in sudden gusts and swayed the plane wildly as he wonders if he dares turn that strut loose long enough to drive stakes, tie back the stick, tail the ship into the wind, and take other safety precautions.

Compasses should be checked rigidly. If they are not compensated and no rose is available at your own field, the ship should be taken to another field where the compass can be swung, as soon as possible. In the meantime, a pocket compass placed on the ground in line with the center of the fuselage will give you the correct readings so you may make out an error or deviation chart by which you can steer in spite of your compass' incorrect readings. A little blind-flight training—or rather a lot—is a good idea, if it doesn't make the pilot overconfident. Portable radios are available for less than forty dollars which, in connection with a ten-dollar aërial, will give weather reports and the beam as further flight protection.

Light planes can be flown, of course, in weather impossible for big, heavy ships, and flown contact. While of doubtful legality, a light plane can be brought lower and lower (don't forget the power lines though!) and because of short turning radius and slow speed, problems do not hit you in the face demanding instant—and correct—solution, as they may with a ship traveling twice as fast. But at best that advantage should not be strained. It is merely the ace in the hole when weather suddenly closes down after you have taken off.

Don't forget that low-hanging clouds often are filled with icy crystals, a death burden if they fasten on speeding wings. Remember too that in sub-freezing weather, or even slightly above freezing, moisture in the air when visible as vapor will make a film of ice over control surfaces that hit them at the speed of your plane. Snow, or rain (if the temperature is *well* above freezing), need cause little alarm, but sleet will create an icing condition worthy of a movie with the hero flying on into a raging storm because, my frans, the mail *must* go through.

Light-plane carburetors will not ice any easier than those on big engines, but the air intake is in the form of a venturi and is smaller than that on the big ships. One-sixteenth of an inch of ice closes up more of the effective space for air intake than the same one-sixteenth inch would in a big carburetor, and therefore is more dangerous. If there is a mixture control in your cabin, you can change it to full lean so that the engine will backfire through the carburetor. That will sometimes blow out the ice. If you haven't? Brother, that's when I hunt a field to land!

Landings should be made carefully in winter, with the motor cleared frequently or even with motor at quarter speed to prevent the quick cooling and consequent warping of valves in the icy air. Sideslips should be kept at a minimum for the same reason. After the plane is on the ground, the motor should be idled briefly to give it a chance to cool from operating temperature before cutting the switch. Cutting off the gas and letting the lines run dry is double protection since it gives the motor this time to cool, and at the same time pulls gasoline out of the lines where any settling moisture might freeze, causing trouble later.

With due care, light planes make pretty good snowbirds. The hundreds of light-plane pilots who fly through the dead of winter on the annual light-plane cavalcades to Miami can vouch for that. But would you enjoy a winter without overcoat and galoshes? Don't forget the woollies for your planes, either. They, too, need them.

Alec the Ace

(Continued from page 15)

bonus to Harry for eliminating the hazard from the lines' Andes course. But Harry felt as though he had taken advantage of the old bird—hadn't played fair. It made him miserable. And the Andes had lost all attraction without the daily battle of wits.

In his preoccupation, Harry heard Johnny feed the power to the Douglas and watched for him to appear on the long runway in front of the hangars. The big silver ship shot past the wide maw of the doors and lifted into a climbing turn. Harry settled back in the cockpit of the Falcon and dozed in the warm Chilean air. He was roused by the sudden lack of activity in the hangar. Rubbing his eyes, he looked over the edge of the pit. Not a mechanic in sight. He looked at his watch—too early for lunch. Then he discovered that everyone was ganged in the radio room.

He was out of the pit in a flash and on his way to the radio-room door. Something must be happening to Johnny! But he was reassured as he elbowed his way through the men. They were all grinning widely, and they wouldn't laugh at trouble in the mountains with a load of passengers and mail. The radio operator, a blue-eyed kid from Boston, smiled up at Harry.

"Your old pal Alec is back again! Every time Johnny starts down the pass, Alec appears and chases him out again. Swazey is tearing his hair in the downtown office. Raves about having to get rid of Alec, or find a new pass through the mountains. A Douglas is too big to dodge a condor!"

Harry felt a thrill at this news. Old Alec was still good enough to fly! He couldn't have hurt him very much. He knew that something would have to be done, because there was no pass other than Uspallata suitable for flying—and furthermore it would be foolish to abandon El Cristo radio observatory and construct another.

"What's Johnny going to do?" Harry asked.

"Swazey's ordered Johnny to return. Going to send a Falcon over with the mail, I guess."

The door banged open behind Harry and the operations manager stormed in. "Warm the Falcon up and gas her! Load Richards' mail into the mail compartment!"

He turned to Harry. "Okay, Oliver, put a shotgun in your pit. You're taking the mail over. You've already collected a bonus for eliminating Alec. Now, after you get the mail through, get him *right* this time!"

Harry's heart sank. Was he still to be the one responsible for old Alec's death? "There's nothing in my contract that says I have to kill birds," he protested.

"I thought that over coming out," Swazey retorted. "Clause seven says that you will conscientiously strive to eliminate all hazards to the safe operation of this air line. Well, that damned vulture *is* a hazard! And you're ordered to eliminate it!"

"Okay!" Harry turned on his heel and headed for the locker room. He hauled out the long unused teddy-bear flying suit and fur-lined helmet. Taxiing out onto the runway, he felt low. He felt as though it was a long-lost friend he'd been ordered to execute, shortly after finding him again.

Still, it was good to have the powerful Cyclone roaring in front of him once more, to feel the propwash slap his face, instead of looking through a glass window at the round nose of the Douglases. The Falcon climbed to clear the foothills, San Felipe passing under the roaring plane. Harry swung the nose head-on for Cerro Negro, sticking its ugly black head above the foothills. Cerro Negro was past and Salto del Soldado was ahead.

The wide expanse of Laguna del Inca lay faintly visible in the distance. Harry held the stick between his knees and loaded the shotgun with a heavy heart. Old Alec wouldn't appreciate a load of buckshot from this ten-gauge blunderbus, but orders were orders. Harry needed this job. And he'd have to be careful: he recalled only too well one of the planes that had smacked a condor in the air. The flying wires were snapped on one wing, the windshield was smashed and the cabin a mass of feathers and butchered red meat.

Harry settled the shotgun down beside him and focused his attention on his flying. Pilots didn't cross El Cristo Ridge without being alert for the ever-present downdraft that would catch them just as they went over. The radio operator at the ridge station was out in front of his station waving him on. Probably knew all about Harry's mission by radio.

Harry eased back the throttle when the downdraft clutched the Falcon, and pulled to the right to enter Uspallata Pass. A train on the Trans-Andean railway tracks puffed out of the tunnel under the ridge six thousand feet below and started its tortuous, winding trip along the banks of the Rio Blanco. Juncal passed under the wing tips while Harry kept his eyes peeled for a sign of Alec. He wondered if the wreckage of the Falcon would today ride that same train into Mendoza. Puenta del Inca came and went with still no sign of the bird.

Harry worried for fear the old devil had disappeared again, then suddenly found himself hoping that he wouldn't meet up with Alec at all. Then he wouldn't have to kill him. He felt guilty immediately, for that would leave every pilot who flew these mountains worrying himself gray wondering whether he would meet the bird while steering a ship full of passengers.

Vacas and Cerro del Plomo were dead ahead and he would soon swing left to clear the pass to Uspallata Valley. Alec must be gone again, for

he had never been known to appear outside of this short section of the pass. Harry grunted disgustedly as he swung into the wide expanse of Uspallata Valley. Alec was gone again and every pilot on the run would be on edge until he either turned up or was eliminated permanently.

Harry slid the Falcon down the side of Uspallata Ridge and into Mendoza. The mail was loaded into a reserve Douglas and started on its way to Buenos Aires. Harry took off again without cutting his motor. He was still disgruntled when he rounded the curve in the pass at Vacas and beelined for Cristo. He wanted to get home and have this trip over. Then he saw Alec!

From a distance he looked very much like another plane, but instinctively Harry knew it was Alec. That skull colored gray was unmistakable. It was Alec, winging his way along the pass to his old nest somewhere in the heights of Mount Aconcagua. Resignedly, Harry settled himself more firmly in the cockpit and freed his shotgun. The Falcon overhauled the lazily flapping wings of the lone condor. Harry wasn't more than a hundred yards to the rear of the giant bird when Alec's head swiveled on a long neck of bristling feathers. Harry's heart beat in violent tempo. This was the first time he had ever gotten a good look at the old fellow.

He was such an inspiring-looking bird that Harry gasped in admiration. As long as he lived he would never forget that baleful glare in the fierce eyes turned toward him. He would forever swear that there was a sudden look of friendly recognition when the condor saw the old Falcon. The condor stopped flapping its wings and soared, continuing to look at the approaching plane. Harry felt as though the eyes were boring through him. He was amazed at the spread of those gigantic wings, the body almost the size of a small mountain goat. Saggy jowls depended from beneath the fiercely glaring eyes.

Harry sighed and slipped off the safety catch of the shotgun and sighted it over the edge of the pit. An abrupt sideslip and he would have a clear shot.

Alec batted his eyes at Harry and swung abruptly at the oncoming ship. The pilot turned loose of the shotgun frantically and put the Falcon into a steep dive. The gun slipped over the side and turned lazily beside the diving ship on its journey to the river below. But Harry wasn't worrying about that gun. He had almost let Alec plow head-on into his Falcon. He pulled out of the dive so sharply that the wings of the ship creaked alarmingly.

Looking up he spotted Alec circling lazily above. Harry grinned. The old days were here again. He knew that Alec was waiting for him to level off; then he would dive. Alec folded his wings and came plummeting down on the Falcon. But he made his same old mistake. He dove straight at the Falcon and didn't allow for forward speed of the airplane.

