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# AIR TRAILS

DESTROYERS of the AIR by Lieut. W. M. Wood—Page 10

FEB., 1938



from Acorn to Oak in Air Transport by Capt. Samuel Taylor Moore—Page 20  
TROPHY-WINNING MODELS • LIGHT PLANE CLUBS • GLIDING  
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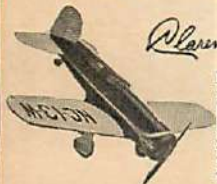


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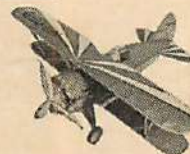
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## CONTENTS

### 3 Articles:

**Destroyers of the Air . . . . . by Lieut. W. M. Wood** 10  
*One of aviation's finest writers, in a discussion of modern pursuit tactics and operations, produces what is probably the most educational article of its kind that has ever been presented to an air-minded audience.*

**From Acorn to Oak in Air Transport . . . . . by Capt. Samuel Taylor Moore** 20  
*An old-timer respected by the industry reminisces on the hard-gained advances of air transport.*

**Convoy-Fighter . . . . . by Frank Tinsley** 24  
*First the Flying Fortress, then the Battle Cruiser, and now it's the Convoy-Fighter. About the plane on the cover—the newest Seversky creation.*

### 2 Stories:

**Hot Stuff . . . . . by Lieut. Comdr. George O. Noville** 14  
*In which a revolution comes to a peppery close.*

**One Shall Die (Bill Barnes Air Novel) by George L. Eaton** 30  
*Bill slammed his stick all the way forward again and went into an outside loop, at a speed that left him giddy—*

### 8 Features:

**Air Progress . . . . .** 4  
*The current news review of aviation.*

**This Winged World . . . . .** 6  
*News photos of airplanes, air events—everything new in aviation.*

**Pictorial History of Man in the Air . . . . .** 17  
*The early days of powered flight.*

**Propeller Parade . . . . .** 18  
*Another in an educational series of pictorial presentations—how propellers are made.*

**What's Your Question? . . . . . by Clyde Pangborn** 26  
*A page of expert information on technical questions for Air Trails readers.*

**The Air Trails Gallery . . . . .** 27 & 36  
*Full-page pictures of the Gloster Gladiator and the Handley Page Hampden.*

**Bomb Development . . . . .** 60  
*pictorial lesson in basic principles.*

**Cross Winds . . . . .** 94  
*The Air Trails Aviation Crossword Puzzle Page.*

### 3 Departments:

**Light Plane Flying Clubs Conducted by Arch Whitehouse** 8  
*New planes for the private flier. An outstanding writer throws light on an interesting situation.*

**Gliding and Soaring . . . . . Conducted by Alexis Dawydoff** 22  
*New contests to be held and the Silver "Cs," featuring Jack O'Meara.*

**Air Adventurers . . . . . Conducted by Albert J. Carlson** 28  
*An association for the advancement of aviation.*

### 11 Model Building Items:

Model Contents are listed on a separate page . . . . . 37



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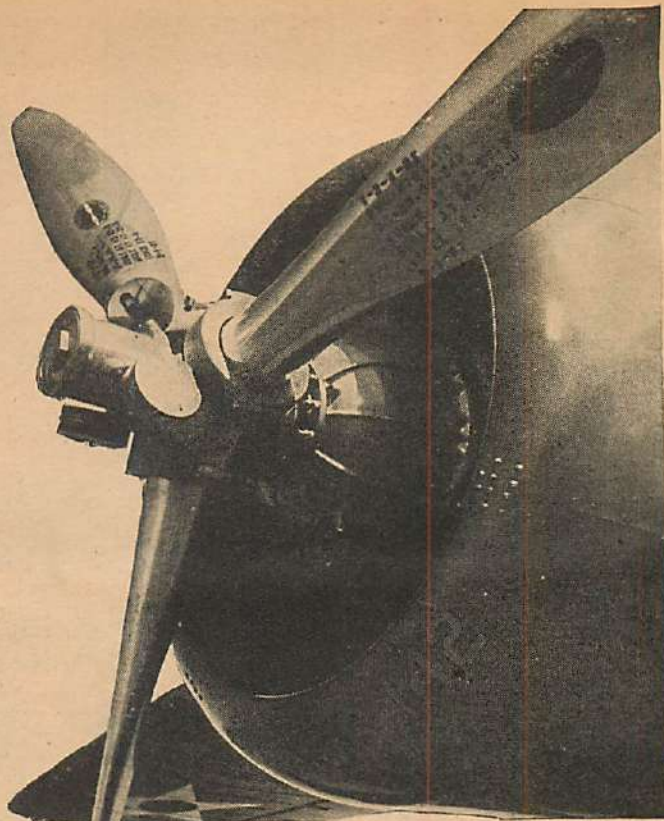
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# AIR PROGRESS