Harry held his course and cracked the throttle wide-open. Alec went by the tail of the plane with terrific speed. Harry shuddered at the thought that Alec might not have missed. He had come closer this time than ever before. Harry watched expectantly for the slipstream to catch the bird and roll him over and over. But Alec too had learned by experience. He opened his wings partly, and the slipstream lifted him above the plane again. He climbed higher and higher and folded his wings for another dive. This time, however, much to Harry's dismay, Alec was allowing for the forward speed. A crash seemed almost certain.

Harry frantically yanked the Falcon into an Immelmann and blasted the motor wide. It seemed that the condor was going to win—then he was clear and the slipstream *did* roll the old giant over and over in the air.

Harry pulled up and dived again before Alec could completely recover and forced him closer to the ridge by El Cristo. He repeatedly dove and blasted the confused bird with the slipstream until Alec was just a tangled mass of feathers. Harry was conscious of the radio operator on the ridge brandishing a shotgun, ready for the moment when Harry would drive the bird within range. It was then that Harry weakened. He couldn't do it, even if it did mean his job!

He yanked the Falcon away from the pass and started across the ridge. The radio operator was looking up disgustedly, shotgun on the ground and hands on his hips. In five minutes the operator would have forwarded the information to Santiago that Harry had deliberately let the bird escape.

Harry landed and taxied up to the waiting crew at the hangar in Santiago. He cut his motor and climbed down resignedly. Swazey glared at him and started to say something. A look of terror crept into Swazey's eyes as he stared over Harry's head, then he turned and dashed into the hangar. Harry stared at him in amazement, then looked over his shoulder. Alec was coming down on the field, one of his wings flapping crazily!

Harry started to run, but was frozen to the cement apron in dazed attention. Alec landed running and folded the injured wing tenderly. Majestically he stalked around the Falcon resting on the line. Tentatively he pecked at the hot motor, and leaped back squawking.

Next Alec spotted Harry standing nearby, and strutted toward the pilot. Harry was rooted to the spot, although he was terror-stricken. He couldn't for the life of him run or even yell. Alec walked around him once, and after a moment's inspection he squatted on the ground and preened his injured wing, uttering little squeaks of pain when his beak found the bloody, injured part. Harry moved to the Falcon and dazedly removed the first-aid kit. Not knowing how he ever got the nerve to do so, he dressed Alec's wing while the giant bird just looked at him with those steady eyes. Harry

clipped the wings with the small scissors from the kit and realized that Alec would never fly again.

When he had finished, Harry stood up and walked toward the hangar. Alec clumped along behind him. Harry went into the front door of the office, Alec following. The office personnel went out the side windows. Harry filled out his flight report and turned into the locker room. Alec seemed quite content just to follow along.

Harry sat down on a bench in the hangar and gazed at Alec in dismay. "Am I going to be followed everywhere I go by you?" he demanded. The condor just clucked in apparent content and settled down on the hangar floor. Gradually the mechanics and other personnel gathered around the strange pair.

"I guess we'll have to keep him as a mascot," Swazey said. "That's one way of keeping the old buzzard out of the pass!"

Harry grinned and lit his pipe, continuing to talk to his new pal, Alec.

Gliding And Soaring

(Continued from page 26)

something like five cents, and one has to gather quite a number of them before they start spelling dollars with a capital D. This means that distance and altitude flights have to be accomplished before the expedition to the meet starts getting itself out of the red. Two weeks of the contest costs a club, just to fly the ship and retrieve it from cross-country flights, around a hundred dollars. Now if the club is so fortunate as to own a high-performance sailplane and have a really good pilot who makes flights of over 150 miles and does it fairly consistently, the price will go up well above that. It cost one of our foremost pilots in the neighborhood of $250 to participate in the last year's meet, and although he placed among the first four, his share of the prize money was less than seventy dollars, while the first and second prize winners were awarded $1,650 and $1,150 in lump sums for altitude, distance and goal flights, not counting the point-award prize money. There is no doubt that the boys deserved the reward they got, for their achievements were great indeed, but some of that money ought to be diverged into the point-award system.

The task of the Soaring Society is to promote gliding and soaring in this country. This can be done through direct contact only. The S. S. A. has about one thousand active members and publishes an excellent magazine, *Soaring*. But a thousand members and a good magazine with a small circulation are not enough. The society has not been self-supporting since its inception. It has been depending upon the financial support of a few of its generous friends and the work of its directors. But any organization has to be self-supporting if it wants to stand on its own feet. A proper solution would be for the S. S. A. to undertake a barnstorming trip across the United States with its two-place sailplane and its manager, lecturing, showing motion pictures of motorless flight and giving flights in the sailplane to those who have joined the society. However, the present financial condition would not permit the promulgation of such a plan; therefore it rests entirely upon the members of the Soaring Society to obtain enough members so that the society could become self-supporting.

We feel that anybody interested in gliding should belong to it. In its turn, this organization should establish a research institute where technical information as to the construction of gliders and sailplanes could be obtained by those who seriously intend to build them, establish or help establish schools for pilots and instructors, take over the awarding of the F. A. I. gliding and soaring certificates, furnish information as to the formation of clubs and what equipment to use, and sponsor all regional and National Contests.

THE SCHWEIZER SGS-2-8

The SGS-2-8 is the first high-performance sailplane built in this country. It was designed and constructed by Schweizer Metal Aircraft Co. of Peekskill, N. Y. The interesting feature of this sailplane is that it is constructed entirely of metal, although the fuselage, tail surfaces and rear portion of the wing are fabric-covered.

The sailplane is of the shoulder-wing type. The wings are braced by a single strut. Tail surfaces are cantilever, both rudder and elevator having stabilizing areas. The cabin is inclosed by a pyralin hood, the seats are in tandem, controls are dual.

The wing construction is of the single metal-spar type, with a torsion-resisting leading edge covered with Alclad. A diagonal torsion brace runs to the rear fitting, taking the drag and torsion loads. All ribs are metal. The fuselage is of welded steel tubing. The rear portion is of the three-longeron type, with a heavy single longeron on the bottom. The landing gear consists of a six-ply 5 x 4 air wheel equipped with a brake, with a front skid and a rubber tail skid.

The tail surfaces are damped to allow flying hands off; they are fabricated from formed metal parts and are fabric covered. They are placed high on the fuselage in order to be away from the interference of wing downwash.

Controls are of the standard stick and rudder pedal type. Spoilers are placed on the top surface of the wings and can be operated from both front and rear cockpits. The tow-rope release is so constructed that it automatically releases whenever any pull to the rear is encountered.

Data is as follows:

Span	52 ft.
Wing area	214 sq. ft.
Aspect ratio	12.65
Dihedral	3 degrees
Airfoil	N. A. C. A. 4412
Weight empty	450 lbs.
Wing loading (2-pl.)	3.7 lbs./sq. ft.
Wing loading (1-pl.)	2.9 lbs./sq. ft.
Min. sinking speed (2-pl.)	2.5 ft./sec.
Min. sinking speed (1-pl.)	2.2 ft./sec.
Gliding ratio	23.5
Tow speed	70 m. p. h.

If the Canal Is Attacked

(Continued from page 17)

troops, pursuit aviation, and local naval forces to repel an attack on the Canal Zone. Modern bombing planes developed within the past five years have changed all this.

We used to think a force of good pursuit planes formed the bulwark of the Canal's aërial defense. Fast fighting ships which could run rings around the slow bombers and shoot them down. In those days, bombing squadrons carried along outriding groups of pursuit ships to protect the big craft from attack. Then came the development of the new aërial dreadnaughts, particularly in the United States, with larger and faster long-range airplanes being turned out each year. Such progress in big ships changed the whole picture of bombers versus pursuits. Bomber speeds advanced with amazing rapidity, and the pursuiters' margin of superiority shrank. To be effective, the latter should be at least one hundred miles an hour faster than the bombing planes, and today they have no such superiority.

Under the air corps expansion program, the United States is building interceptor planes of much improved performance. The answer, however, does not lie here. Military airmen have developed a new strategy to defend the Canal. Modern bombers, despite their maximum 3,000-mile range today, must operate from bases not more than 1,200 miles away. They must reach their target and return and have gas enough to maneuver in the area they are attacking. Draw a circle with a radius of 1,200 miles around the Canal Zone, and if enemy air bases can be kept out of this area, the "life line" should be safe from successful attack.

No such bases of any possible enemy now exist within this area, but floating bases—aircraft carriers—can come into it at speeds of thirty knots and land bases can be set up with naval support in a few days. From an aircraft point of view, therefore, Canal defense means the maintenance of a sufficient force of bombers to break up an attempt to establish a base within range of Panama, and with submarine support, to make it highly dangerous for aircraft carriers to come into the Canal area.

Do we therefore have our "flying fortresses" based at France and Albrook Fields in the Canal Zone? No, the air corps' best bombers, superior to any in the world, are kept at Langley Field, Va. Only the two-engined B-10s and B-18s, older and much less potent craft, are in Panama. The B-17s, however, can reach the Caribbean within a few hours in case of need. In fact, the only reason for having any bombers at all in the Canal Zone is the lack of any other bases inside the 1,200-mile circle. How much better to have them hundreds of miles away, to keep a possible enemy that much farther off. A sudden attack without warning might destroy bombers, air base and Canal. Outlying air bases would require an enemy to strike at them first, before moving against Panama.

Point number one of the new Canal defense scheme is, therefore, outlying aircraft bases.

Under funds voted by the last Congress, the principal American-owned island in the Caribbean is being made into a major stronghold. Two large air bases are being constructed, one for the army near San Juan, Puerto Rico, to cost $8,600,000, and the other on Isla Grande in San Juan harbor, to cost about $8,300,000. Harbor defenses and antiaircraft units have recently been ordered there, and a regular overseas military department comparable to that of Hawaii, Panama, and the Philippines has been organized. A submarine base is to be installed, and naval air and ship facilities at Guantanamo Bay, Cuba, and in the Virgin Islands are to be strengthened.

Supplementing the new Atlantic defense "spearhead" at Puerto Rico will be a major army air base at Tampa, Florida, and a large naval air center at Jacksonville. At Mobile will be an air depot, to supply Panama, Puerto Rico, Tampa and the bases in Texas. These mutually supporting bases, together with government and commercial air fields at Miami, all along the Gulf and on the Rio Grande River, will blanket the Caribbean, Mexico and Central America. Puerto Rico and Panama will control northern South America.

In the Pacific, the United States owns no islands closer than the South Seas, and therefore cannot put a counterpart to Puerto Rico in the west. There are a few possible land bases in this area within striking distance of the Canal Zone, and Uncle Sam would like to own them. The Galapagos, a possession of Ecuador, would make an excellent advance post, and rumors of negotiations looking toward American purchase of the group are heard from time to time. Clipperton Island, owned by France, and the Costa Rican Cocos Islands, also command the Pacific approaches to the Canal, but they are too small for a base of any real consequence.

The wide Pacific, however, presents a situation different from that in the Atlantic. An impregnable base in Hawaii and advance-patrol-plane bases in the South Seas can act as an effective barrier to an attack on the Canal launched from Asia. Lying in the direct path of such an endeavor, a chain of mid-Pacific bases would force aircraft carriers far to the south, a roundabout maneuver beyond their fuel capacity. The navy is now constructing such a chain of advance air bases, the farthest south being Palmyra Island, and is planning other such fields on Canton Island and Rose Island, the latter in the Samoas.

Besides these known bases, there are reports of other projects in Central America. Newspapers in Bogota, Colombia, last July 16th stated that the United States was building air bases at Virao, and on the islands of San Andres and S. Luis de Providencia, all in Colombia. According to the articles, they would remain in the possession of the Latin American State in peacetime, and in war be occupied by the United States. Such reports are impossible to verify.

Moreover, the Canal Zone defenses proper are being strengthened and reorganized, for, as important as will be the advance defenses, an enemy may be able to sweep these aside and strike for the "life line" itself. "We can afford to take no risk whatsoever involving the security of the Panama Canal—the keypoint of our whole protective system," Secretary Woodring declares. "Therefore, more aircraft installations and air squadrons must be located in the Canal Zone. The completion of our antiaircraft artillery and coast-defense installations in the Canal Zone must be assured."

Thirty-one of the army's latest pursuit planes—P-36s—were recently flown to Panama. More will follow. One aircraft wing is stationed in the Zone—the 19th. It is made up of a two-squadron group of bombing planes, two squadrons of pursuit, and two squadrons of reconnaissance aircraft, plus miscellaneous craft. The exact number of planes is a military secret.

At Coco Solo, in the Canal Zone, the navy has air and submarine bases. The former is primarily designed for long-range patrol planes which would play an important part in finding and destroying enemy aircraft carriers in time of war. Navy department approved plans call for expanding the Coco Solo base to a seven-squadron base, capable of handling ten squadrons of the big patrol bombers in time of war. Also in view is an additional submarine base on the Pacific side of the Canal.

Air defense, while important, is only one phase of the ringed barrier that is Panama. Mighty coastal guns, many of them firing sixteen-inch shells twenty miles to sea, are intended to keep an enemy fleet beyond the horizon. And rapid-firing antiaircraft guns scattered over the area can send three-inch explosive projectiles five miles high and half as far across, each shell burst dangerous for a radius of fifty yards.

Part of the equipment of these batteries are large sound detectors which pick up the engine and propeller noise of approaching planes, make automatic adjustments for wind currents and the travel time of sound, and thus give their approximate location. Large searchlights which shoot bright beams miles into the sky and are synchronized with the sound detectors make it possible to use the guns at night as well.

Now installed, or soon to go into service, are twenty-nine batteries of these guns, supported by 160 antiaircraft machine guns and 107 of the searchlights. There are thirty-nine of the seacoast defense batteries and two submarine-mine units. Fully to man this artillery defense, 180 officers and 6,400 enlisted men are being moved to the Canal. The cost of these additional troops—pay, housing, et cetera—totals $27,000,000 alone.

Good as these guns are—and a General Staff officer recently testified

that they were the best in the world—the army high command does not put its sole reliance in their effectiveness any more than it does on defensive aircraft. Brig. Gen. George V. Strong, chief of war plans, recently made the statement that antiaircraft fire had improved 500 percent in the past fifteen years. But he added: "The modern airplane goes 300 miles an hour. For instance, an airplane coming in at one side of the Canal Zone is across the Zone and gone in 120 seconds. That means that an antiaircraft battery gets really one crack at a flight of planes, and that is about all, before it is gone. It is a good deal like shooting ducks."

So, besides strong aircraft, antiaircraft and coast artillery defense, the war department is expanding other means of defense. There will be an infantry brigade on the Atlantic side and another on the Pacific side to repel an invader who might land in the Republic of Panama. The artillery pieces supporting these foot soldiers can be mounted on horses and mules to operate in the mountains and jungles which surround the Zone.

These topographical features present a formidable barrier in themselves. Mustard gas, artillery, machine guns, hand grenades, rifles—all of the weapons of a modern army—make up the fighting equipment of the Panama defense forces. They would make an invasion by land a difficult operation. Even mechanization—so successful in the invasion of Poland—may be applied in the Canal Zone. A modern high-speed military highway is being constructed across the isthmus, and the army's greatest expert on mechanized warfare, Maj. Gen. Daniel van Voorhis, is being sent to Panama to take command.

With all these safeguards, there is still the chance that a daring air raid or sabotage might put the waterway out of operation and bar a rapid transfer of the fleet from one ocean to the other. Eternal vigilance is the only safeguard against the latter—that and improved relations with the Panamanians. Substitution of the "good-neighbor policy" for "Yanqui imperialism" and a new treaty with the little republic giving a number of concessions, will, it is hoped, weaken inimical foreign influences in the country.

There remains the chief weakness of the Canal—that a sudden attack of a few daring bombing planes or a massed superior aërial force might get through the ring of air bases, naval forces, and antiaircraft guns and manage to plant some 2,000-pound bombs on the waterway.

Two important projects are under way to guard against such an eventuality, both major features of modernization of the Panama defenses. Weakest link of Canal itself is the machinery which operates the locks. A bomb dropped alongside the watercourse might block it by a slide, but dredges could soon clear the way. Similarly if a lock were hit, new concrete could be poured and the channel would soon be in operation. A direct hit on buildings housing the lock machinery would be a different matter. Under a $27,000,000 appropriation made last year for the Canal, the nature of which was kept secret, it is believed the lock machinery is being placed underground.

The other is the most costly undertaking of all—construction of a $277,000,000 spare set of locks for the vital waterway. There are two sets of locks at present, closely paralleling each other. The new set would be constructed at a distance from the existing ones and connected with the canal by means of by-passes. The chance of an air raid putting all three sets of locks out of operation for any length of time is considered negligible. In fact, an army board which studied the question for two years, reported that construction of the additional locks would assure that the Canal could not be closed to use of the navy in time of war.

Thus, Uncle Sam plans to make the key point of his defense system impregnable. Costly, yes, but cheaper than a large standing army, two fleets, or defeat in warfare.

The Kingfisher

(Continued from page 35)

of the rudder and finishes off the lower rear part of the body. It is braced vertically on each side with a thin piece of veneer which prevents breakage from sudden side skidding. A thin piece of wire $^1/_{16}$" in diameter is cemented to the bottom side of the fin. This prevents wearing away its underside.

Motor Mount

Material:

3 each $^3/_{16}$ x ½ x 24" pine or bass
1 each $^1/_{32}$ x 3 x 24" veneer
1 each .062 dia. x 12" wire

The motor skid or mount is built as a complete unit which slips into the body and is removable in its entirety with all motor parts held rigidly in position. The timer is mounted just in front of the firewall on the skid and is accessible from the top. The motor illustrated is mounted inverted. The exact position of the batteries and coil is located after the final balancing of the finished model is checked. They are then held in place by hooks cemented to the veneering, and rubber bands passing over the top. Note that the motor skid is anchored in two ways, with a heavy pin running through the top and with hooks and bands on each side. The motor mount slips into two balsa runways, one located on each side of the interior of the fuselage.

Propeller

Material:

1 pc. 14" dia. pine, 5 or 6" pitch

The completed model ready to fly glides at approximately 16 to 18 miles per hour, and it is not advisable to fly much faster than about fifty percent above this speed, which would make the maximum speed between 24 and 27 miles per hour. For instance, if the speed of the motor is 6,000 r.p.m. and the propeller pitch is 6", we should have a normal forward

speed of 36,000 inches per minute. This would give us a theoretical speed of 30 miles per hour, and allowing for an approximate slippage of twenty-five percent, we should have an actual speed of about 22½ miles per hour. This actual flying miles per hour figure will vary considerably depending upon the propeller pitch and its slippage and the r.p.m. of the motor.

Wire Fittings

Material:

1 pc. light wire, .062 dia. x 24" long, wing hooks
1 pc. light wire, .047 dia. x 24" long, tail hooks

The wire hooks for the tail unit and motor mount are bent from .047" diameter wire. The wing mounts have the greatest strain and should be bent from .062" diameter wire doubled back to give extra gluing surface and in addition a ⅛" piece of balsa is cemented and overlaid on the wing hooks. These hooks are attached to the hard wood veneering at Sections No. 2 and No. 6.

It is well to keep in mind that they must carry a load of at least 48 ounces under flying conditions and therefore must be attached very securely. The tail fittings run through the body at Stations No. 12 and No. 14 and over the rudder mount, as illustrated in the perspective sketches.

Covering

Material:

Heavy bamboo—landplane
Light silk—seaplane

For land flying the entire model can be covered with a good grade of heavy bamboo paper. Two coats of clear dope are applied and then the body is painted light blue and the wing light yellow. The photograph of the finished model illustrates the simple decorative color scheme employed.