## A SUMMARY OF AVIATION NEWS

The constant-speed propeller which has so improved aircraft performances is the culmination of years of experience and engineering effort.



### TRANSPORTATION

THE value of aeronautical products exported from the United States between January 1st and August 31st in 1937 amounted to \$24,269,243 which represents a gain of about 75% over the same period in 1936. During the first six months of 1937 aviation transport registered a gain of 42,594 passengers over the 421,519 carried in the first six months of 1936.

Schedules of the Chinese air services, including the link between Hong Kong and Chungking, were recently restored since the suspension brought about by the war in China. Schedules will be maintained twice weekly with Chinese planes connecting with the Clippers at Hong Kong. Many American pilots who resigned from these lines some time ago are now back flying Douglas transports. This means that Nanking is now connected by air, by a roundabout method, with Hong Kong and the trans-pacific air line to the United States.

United States-Bermuda flying operations have now shifted from New York to Baltimore for the winter months. Planes of the Pan American line and Imperial Airways will return to the Port Washington base in the spring. The Baltimore base is located in a sheltered harbor where the Patapsco River empties into Chesapeake Bay. Both lines expect to use the Baltimore base next year when they inaugurate their "southern route" through the Azores. But New York will be used as a terminus for the "great circle" route used during the summer months.

Major Albert W. Stevens, stratosphere explorer, recently stated that 480 m.p.h. was absolute tops in airplane speed, as far as pay loads are concerned.

He explained that the compression effect of high speed makes it impractical to attempt to build special planes to overcome this obstacle.

Major Al Williams, aviation expert and speed flier, declares that much of the ballyhoo connected with one-wheel or partially retracted landing gear landings is often misplaced dramatics. He recently pointed out that a pilot who can nurse an ailing engine—or a transport with one engine cut out—down to a safe landing deserves much more credit.

The Glenn L. Martin Co. has just started work on a new giant ocean airliner which will dwarf all Clipper ships. It will have a wing spread of 188 feet and will carry 100 passengers by day and 60 by night. It will be able to fly the Pacific in a single hop or make a round-trip, nonstop flight to Europe. The same company has built a giant flying boat for Russia.

Owing to the fact that proposed transport planes will require longer landing strips, many key cities in the present air-line services may have to face curtailed services until they can enlarge their fields. Washington, Chicago, Kansas City, Denver and Los Angeles will have to lengthen their runways next spring when a number of new 40-passenger planes will be put into service.

The giant flying boat *Lieutenant de Vaisseau Paris* has completed its first round-trip flight of the south Atlantic between Dakar, Senegal and Natal, Brazil. It covered 1,830 miles of open sea at an average speed of 105 m.p.h. without incident.

United Airlines has ordered 28 Pratt & Whitney, Twin-Wasp engines of the 1830-C series designed for operation on 100 octane fuel. (Turn to page 91)

### 30 Years Ago

The Aerial Experiment Association moves from Baddeck, Nova Scotia—where it has been since sponsored by Mrs. Alexander Graham Bell in 1907—to Hammondsport, N. Y. The Curtiss engine factory being located here made it convenient for experiments to be carried out combining the gliders and engine installation for powered flight over the ice of Lake Keuka.

This famous association contained among its distinguished members such noted aeronautical pioneers as: F. W. Baldwin, chief engineer; Thomas E. Selfridge, secretary; Glenn H. Curtiss, chief executive officer; Alexander Graham Bell, chairman; J. A. D. McCurdy, treasurer; and Augustus Post.



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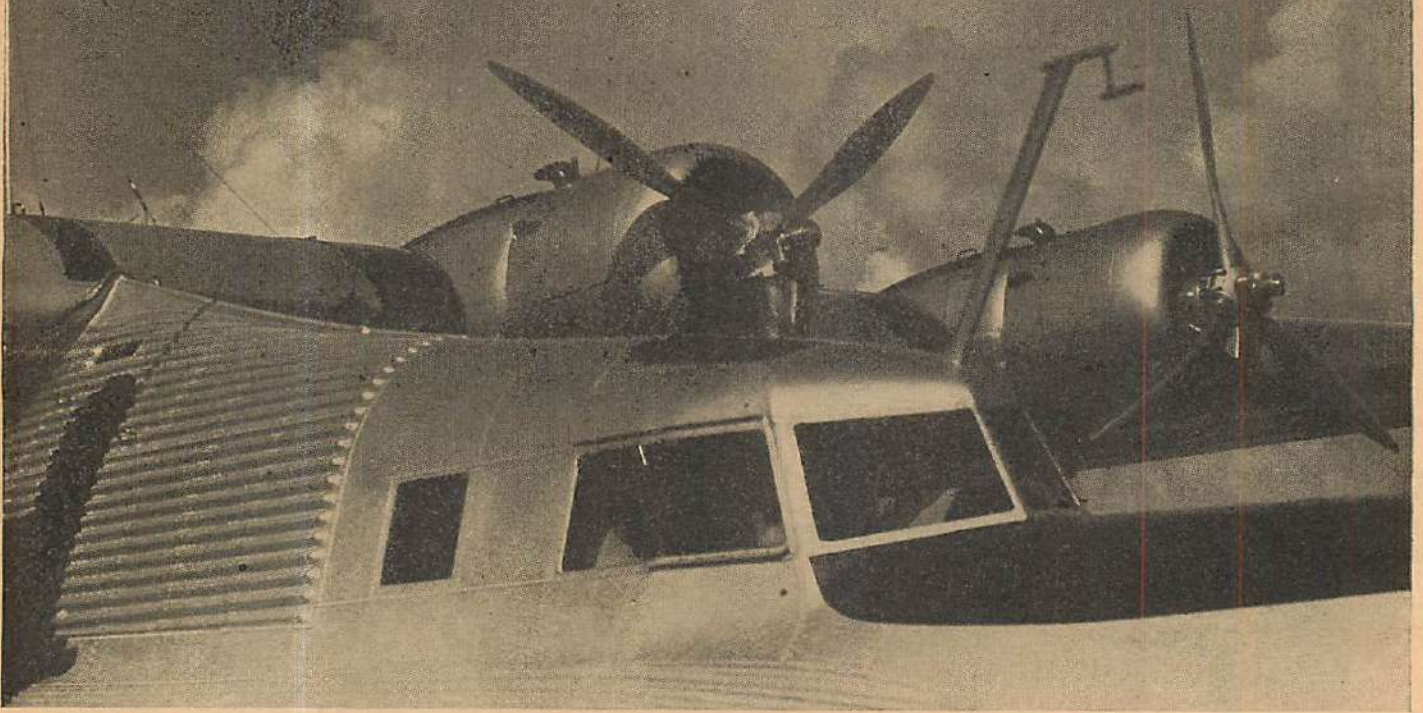
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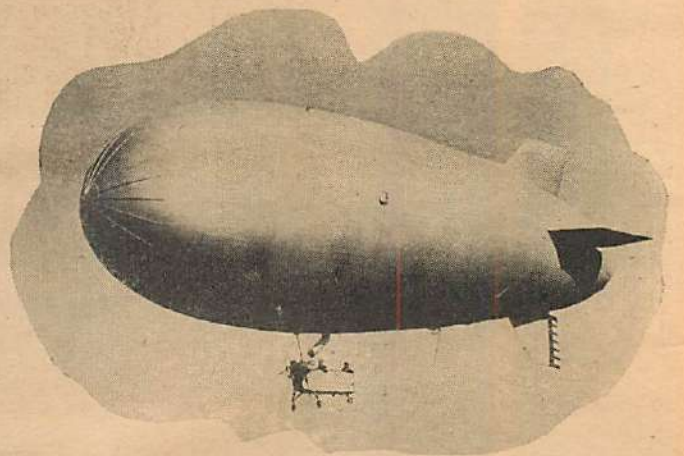
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# This Winged World