The seaplane model should be covered with silk and doped at least twice and later given two good coats of color. In testing, our seaplane model turned turtle a few times and was pulled out undamaged and unsoaked. The motor also slipped in accidentally with the entire skid—new batteries were attached, the water pumped out, motor cleaned thoroughly with gas and oil, and in about fifteen minutes was running again. It is impossible to keep a seaplane model dry unless the necessary waterproofing is applied, and for the seaplane model silk must be used.

Full-size Plans for
Kingfisher Model

AIR TRAILS
79 Seventh Avenue
New York, N. Y.

Inclosed find 40 cents for a set of full-size plans (62 by 47 inches) drawn by Joe Ott himself, printed on both sides.

Name.....
Address.....
City..... State.....

What Ship Is That?

(Continued from page 18)

lower wing tips of the double-decker resemble the partially visible outlines of a flying boat's wing-tip pontoons.

When passing directly overhead, a monoplane presents the observer with an unexpected puzzle. What type is it? Is it a low-wing, high, or midwing job? Like Mike and Ike, they all look alike when seen from below. In this dilemma our observer must turn to his knowledge of design. The outline and proportions of the wing in relation to the size and shape of the fuselage, usually identifies the ship. If still stuck, as he probably will be if the plane in question is a light sport plane, he will have to fall back on such details as the shape of the engine cowling or the design of the tail planes. These features differ slightly in the Cub, Taylorcraft, Luscombe, et cetera.

To warring airmen across the Atlantic, the ability to distinguish between hostile and friendly aircraft is a matter of life and death. This is especially true in the present conflict, where insignia is often obscured and practically all military planes are camouflaged. As in the last war, books of recognition silhouettes are issued to the fighting pilots of all armies. These pocket-sized encyclopedias of aircraft design are assiduously studied until the characteristics of the various models are learned by heart. In the case of friendly planes, recognition training is speeded up by the fact that flying cadets are constantly surrounded by their own service types. Captured enemy ships, flown in practice combat, help train the tyro's eye to distinguish hostile contours. Needless to say, recognition silhouettes of newer models are promptly distributed and the fighting pilot, if he values his skin, must constantly keep up to date.

As a preliminary to the study of individual plane designs, a knowledge of the main types of aircraft is necessary. The first step in airplane identification is, of course, the general classification of the ship in question. Is it a landplane, seaplane (equipped with floats), or flying boat? Is it a monoplane or biplane? Is it of conventional design or one of the unorthodox types, such as the Hammond "pusher," the autogiro, or the Waterman tailless "Arrowbile"? This basic classification flashes through the observer's mind almost instantaneously and he can go on to a more detailed examination. If the ship is a biplane, are the wings of equal or unequal span? Are they staggered? Positively or negatively? If a monoplane, is it of low, mid, or high-wing type? Examine the power plant. Has our ship one or more motors? How are they placed? Are they round, bulbous, air-cooled radials, or slimly cowled, in-line engines? What is the ship's general layout?

Having answered these secondary questions, our observer has narrowed the field down to a handful of possible planes. He then proceeds to

study the wing plan. What is its general proportions (aspect ratio)? Is it long and narrow, or short and broad? Are the edges of the wing straight or do they taper? How about the wing tips? Are they square, square with rounded corners, round, or raked? If tapered, do the edges of the wing have an approximately equal taper, or is one edge tapered and the other straight? Is the degree of taper mild or sharp? Do the wings back-taper in at the fuselage or do they bend downward to form a "gull wing"? All these points are important in identifying a plane and all should be studied carefully.

By this time, our observer should have recognized the plane. If he hasn't, it is probably due to the fact that quite a few ships resemble each other very closely in plan form. Among the bimotored, low-wing transports, the Barkley-Grow T8P-1 and the Lockheed Electra, 12-A and 14 are almost indistinguishable at a distance, differing only in size. They all have slim, well-streamlined fuselages, twin, air-cooled motors, twin rudders and wings which taper sharply on both edges to a rounded tip. The only difference, difficult to detect at a distance, lies in the proportions of the tail planes and the milder taper of the Barkley-Grow's leading edge. The Beechcraft 18 is also very similar in wing shape and plan to the above ships, but may be identified by the placement of its twin rudders.

Many of the single-engined monoplanes are equally difficult to tell apart. Among the medium-sized, high-wing jobs, we find that the Fairchild 24, Howard DGA-11 and Cessna Airmaster vary only slightly in their proportions and plans. Bellanca's famous fleet, however, are easily spotted by their square wing tips, while the Stinson Reliant has an unmistakable wing form.

In the low-wing category, we tend to run into the same trouble. The silhouette of the Fairchild 45 closely resembles that of North American's military two-seaters. The sharply tapered wings of the Ryan-SC are almost duplicated in the new Phillips 1-B. The Pasped Skylark, Miller Zeta and Security S-1B could pass at a distance for Ryan's famous S-T trainer. Distinctive among the low-wings, however, are the sharply raked wing tips of the Spartan Executive and the Severskylike wing plan of the Dart sport trainer.

The new big transports and transoceanic flying boats are comparatively easy to identify. The contours of the DC-4 are familiar to every newspaper reader in the land. Boeing's Stratoliner is easily picked out by its four motors and capacious, cigar-shaped fuselage. This latter feature is also characteristic of the new Curtiss twin-engine transport. The Boeing wing plan in conjunction with a slim, turret-studded fuselage has come to mean "Flying Fortress" in any language. Glenn Martin's celebrated Clippers are readily recognized by their sea wings and indented trailing edge, the bigger Boeing boats by their triple fins and deep hulls. Among the medium-sized flying boats we find a strong similarity between Sikorsky's amphibious S-43 and the Consolidated PBY-2. The latter, however, can be distinguished by the square wing tips formed by its retractable wing floats.

Accompanying this article is a number of three-view silhouettes of well-known American aircraft. They are intended as the basis of a recognition book, that may be augmented by photographs of known planes in various flying poses. Complement your study of these by as much field work as possible and you will be surprised to see how soon you will be able to call your shots when the old eagle eye focuses on that distant speck against the blue.

Heads up!

We Bombed Nicaragua

(Continued from page 20)

"What's the idea?" said Mason, not daring to wisecrack before all that distinguished gathering.

"My invention," answered the youth. "This is the bomb that will quickly end the war. It is stupendous. When the rest of the world learns about this implement of death there will be no more war, and you, my dear major, are to have the honor of being the first to demonstrate its irresistible power."

Somewhere the bomb maker had got hold of a piece of tin tubing ten feet long, probably a piece of drain pipe. First sealing one end with a plug of wood, he had stuffed it full of sixty-percent dynamite. He pointed to the short fuse sticking out the top end and said it was connected with a hundred fulminate detonators, one for each stick of powder used.

Now sometime or other either Mason or myself had in a moment of absent-mindedness let slip that information that a falling bomb reached a terminal velocity of about five hundred miles per hour. They had figured it all out: 2,640,000 feet per hour, 44,000 feet per minute, 734 feet per second. They had figured the length of fuse necessary to burn one second, and figuring that we would fly at five thousand feet, which we seldom did, a seven-second fuse would explode as it hit the ground where the enemy were supposed to be cowering.

That wasn't so bad. At least it gave us the time to heave the bombs overboard and be well away before the explosion occurred. What we had to watch out for was to see that they did not use an instantaneous fuse. Fortunately such fuse was marked with a red thread in its weave. Such bombs we dropped without lighting the fuses.

But the pole bomb was a work of art. It looked like a slim barber pole, wound round and round with red ribbon, to distinguish it from any possible rebel bombs, we were told.

Jinatepe was not much of a town as towns go, but it was located in a very strategical position, commanding three main trails. In addition it was supposed to be the headquarters

of that very elusive master of banditry, Sandino.

Mason and I tossed a coin to see which one of us would avoid the honor of taking the barber-pole bomb for a ride, the winner agreeing to go along in the other plane so as to be able to give the sorrowing relatives back in the States all the gruesome details. Mason won the toss.

Amid the cheers of the throng I took off, using one hand to fly the plane and the other to hold the barber pole upright, the base resting on the floor of the cockpit and the fuse end high above and forward of the upper wing.

Jinatepe was the most welcome sight I'd ever seen. I could have ditched the pole bomb before getting there, but that would have been reported by the ground troops scattered over the country. I had a couple of nails driven in the side of the fuselage, and I knew when they lined up with my objective it was time to drop my bomb, crude but as accurate as most of the mechanical bomb sights. When the two nails neared the point of coincidence with the objective, the town plaza, I started to heave the bomb out, but it wouldn't move. The wind pressure was holding it tight against the wing.

I circled around and fought that bomb all I dared to, remembering the hundred fulminate caps, which are about the most delicate of explosives. I couldn't move the bomb, but I just had to get rid of it. I took a chance and released my hold on the bomb. It stayed put as though it were planted. I reached for the machete and in a matter of seconds had a hole chopped through the floor of the fuselage. Then I heaved straight up on the bomb and was able to get the end to the hole. Slowly I let it slide through my hands. I hadn't intended to light the fuse, but as it appeared before my face I thought, "Why not? It's all set and safe enough."

I closed my knees on the bomb and fished out my cigarette lighter. I watched my objective and at the proper time I snapped the lighter and pressed the flame to the fuse. The sparks flew.

I blew out the flame of the lighter and grabbed the bomb. Looking at my sights I breathed a prayer for what was beneath me and let go. The bomb moved down a few inches and stopped, sparks flying almost into my face. I pushed and twisted, but the bomb stuck as if glued to the ship. In my anxiety I had let the nose of the plane drop. Now I pulled back on the stick and tried to hold it with my knees while I devoted both hands to the bomb. Somehow the stick got caught in my cartridge belt, and as I heaved back, the nose of the plane came over in a perfect loop and I felt the bomb yanked from my hands. The centrifugal motion of the looping plane had done what I had been unable to do with my hands.

I righted the plane and looked over the side. At first I couldn't locate the falling bomb, then the ribbon began to unwind and I watched it flutter downward. I circled, and almost before I had time to get set, the bomb hit the ground in the center of the plaza, right in front of the church and the *comadancie*. There was a huge puff of dust or smoke, then a second later a dull roar came to my ears above the sound of the motor.

I'd lost sight of Mason during all this excitement. Now he flew alongside me and made a motion as though having a drink. Jinatepe had been quiet and peaceful when we arrived, and I'd hoped no one was there, just in case I did hit something with that infernal contraption. Now as we flew away I could see puffs of smoke coming from the bushes below, and knew that some of the rebels were potting at us with their old Mauser rifles that shot a slug weighing two ounces and used black powder. These were the bullets we really disliked, for if they ever struck a vital part of the plane they were big enough to wreck us. We hightailed it away for that drink.

The success of that raid made a hero of the inventor of the pole bomb. Spies inside the town reported terrific damage, hundreds of rebels killed and a complete rout of their forces. I knew no one had been hurt.

They manufactured bombs faster than we could drop them. Some of the bombs were so large we could not get them into the fuselage, and had to tie them onto the under-carriage and hope they would not jar off as we left the ground and would fall clear when we cut the ropes holding them in place.

In self-defense we encouraged the youthful bomb makers to confine

Photo Credit List

The following list shows the sources from which credited photos were obtained. Abbreviations: Bot., bottom; T., top; U.L., upper left; U.R., upper right; L.C., left center; R.C., right center; L.L., lower left; L.R., lower right; Cen., center; T.C., top center; B.C., bottom center.

Page 9—Hans Groenhoff.
Page 10—L.C., Wide World; Bot., International.
Page 11—L.L., International; R.C., James Tenety, Jr.; L.R., Mirzaoff.
Page 12—T., Wide World; Cen., International; Bot., International.
Page 13—T., Wide World; Bot., International.
Page 14—T., British Press Combine; L.R., Wide World; L.R., ternational; LL., International.
Page 16—Bot., Official U. S. army air corps photo.
Page 17—All International.
Page 19—U.R., British Press Combine; rest by International Photo Correspondents Corp.
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Page 32—Al Daraghy.
Page 33—Al Daraghy.
Page 34—Joe Ott.
Page 35—Joe Ott.
Page 41—Al Daraghy.

their inventive genius to small bombs weighing not over five pounds. These we could load into the cockpit and toss over the side as needed. We had a lot of fun throwing these "noise pots," as we called them, over the countryside. Trouble was we could seldom see the rebel soldiers if they were beyond the towns. The jungles offered perfect protection, but as the bombs made a lot of noise and smoke everyone seemed to be satisfied. The Federal leaders because they were bombing the enemy, the rebels because they were suffering no casualties, and Mason and I because as long as they were trying to dodge our bombs they would not shoot at us.

One morning I overheard one of the bomb makers explain to a coworker the principle he had evolved from reading about a Black Hand bombing in the States. He wondered when they were going to try out his invention and explained that the working parts had been made from an alarm clock, which he had set to go off at a certain time. That was enough for me.

"Hey!" I yelled at the inventor. "Where is that bomb and what time did you set it to go off?"

He was so rattled he could hardly answer. Finally he explained, "Señor Major, the bomb is in the hangar waiting for its trial." He couldn't remember the time he had set the clock for the explosion.

That was bad. I estimated that at the very least there were five hundred pounds of dynamite in the bombs stored in the hangar. Someone had to find that bomb, quick. I ordered the bomb makers to remove the bombs from the hangar to one end of the field and to search for the time bomb and put it by itself. Then Mason and I took off. We felt that the safest place for us in Nicaragua right then was five or six thousand feet in the air. We cruised aloft for a while, then Mason flew alongside my ship and waved his hand ahead. Faintly through the haze of the smoke arising from the volcano Momotumbo we could discern the shoreline of the Pacific Ocean and the so-called port of Corinto. I got Mason's idea right away. There was a landing field of sorts at Corinto.

We stayed in Corinto for three days, visiting with the marine officers and joining in their nightly poker games, all the time wondering what that infernal bomb maker had used, an ordinary alarm clock or one of the eight-day variety.

It was a relieved group of officials that greeted us on our arrival back at the field in Managua. The wires were down from Managua to Corinto and our whereabouts had been unknown, but they were afraid their air force, both of us, had been shot down by the rebels.

We inquired about the time bomb. There was no sign of an explosion around the field or hangar. The inventor who had caused all our heart failure woefully told us he had discovered his pet bomb among the stores. "But, señores," he said in an apologetic manner, "the clock I used must have been an old one. It had stopped. Perhaps I forgot to wind it."

I examined the time bomb and found that if it had exploded at the time set we would all have been blown to kingdom come a full day before we even heard about it.

Then a man working on the field as a laborer came to me and said that while he did not know a thing about aërial bombs, he did know how to make a contact detonator that would be safer than all these time bombs and fuses we were being pestered with.

Charley Ainaud, he said his name was, a Frenchman, but with papers showing he had served in the American army. He had drifted into Nicaragua with a revolution and never had got up the courage to leave. He'd missed too many boats and eaten too many tortillas.

We showed Charley the size and type of bombs we needed and he set up a little plant at one end of the field. Best of all, he started a class in bomb making, utilizing the amateurs who had been pestering the life out of us with their infernal machines. And he did contrive a percussion detonator that worked, and he made his bombs a standard size and put something in them besides dynamite. And the more things to make a noise, the better.

We were taking plenty of chances every time we flew over the jungle in our old Swallows, but we were lucky. Never a forced landing and never a bad hit from a bullet, though many times we returned with as many as twenty holes through the wings of the planes. Dropping buckshot kept the ground firing under control, for the rebel soldiers thought the buckshot was their own bullets falling back on them. But even that did not stop all the shooting, so we spread the report we were going to use gas bombs.

It was a funny thing. I'd tell a story like that to some mechanic and be positively assured that by the following night at the latest every enemy within a hundred miles of Managua would have the story with all its additions and horrible ramifications. Our own troops would know it as well, and would be waiting tensely for the next great accomplishment of the gringo aviators.

In this case we had to make good. We did. To just an ordinary small dynamite bomb we tied a bottle of ammonia. The bomb exploded and the bottle broke at the same time, and the few people who got a whiff of the pungent vapor were convinced, and they in turn told everyone else of their escape from poison gas. For quite a while Mason and I could fly over the jungles and never see a puff of black powder smoke or hear the whine of a high-powered Mauser bullet.

I don't think we ever killed anyone with our bombs or did any material damage, but we did make a lot of noise and many a heroic politician got his start making bombs for us. When the United States marines took over the job of policing the republic our job was done, but we left behind such a reputation with the natives that they used to say it took four thousand marines and twenty-eight planes to do the work that we had done with our two obsolete Swallow ships and the aid of the young bomb makers.

Stingers

(Continued from page 25)

patrol plane which carried a 37-mm. gun in its nose cockpit for use against submarines.

Other British airplane manufacturers, too, such as Boulton & Paul, Fairey, Gloster, Handley Page, Saunders-Roe, Short and Supermarine, were encouraged to build tail-gun warplanes prior to 1937. Some of the patrol flying boats of that era, including the Saro London, the Short Singapore III and the Supermarine Stranraer, are still in use by the Royal Air Force. All of these planes had open cockpits, but on the latest types of high-speed aircraft now in use, inclosed tail-gun cockpits are employed. Modern aircraft such as Armstrong-Whitworth Whitley, Handley Page Harrow and Vickers Wellington twin-engined bombers, Bristol Bombay troop transports, and Saro Lerwick and Short Sunderland patrol flying boats, have inclosed multigun turrets neatly streamlined into their tails.

While this development was proceeding steadily in Great Britain, other nations were not slow to take up the idea. France has built a number of Breguet Bizerte patrol flying boats with tail guns, while Italy has produced modern aircraft such as the Macchi C-99 patrol flying boat with this armament. Germany has also equipped her Dornier Do.24 and her Blohm & Voss BV.138 patrol flying boats with inclosed tail-gun turrets, and on the latter plane two tail turrets are superimposed as on a battleship. The new Junkers Ju.89 four-engined bomber is said to have a 20-mm. gun in its tail turret in addition to its other defensive armament—which ought to make it very effective.

Holland has had experience with conical tail-gun turret installations on her twin-engined Fokker T-5 bombers and G-1 fighters, while the U. S. S. R. have used tail guns on their TB-3 heavy bombers and other aircraft for several years. Japan has not neglected this type of defensive armament and as long ago as 1934, her Hiro 90-1 and Kawanishi 90-2 patrol flying boats were equipped with stings in their tails. As for the United States, we are relatively backward in this development inasmuch as at the present time we have only two warplanes equipped with a gun station in the tail. These two planes are the Sikorsky XPBS-1 and the Consolidated XPB2Y-1 four-engined patrol flying boats. Although a considerable number of the last-mentioned planes are being built, unfortunately there are no indications of any twin-engined patrol flying boats or land bombing planes with tail guns on order for our air services.

With regard to the advantages of the tail gun for the defense of large multi-engined aircraft, it is obvious that clear fields of fire from the tail in both the horizontal and the vertical plane are of great tactical importance. A "blind tail," as is well known to the crews of military and naval aircraft, is a tremendous handicap when the airplane is attacked from the rear by enemy planes. Gun stations amidships are desirable, but they should only be regarded as a secondary defense for tail protection inasmuch as the gunners in them do not have a clear field of fire astern. Large aircraft cannot maneuver quickly when attacked, and it is vital for their protection that a gunner should be where he can see what is attacking him and have a clear field in which to return the fire.

Are Tail-first Planes Practical?

(Continued from page 21)

lifting elevator, and three-wheel landing gear. Tests have brought out the fact that any excessive stalling maneuver helps the forward wing to overcome this critical stalling angle, and consequently the nose drops automatically. Tests have likewise shown that take-offs can be made by simply opening the throttle.