PIONEER of transoceanic air transportation, Pan American Airways operating the giant four-motored Clippers—one of which is shown here in close-up—carried 1,986 passengers on their Pacific route in the year ending October, 1937; flew 800,000 route miles and 7,931,312 passenger miles; transported 505,944 pounds of cargo.



MOTORIZED SAUSAGE, recently tested by the army, proved capable of 40 m.p.h. when powered by the 90 h.p. Lambert engine. Hitherto the "sausages" were towed from the ground—a process retarded by trees, power lines and other obstacles.

NEW-TYPE WING FLAPS—standard on the Northwest Airlines' new \$80,000, 260 m.p.h. Lockheed 14 transports—are three times the size of any used before. The peculiar design makes for more efficient handling at landing speeds.

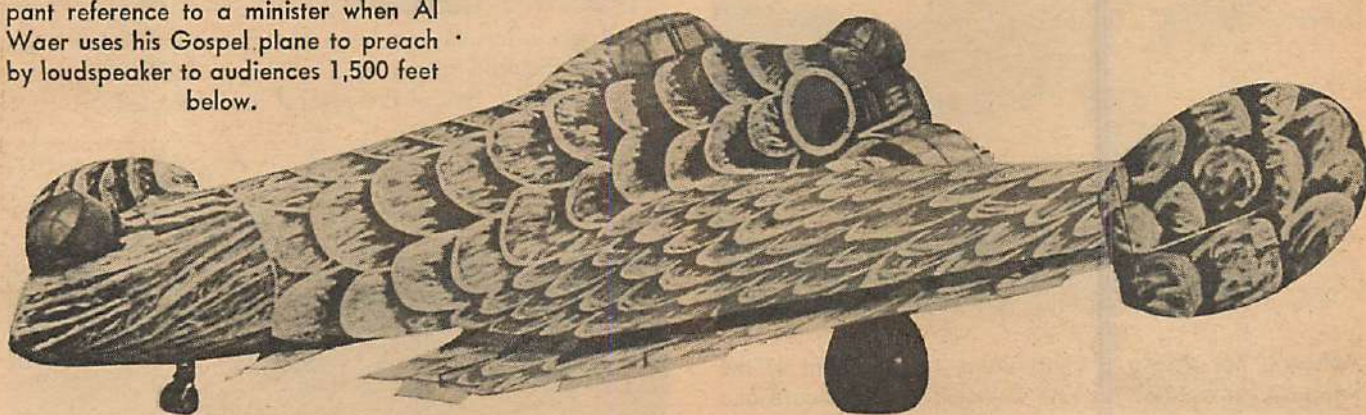




GERMAN OFFICERS, by reciprocal invitation from the R. A. F., inspect Britain's fighting craft at Mildenhall Airdrome.