Landings have been made by simply throttling back, letting the ship settle, and, when just off the ground, closing the throttle.

From its inception the Steffanuti interested military officials, who saw promise in it as a fighting machine. A fighter version is now being built. The excellent visibility enjoyed by the pilot is especially noteworthy, as is the high degree of maneuverability of this type ship. The wing and fixed part of the empennage have been designed in a triangular form to give maximum stability. The elevator is an independent structure, forming a slot with the fixed forward wing. Even in a stalled position the control has proved to be positive and easy.

The two rudders on the extremities of the wing may be used as air brakes by converging them forty-five degrees when landing.

After a long test period with the SS-2 and SS-3, a cabin-job fighter, the SS-4, was evolved. This single-seater mounts a radial air-cooled engine and will have placements for three heavy machine guns, as well as usual bombs and radio equipment. Seated well forward of the wing, the pilot has a remarkable range of visibility in all directions and in addition has a large engine at his back to protect him from fire from the rear.

Such "new" design features as the tricycle landing gear are now accepted as the latest word in aircraft manufacture, and the next few years may see designers once again adopt the tail-first formula of Wright and Curtiss.

The 1939 Moffett Trophy Winner

(Continued from page 41)

BILL OF MATERIALS

(Balsa, unless otherwise specified)

Fuselage

4 pcs. 1/8 x 1/8 x 32", longerons
10 pcs. 1/8 x 1/8 x 24", cross and diagonal braces
2 pcs. 1/16 x 1/8 x 6 1/8", wing mount bamboo
1 pc. 1/8 x 1/2 x 4 1/2", nose cross braces (hard)
1 pc. 1/32 x 2 3/8 x 6 1/8", wing well floor
1 pc. 1/8 x 3/8 x 3", brace between landing-gear struts
12 pcs. 1/8 x 3/16 x 7 3/4", stringers around nose of ship
1 pc. 1/8 x 3/4 x 3", rear plug braces (very hard)
2 pcs. 1/16 x 1/4 x 9 3/4", landing-gear struts (bamboo)
1 pc. 1/16 I.D. x 1/2", (brass tubing) bushings
4 pcs. 1/8 x 1 5/8 x 1 5/8", wheels (hard)
1 pc. 7/16 x 1 3/8 x 1 5/8", nose block (pine)
1 pc. 3/16 x 3/16 x 1 3/8", rear rubber plug (hardwood)

Wing

1 pc. 1/8 x 1/8 x 2 1/2", leading edge
2 pcs. 1/8 x 1/8 x 11 1/4", leading edge
2 pcs. 1/8 x 1/8 x 6" leading edge
1 pc. 1/8 x 1/2 x 2 1/2", trailing edge
2 pcs. 1/8 x 1/2 x 11 1/4", trailing edge
1 pc. 1/8 x 2 x 12", trailing edges and tips
1 pc. 1/8 x 3/8 x 40", wing spar (hard)
2 pcs. 1/20 x 2 x 24", ribs

Rudder

1 pc. 1/8 x 1 x 10", leading edge, tip, and base of rudder
1 pc. 1/8 x 1/8 x 13 1/2", spar and ribs
1 pc. 1/16 plus x 1 x 12", lower and rear part of rudder

Elevator

1 pc. 1/8 x 1/8 x 18", leading edge
1 pc. 1/8 x 5/16 x 18", trailing edge
1 pc. 1/8 x 1/4 x 20", spar
1 pc. 1/16 x 2 x 12", ribs
1 pc. 1/8 x 1 x 12", tips

Additional Items

1 pc. 1 5/8 x 2 x 8", prop block
1 pc. 1 3/8 x 1 3/8 x 1", spinner
1 pc. .040 diam. x 10" spring steel wire, prop shaft, counterweight holder, and axles
1 Jasco ball-bearing washer
4 pcs. .032 x 1/2 x 1/2" brass shaft bushings
4 pcs. .028 x 5/32 x 1" brass hinge pieces
1 pc. adhesive tape for hook covering
38 in. of 3/16" flat brown rubber
cement, dope, and three sheets of red tissue paper

Air Adventurers

(Continued from page 29)

and so he was given the kind the troop itself can dish out. Then he quit. Don't you understand?"

It was a new angle to me, and I was somewhat puzzled about it.. I tried to figure it all out, knowing the lad in question. He was healthy and strong, and the "licks" the rest of the troop might have inflicted on him would hardly have been noticed by him. But it was something else he couldn't take; the punishment as handed out by his own pals rather than by a superior Scout officer.

I tried to readjust it all in my mind and naturally I began to think of our Air Adventurers, who may be regarded as Scouts whose interest is concentrated in the medium of the air. I wondered how many of us would be able to take our punishment under the same conditions. In our case, of course, we have little personal contact with other members. Still, we do horse around, as my pal of the Scouts has it. We ignore our duties to the rest of the crowd. We don't really co-operate and we have our petty jealousies, but unfortunately none of us can order out the paddles and hand out the licks.

We get many letters from members who are safely far away. They grumble and growl about this in the magazine and that in the magazine. They argue about the ability of a particular writer or artist, forgetting that perhaps he has slaved for weeks gathering his material. But many Air Adventurers ignore all this and horse around with their criticism. They forget that the industry changes overnight, that new types and new ideas come hammering down the assembly lines faster than most of us can accept them. What you read here today was written at least two months ago to conform to the mechanical problems of publication and distribution, but many Air Adventurers ignore that and complain.

We can't take out the paddles and hand them around and order the complaining Air Adventurer to frog it down the line. Most of our Air Adventurers would be game enough to "take it," we'll agree, but there *might* be one or two who might quit on us and run home and tear up their cards.

So, before we get that far, let's all try to play the game and give credit where credit is due. Let's all chuck in together and make this aviation business the best in the world. We have no national conflict here in America to bind us together for security as they have in Europe, but we can create a better bond by remembering the creed of the Air Adventurers and taking our share of the work required in the build-up. Remember, you can't outgrow Air Adventurers. You can't become too big for the organization. We don't care if you become a nationally known test pilot, a president of an aviation manufacturing concern, the chief of the air corps, the head of a great flying school, or the latest air-race hero, you will always be an Air Adventurer. You may want to quit, you may object to playing your part, but you'll find that, just like our Boy Scout who quit, you'll be trying to get back to regain your self-respect.

Think it over, Air Adventurers!

Your Flight Commander,

ALBERT J. CARLSON.

CLUB NEWS

And now for the mail bag, as far as space will allow.

That good Air Adventurer George Mikari of Sag Harbor is back again with three new members, a flock of swell pictures, and a grand letter. He says in part: "I have earned a little money and I have bought a helmet, goggles and a flying jacket, and I have just managed a little more to get a ride in a real open-cockpit plane. It's grand to feel the air around you in an open-cockpit plane."

Erich Messenbrink of Spring Valley, N. Y., writes in to say: "I am greatly pleased to know that my application has been approved and to know that I am a fellow member of Air Adventurers. I will certainly do all I can to further the advance of American aviation. I follow your monthly report on the club with great interest, and now my chance has come, for I have completed my gas job and am now applying for my Airplane Mechanic award."

W. J. Valentine of the Bluff, New Zealand Aëro Club has sent in a very interesting letter telling us that he wishes to get a number of the boys at Bluff interested in model building. He wants to know how they can all join Air Adventurers.

Dick Martin, of Binghamton, N. Y., has qualified for his Topographer award on the strength of a neat drawing of the layout at the Binghamton Airport, Chenango Bridge, N. Y.

Robert Korosnanski, of Bernardsville, N. J. (and we hope we have the name correct, because he signs his letter a bit carelessly), sends in a photo of his six-foot glider which has had several flights of ten minutes, according to his pals, Grafton Ely and William York.

Private Robert Fix (and what a swell name) sends in a picture of his navy Curtiss Hawk, which he claims is made mostly from the folding spouts taken from salt boxes. There's a new one for you! "This plane took me more than two years to complete," says Fix in his letter, sent from the Fourteenth Air Base Squadron at Bolling Field, "and I can safely say that my time has been well spent and well rewarded. Originally this plane was an eighty-cent kit, but with improvements and modifications the complete job cost me about twenty-five dollars."

Eugene Sommerich, of St. Louis, has qualified for his Topographer's award with a detailed drawing of the new proposed airport which is under consideration in St. Louis.

Photography awards have also been won by Joe La Shelle, of North Hollywood, Cal., for a shot of a three-place Waco. G. Dalton Crandell, Dr., also wins an award for his enlarged shot of a C. A. A. Fairchild taken at Hillsgrove, and Bob Trebilcach, of Verona, N. J., for his shot of a Curtiss P-36.

Streamline, Says Cahill

(Continued from page 32)

large knots of rubber motor. A planked balsa fuselage with various different-shaped bulkheads seemed to be the only answer. My only caution to anyone building a fuselage of this type is that they must use light, mushy wood which almost measures up to indoor standards for weight: The original fuselage was little heavier than an ordinary paper and stick fuselage. The strength was, of course, much better.

The fuselage had one coat of grain filler and two coats of dope and then was waxed to make it as smooth as possible.

I wanted to have the wing readily adjustable and able to absorb shocks if it hit anything, but I also wanted to put it inside the fuselage. So a sheet of aluminum fairing, held on with smooth interior decorator's tape, was devised to fit over the wing. Later, bond paper was used, as it was easier to handle and replace.

The wing and tail were straight, with rather long elliptical tips. It seems to me to be more important to get a good uniform airfoil than to worry about "efficient" plan shapes on the wing. Of course, the tip sections should be streamlined to reduce the tip vortices.

I used the one-bladed prop because it has less resistance in the glide. In my opinion, a folding propeller is very superior to a freewheeling propeller.