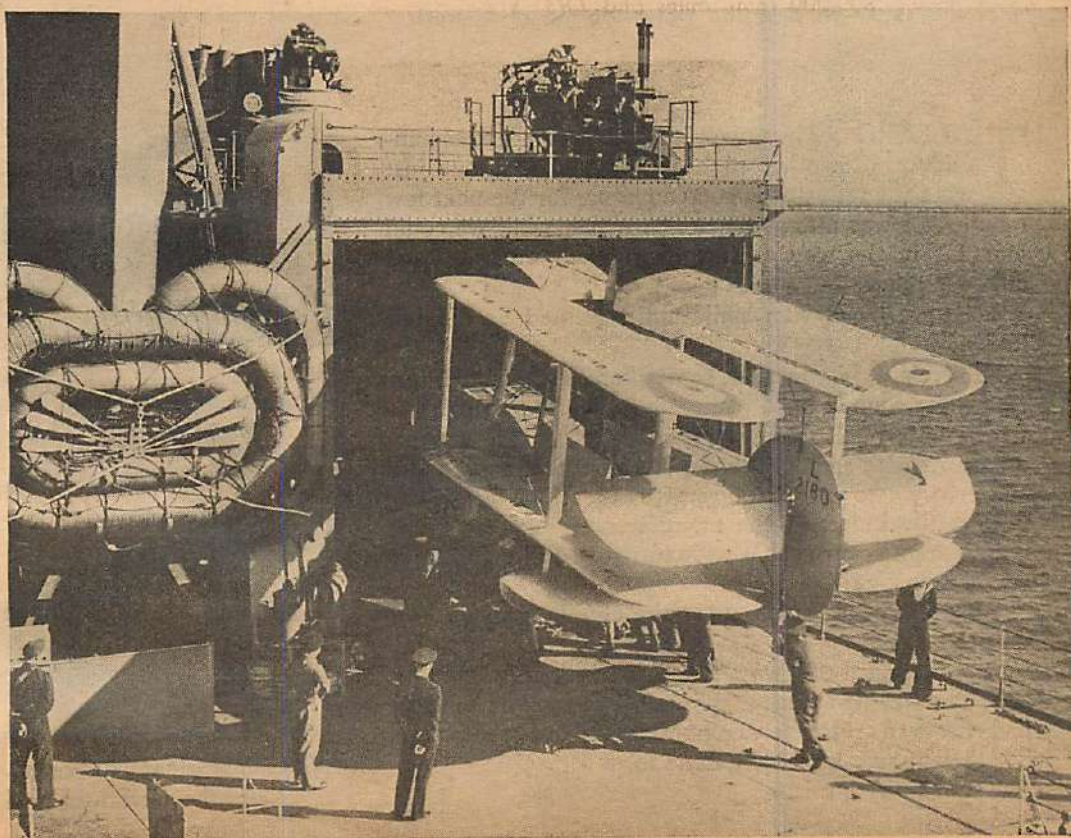


SKY PILOT becomes more than flip-pant reference to a minister when Al Waer uses his Gospel plane to preach by loudspeaker to audiences 1,500 feet below.



BIRD OF PREY describes perfectly this new Russian bomber. Of tail-less design, it boasts both tail and nose turrets. With characteristic flair for odd decorations of planes, the Russians in this instance have even simulated feathers.

WALRUS amphibian, wings folded, is trundled into its special hangar aboard the British cruiser H. M. S. "Sheffield." This newly developed hangar protects the plane from the elements—a feature unused in American practice, planes assigned to navy vessels other than carriers being protected by tarpaulin only.

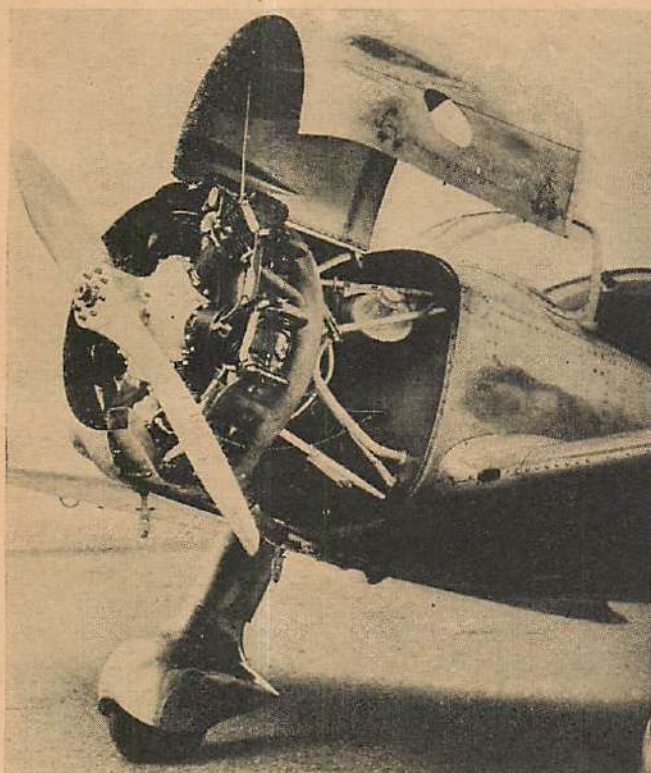




Send in your club news, photos, and notes—A. W.

# LIGHT PLANE FLYING

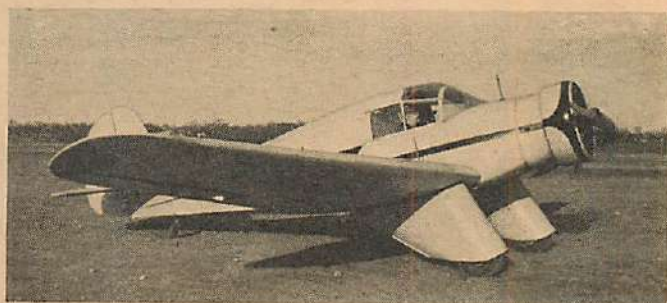
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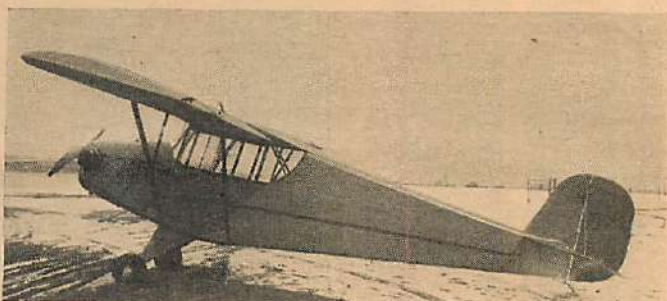
Although not strictly a light plane, this close-up of the Ryan S-C metal-cabin plane is included to indicate one line of development. Note the hinged auto-type hood arrangement. Those who are not too restricted when considering purchasable planes will find the three-view of this ship—on opposite page—to be of interest.



The Rearwin has always been associated with quality airplanes. Pictured above is the 85 h.p. LeBlond-powered model, one of the several manufactured.



The Aeronca LA-70 is as versatile as it looks. Safe in the hands of any pilot, it yet displays fine performance on a 70 h.p. LeBlond.



A true light plane in the full sense of the word, the 37 h.p. Continental-powered Porterfield Zephyr is a noteworthy design. The Zephyr has wheel brakes.



When light planes are mentioned one thinks of the Taylor Cub, the fastest-selling light plane in the world.

TALKING with a well-known light plane manufacturer the other night, I tried to find out just what the industry is contemplating for the next few months. I was attempting to learn just what we could look for in the way of new mounts for our club and amateur pilots.

He gave me a wan smile and admitted he did not know.

"There's a big market somewhere in these United States for a good light plane," he said, "but legislation which helped us so much in the early days is now turning on us with something of a Frankenstein snarl. Did it ever occur to you that aircraft laws, which attempt to protect the industry, the manufacturer and the flying man, cannot cover such a wide territory and do all three subjects justice?"

I admitted that I was not quite certain what he was driving at.

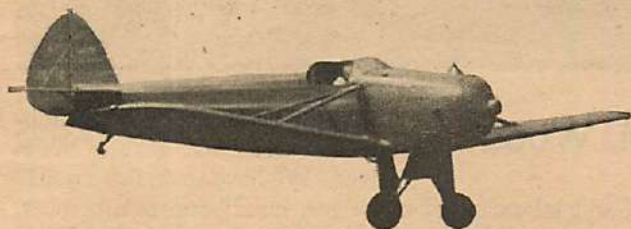
"Let me put it this way, then," he went on. "A short time ago I came across a ship—still flying—on which I had taken a refresher course about five years ago. That's what air laws have done to us!"

I still didn't get it.