It is essential that the prop stops and folds immediately at the highest altitude which the model reaches. A slipshod folding mechanism, in which the motor has to be wound up backward by the slipstream before the propeller folds, is not worth two cents.

I have hoped to make you realize by comparing this model with the usual slab-sided fuselage model that streamlining really does pay. I have another Wakefield-type model, "Boxcar," which is the usual rectangular fuselage type. It has made nine flights in contests which were over three minutes long, but it has yet to fly over five and one half minutes. This is in direct contrast to *Clodhopper*, which usually sticks in a thermal once it hits it.

"But I don't have time to build a complex streamlined job," model builders say. But you do have time to improve on the present type of ship. On Frank Zaic's "38" Wakefield model, he used four main longerons to build the usual type of fuselage and then added four pieces running lengthwise to produce an octagonal-shaped fuselage. This is an easy and light way to help streamline your model. Another thing, if your wing is flush on top of the fuselage, why drag your wing rubbers all the way around the fuselage? Why not put little slots just beneath the top longeron so that you can slip the wing rubbers through?

Also, if you block up your wing for needed incidence, why not carry the curve of the top of the wing all the way down to the fuselage and get rid of a little more resistance?

The diamond-type fuselage is theoretically less resistant and seems to be increasing in popularity. The tail may be faired in on a diamond fuselage much more effectively than on a rectangular fuselage, but it is usually difficult to get a good wing mount. The British, for the last several years, have been making wings on their Wakefield models in two pieces. They have no center spars, just husky leading and trailing edges. At the inside rib, these spars are left in a rectangular plug shape. These plugs fit snugly into a hollow box which is built inside the fuselage. Using this method, the wing fits nicely into any shape of fuselage, and beautiful fairings may be built on the fuselage.

I believe many of the model builders, especially those few gas modelers who still design their own, are overlooking a good thing in not trying more models with a bulbous nose for cross section and using a tail-boom effect. This type has less skin friction and is lighter than the ordinary fuselage. There is one practice some model builders have which is really laughable. That is to make a gas job with oval fuselage, elliptical surfaces, well-doped and polished and then leave a nice flat fire wall out in the open right behind the motor.

I think the Wakefield-type models should be reduced to a smaller wing area and perhaps have a definite weight of rubber motor, mainly to keep from losing so many of them.

As a last reminder, here are a few thoughts. Is it worth-while to build a fairing on your fuselage for the propeller to fold into? The best thing, of course, would be to chuck the whole assembly inside the body. Usually the last operation is doping the model. Many ships would be improved if skin friction were cut down. I believe the usual aircraft dope makes tissue too brittle. Al Van Wymersch of Belgium uses a combination of dope and lacquer which produces the best finish which I have ever seen on a model. It is flexible, light, and very glossy. So slick up your models, boys, and watch them go!

Don't Streamline, Says Korda

(Continued from page 33)

postponed and held at a later date, but on reading through the Wakefield rules, it will be found that the finals must be held on a specified date or the contest is void and the trophy goes back to England. Several times the finals were held on rainy days and the results put up by square jobs were not very high due to the body twisting under the strain of a full-wound motor. An easy way to cure this is to cover the fuselage with silk, using several coats of clear and pigmented colored dopes. Cov-

ering a fuselage in this manner will prevent warping in any sort of weather and reduce the damage caused by breaking rubber.

Several ounces of thinned-out colored dope should be carried in every repair kit to use in an emergency, should you ever be forced to fly a square job on such a day.

A few more changes, to use in bringing a square job up to streamline standards, are to experiment with several types of props and rubber. By using a prop blade shaped on the order of an indoor prop the area can be brought near the tip, cutting down the r.p.m. and increasing the motor run. Longer rubber lengths can be used without danger of vibration by using the system described in my article last month, "How to Break Records." With careful construction and plenty of testing, a square model can be made to average four minutes.

Model Matters

(Continued from page 40)

too bad it was so short-lived. Typical of the effect of altitude was the experience of the boys from the Mile-Hi Model Club of Denver, who had a hectic time readjusting their models to perform under sea-level conditions at the Detroit National Meet. Gas-Hoppers is the name of the new club in Salt Lake City. Jack Douglas is N. A. A. contest director and adviser. Interested modelers can contact him at 105 East Second South Street. Albert Carlson is president. One of the Gas-Hoppers, Ronald Conrad, recently flew his radio-control model. Total weight with receiver is four and a half pounds, span is six feet. A Brown D does the work up front.

Charles H. Stagg is the new director of the Quaker City Gas Model Association. He's a pioneer member and experienced model builder. Bill Berry had been directing the Q. C. G. M. A. throughout the past years. He's still in models up to his ears, if we can judge by the interest and enthusiasm he displayed at the recent meeting of the academy, when the question of rule changes was brought up. The Philadelphia boys got a nice send-off in the Sunday supplement of the Philadelphia *Inquirer*. A full page of excellent photos provided a short summary of model work. Such constructive publicity is welcome. And it should be effective, since the Sunday circulation of the *Inquirer* is in excess of a million. . . . Philadelphia boys did their part at the Legion Air Races held October 29th at Northeast Philadelphia Airport. A crowd of thirty thousand took time out from the large-plane events to watch a model exhibition of radio control, pick-a-back launching, parachute dropping, and banner towing.

One of the newer model clubs formed recently is in Port Huron, Michigan. Known as the Inter-City Model Club, the members come from three cities—Port Huron, St. Clair and Algonac. Plans call for N. A. A. charter. Robert Fraser Lee is president. Modelers in eastern Michigan can write or call him at 714 Howard St., Port Huron, Mich.

MODEL ACADEMY MEETING. The Second National Model Aircraft Conference and Academy of Model Aëronautics Meeting was held Saturday and Sunday, November 25th and 26th, at Hampton, Va.

Sponsors were Virginia Model Association, N. A. A. Model Division, and the Academy of Model Aëronautics. Representation was from about a dozen States: New York, New Jersey, Texas, Massachusetts, Pennsylvania, Maryland, Virginia, South Carolina, Illinois, Michigan, Ohio, and West Virginia.

In addition to the Academy meeting (which is always interesting and educational) inspection tours were made through the testing laboratories of the National Advisory Committee for Aëronautics at Langley Field, on Saturday morning. Modelers were able to see what an important part model airplanes play in research.

On Saturday afternoon the Model Airplane Conference was held at City Hall, Hampton, Va. Conference Chairman Al Lewis of the National Aëronautic Association introduced the guests and academy members who spoke on a variety of topics. E. R. Sharp welcomed the builders. He is administrative officer of the N. A. C. A. and sponsor of the Hampton Roads Model Club. H. J. E. Reid, engineer in charge, N. A. C. A., spoke on model building as related to full-scale aëronautics; Eastman N. Jacobs, N. A. C. A. research engineer, spoke on gas-model performance. Visiting modelers were thoroughly impressed by the interest the personnel of the N. A. C. A. have shown in model airplanes. The boys from Hampton have sold them the idea and much valuable scientific work is being done as a result. The N. A. C. A. has done much to beat down the problems of full-scale airplanes. And with models receiving more of their attention we can expect similar results. The most convincing evidence of the N. A. C. A.'s interest in modeling is the fact that a trip could be made through the laboratories at this time. In the present state of limited emergency it's practically impossible for anyone without duties in the N. A. C. A. to see the labs. It was certainly a privilege for the visiting model builders to make this tour.

Saturday evening the banquet was held at the Chamberlin Hotel, Old Point Comfort, Va. Good food was coupled with an interesting program on helicopter flying and colored movies of the Virginia State Championships. A pseudoscientific note was injected into the proceedings when a new-type covering for indoor models was announced. The covering was described as lighter than microfilm and consisting of a layer of helium atoms held to the wing with a negative charge of electricity. The boys carefully wound up an indoor model for a demonstration flight. The wings of the model looked bare—but this was explained as due to the fact that the layer of helium atoms was invisible. The indoor builders in the audience looked sort of jittery—thinking a new development had taken place un-

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known to them. But the model tumbled to the floor when it was launched.

It is more merciful to give a condensed account of the academy meeting—since it lasted from 8 p. m. Saturday night until 4 a. m. Sunday morning. After the first half hour coats were removed and sleeves rolled up. The boys settled down for a hard night's work. New rules were discussed, and when the smoke had cleared away the following items of importance emerged: general agreement that the weight rule for gas jobs, Class B and C, should be boosted to eighty ounces per cubic inch of piston displacement (a job using a Brown motor of .6 cubic inches would weigh a required three pounds); weight of Class A (up to 250 square inches wing area) would remain at eight ounces per square foot wing area; modelers within a fifty-mile radius of the city holding the national meet should compete in a qualifying contest before participating in the national events; take-off of gas models should be entirely unassisted (the discus-heave method of launching is out); raised platforms for take-off should not be more than six inches above the ground; average of three official flights will be retained for gas and outdoor rubber-powered models; indoor models will be rated on the longest of three officials; models where the strength or usefulness of the landing gear is doubtful should be required to glide from a height of at least four feet and land without damage and without nose-over or striking a wing tip; also the landing gear should support the model in a normal attitude while landing and taking off. A twenty-second motor is practically a sure winner for 1940, although official verdict is still to be decided.

Discussion centered about the new weight rule. Practically every academy member had his own idea. All seemed to think the weight of the models should be increased, but it was difficult to agree on a method. About two in the morning the majority seemed to agree that a ruling of eighty ounces per cubic inch of piston displacement would be the most effective. This rule was championed by the Virginia Model Association and represents considerable thought and experiment on the subject.

All in all, we had a good time in Virginia, and the Virginia Model Association did a bang-up job in providing entertainment and keeping things moving on schedule. The committee consisted of Charles A. Hulcher, chairman, Herbert K. Weiss, Robert Crawford, Caldwell Johnson, Robert Little, Edward R. Sharp, Jr., Phillip Pepoon, Raymond Hulcher, Lloyd Barclay and W. L. Lindsey. All but Herbert K. Weiss are associated with the National Advisory Committee for Aëronautics.

CHICAGO SKY LINES. (By Frank Nekimken.) The gas-vs.-rubber contest held in Chicago at the G. M. A. flying field October 8th was a success. Sponsored by the Chicago Park District, it attracted 143 contestants who paid their twenty-five-cent entry fee and seemed well pleased with this type of meet. Rules stated that each contestant must fly only one type of model—gas or rubber-powered. The following statistics prove interesting in gauging the popularity of the two types of models:

Rubber Contestants	49 Jr. & Sr. 10 Open
Gas Contestants	46 Jr. & Sr. 38 Open

Nineteen of the fifty prizes awarded went to rubber modelers, the rest to the gas boys.

Late in October the Chicago *Daily Times* and the Park District clamped down the lid on the 1939 outdoor season with the biggest meet ever held in Chicago. Five hundred and fifty-one contestants (only 330 less than the 1939 Nationals) broke four national records, while 20,000 spectators crowded the field. Thirteen hundred flights were turned in.

New officers of the Gas Model Aëronuts Club are: President, R. L. Webber; vice president, Stefen Sadlek; secretary, Jerome Walter, and treasurer, Al Solomon. New committees were appointed to carry on the club's activities. One of their outstanding activities is the sponsorship of the Annual Midwestern State Gas Model Contest held every summer. This year the date has been set for Sunday, August 4th.

CALIFORNIA NOTES. (By Elbert J. Weathers.) Southern California experienced two major gas-model contests only a week apart; San Bernardino, December 3rd, and Los Angeles, December 10th. San Bernardino is only about sixty miles east of Los Angeles and is convenient for all southern California gasoleers to get to.

Swinging back to the City of the Angels we find the G. M. A. A. S. C., Inc. (you don't say that one; you sneeze it) offered $50 and a trophy for the lucky one, $20 for second, and $10 for third. A special award has been set up for the Best Appearance Event winner. The ships in this event are required to fly—which always discourages the builder who turns out a model so beautiful he's afraid to fly it! A new contest rule at this meet states "all entries must be completed and painted."

A marathon-type gas-model contest was held at Tulare, Cal., October 22nd. This stunt was imported from Chicago—where it was first tried out a few months ago. The idea is to get as many flights of over one minute as possible during the six hours of flying time. No limit was put on length of motor run—since it's obvious that a long motor run will only take up valuable time that should be used in making additional flights. The winner was Jack Crose with six official flights. He earned $20 for his trouble.

NORTHWEST NEWS. (By Glen Chambers.) A new radio-control model in this part of the country is the one built by D. H. Loughridge, son Don, Clayton Merry, Ray Wilson, and Don Burcham—all of Seattle. The motor is especially interesting. It was built by Merry of M. & M. Wheel Co. It is a six-cylinder radial motor consisting of six regular M. & M. small-bore cylinders—each attached to its own crankshaft, which in turn is geared to the prop shaft

by a two-to-one reduction gear. Speed range is from 600 to 4,500 with a twenty-four-inch propeller. Motor operation is smooth—practically no vibration.

The radio control embodies a double transmitter and receiver, each working on slightly different wave lengths. Each receiver operates a relay to control a toy-train electric motor which moves the control shaft through ninety degrees each time the transmitter key is depressed. This set-up is used to give four rudder movements and three motor speeds. The motor is not stopped for landing; merely retarded enough to allow a flat glide.

The model's flight should be interesting with such motor-speed flexibility. The ship itself has a 10½-foot span, 8-foot fuselage, and total weight of 20 pounds.

Rubber-powered competition in the Northwest has developed into a duel between Tacoma and Seattle (which has been the battleground so far) During the past season there have been three contests. Dick Hill and Hank Cole are the mainstays of the Tacoma group. Hill won two firsts and a second in two of the meets. Cole has also done outstanding work in models. The indoor season began the end of November in Seattle. The rivals from Tacoma suffer slightly because indoor facilities are not readily available for practice flights. But they intend to give the Seattle lads plenty to think about.

EASTERN FLYING. (By Carroll Moon.) The Metropolitan Model Airplane Council, which has become one of the leading councils of the sort in the United States, was organized in November, 1938, and the group is currently celebrating its first anniversary with bigger and better plans for the 1940 season.

In the fall of 1938, during a contest sponsored by the Richmond Flying Club, Sam Block of the New York Aëronuts passed the word around that a council of clubs was being "contemplated," and requested the clubs to send a representative for the first meeting. At that initial gathering the modelers (through their representatives) drew up a preliminary plan for consolidation, and a few meetings later Irving Polk was chosen as the first president. Mr. Polk was assisted by Ben Shereshaw, vice president; William Effinger, secretary; Mr. Block, treasurer, and Joe Raspante, corresponding secretary. Due in large part to the efforts of these leaders, the council has made a splendid record and has contributed much to modeling in the New York metropolitan area.

One of the prime purposes in such an organization was to provide some sort of competition for this section. The first contest, a rubber meet, was held in Central Park shortly after the first organization meeting. In February, March and April, gas-model meets were held at Creedmore, L. I., followed by a rubber meet at Holmes Airport in the summer, a seaplane gas-model meet at Lake Hopatcong, N. J., a marathon gas-model meet at Creedmore, and a rubber meet at the same field. In these meets members of clubs affiliated with the council were eligible to compete, and in several of them the general modeling public. At present the council is composed of the following clubs: New York Aëronuts, Queens Aëro Model Association, Sky-Scrapers, Majestic Model Club, Richmond Model Flying Club, Metropolitan Model League, Idlewild Gas Model Club, Metcalf Aëro Club, Kresge Aëro Club, New York Gasoleers, New York Airfoilers, Franklin K. Lane Model Airplane Club, Tru-Pitch Model Club, New York Air Screws, Silk City Model Club, Lucky Devils, Albatross Model Club, Sky Scouts, South Connecticut Gas Model Club, Jamaica Model Club, and others.

The council meets are attended by the officers and two representatives from each member club. Matters of national and local importance are discussed, and when votes are required, representatives confer with their clubs and return to the following meeting with supported opinions. The council has arranged a number of winter events, and following the publication of the 1940 schedule, a program for the year, these will be announced.

Nearly a dozen new motors have been placed on the market within the past months, most of them very efficient pieces of plumbing, and most of them designed after careful study of the faults in previous motor designs. First of the Mighty Atoms are off the production line, and seem to be nice jobs. Small jobs, flying furiously around with Atoms in the nose, give rise to the old cry of "Quick, Henry, the Flit." A new Bantam is in the offing. Test model showed tremendous power, taking second when installed in a Class B ship and flown at the Philly meet. The original model turned in a fine flight when used in a Comet Zipper—a remarkable performance for a Class A motor. The sample models of the Sky-Chief motors were wonders—easy starting and lots of "zoop." The manufacturer states that the cylinders and pistons are diamond-bored within 1/10,000 of an inch. Sounds interesting.

Ranger is proving a darn fine job. Nice machine work and the motors are very consistent. Good-looking, in a "Brownish" sort of way, and at the new price should sell well. A lot of Class B ships now using this motor; we've seen them at the fields.

Big argument—are the one-and-one-half-volt Aëro coils as efficient as the three-volt? Rumor says 'tis not so. In fact, same rumor states that the Elf coil is superior at one and one half volts, although rated at three volts. However, most contest men are using Aëroes and Smiths; guess they're more numerous.

Lately the trend seems to be toward all-balsa wheels on high-performance jobs, not alone on Comet models. The boys claim the ships are so light they don't need the added shock-absorbing power of the rubber-model wheels.

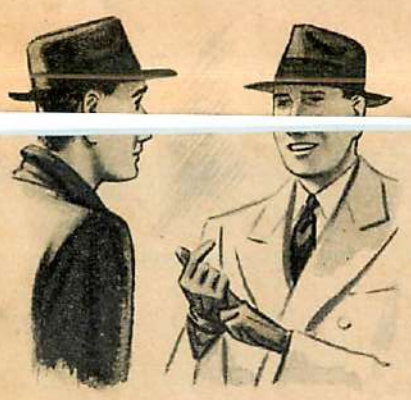
We went to see the new Cyke. Looks good, and as we all know, the Cykes were getting better and better in the old model. If it performs as well as it looks, we plan on selling off our old trophies, scrap wood, sticky timers, and buying one.

"DADDY, ARE YOU A 'BIG SHOT'?"

KIDS can ask embarrassing questions! "*Bobby says his father is a 'big shot,' Daddy. Are you?*"

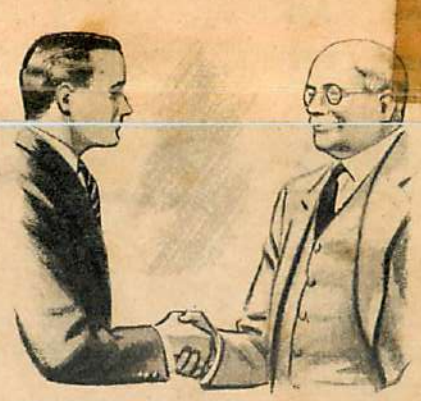
"*Yes sirree!*" I said, laughing—but it's no fun fibbing to your own son! And the fact is, I was a pretty small potato, with no prospects of getting very far with the company.

THAT "*kid question*" started me thinking. I decided to have a talk with Bobby's father. He's a friend of mine—and I knew he had had a pretty big promotion recently.



"I FINALLY learned you've got to have *sound training* to get ahead," he said. "So I went out and got it, through the International Correspondence Schools. I'm out of the rut now."

THAT settled it! I enrolled for an I. C. S. Course in my line of work. The course was clear, concise, simple—yet it enabled me to improve my work on the job 100%! And it was *fun!*



THAT son of mine started something! I've just had my first promotion, and I'm going places! Think it over. If lack of training is holding *you* back, mail this coupon—*right now!*

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