# CLUBS

Do you hope to some day own a light plane, or to assist in forming a club? Why not consult your light plane editor, who is prepared to assist you in your problems, through the medium of these pages? Questions pertaining to all phases of light planing will be answered in these columns each month. When time is imperative, this service will be rendered by mail.



The Arrow Sport, because of its auto-type engine (82 h.p. Ford V-8), is considered by one group of visionists to be the light plane ideal of the immediate future.

"Don't you see," he explained, "that that plane, to remain in service so long, must have been rebuilt about five times to pass that many D. of C. examinations? That it still carried its license numbers indicates that it is still in airworthy condition. Had that been an automobile, it would probably have been scrapped by now, and the owner would have bought a new one. As it is, it has been rebuilt time and time again and as far as the owner is concerned, it is as good as it ever was. How far this sort of thing can go, is our problem."

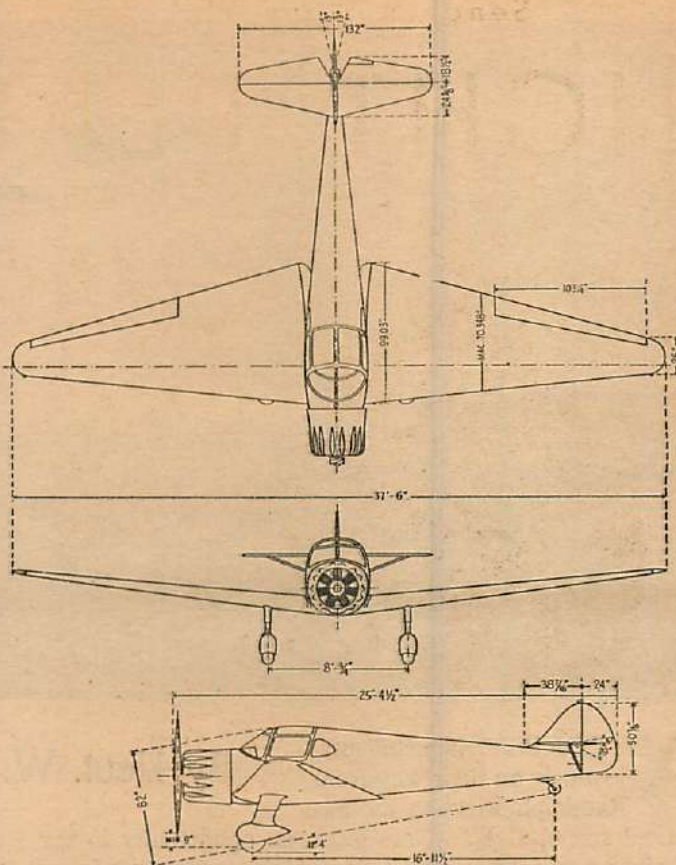
"But," I answered, "if it has been rebuilt several times, you must have made something out of selling the spare parts. The motor manufacturer must have made something, too."

"True," he agreed. "But spare parts in our business comes under the head of service. By the time you have made the part, stocked it, paid a man to keep track of it and then sell it for a replacement, there is little left for profit. Actually, there is very little in this service side of the business."

It was a new angle to me, but at once I realized that the manufacturer's loss was the light plane owner's gain. A second-hand plane, carrying a government airworthiness certificate, is not like buying a second-hand automobile. It *has* to be right, or you can't fly it.

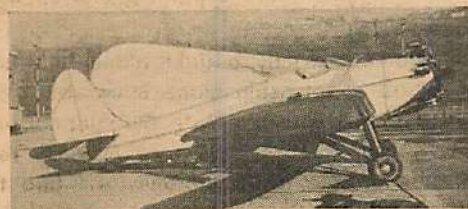
So, if you are considering the purchase of a light plane this spring, here is an important point for you to consider. If you cannot afford a new ship, do not give up your plans. There are plenty of good buys in the market, and the cost difference may mean the price of a parachute, a private ticket, hangar and service costs, or insurance.

(Turn to page 93)



WARNER-POWERED RYAN S-C METAL CABIN PLANE  
RYAN AERONAUTICAL CO.--LINDBERGH FIELD, SAN DIEGO, CALIF.

The Kinner K, powered by the Kinner K-5 100 h.p., has folding wings.



The Taubman LC-13 with the 75 h.p. Rover engine is a newcomer to the light plane ranks.



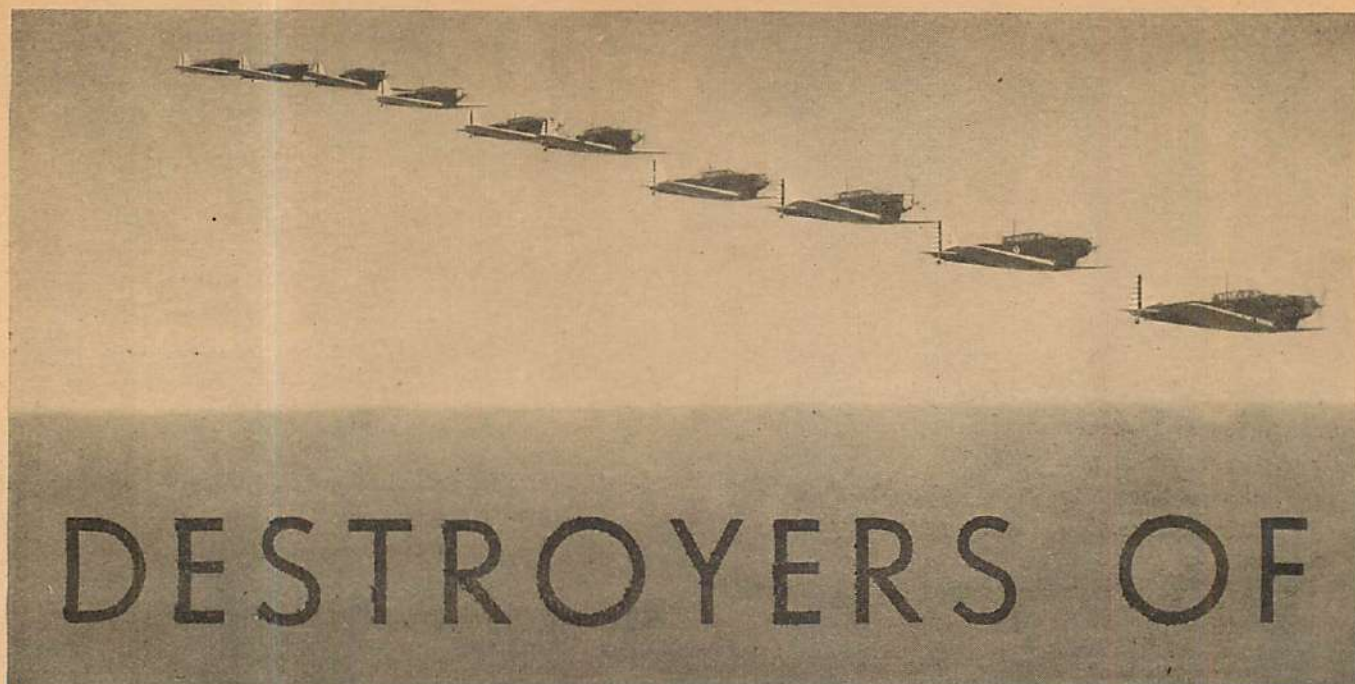
The Aeronca LC, Continental 40 h.p., is the 1938 version of the model K.



The Speedbird, LeBlond 70 h.p. motor, illustrates the possibilities of biplane design.







# DESTROYERS OF

AIR CORPS flying students, joyously on their way from Randolph Field to the ad-

By Lieut. W. M. Wood

vanced school at Kelly, are given an opportunity to say whether they prefer pursuit, observation or bombardment aviation as their specialty. And quite frequently they actually get what they ask for.

Some have a genuine liking for bombardment, observation or attack. A number of others choose those branches in hope of being sent to a certain field after graduation, or for other special reasons, such as the value of bomber flying experience to a man applying for an air line flying job. A large proportion of every class, however, chooses pursuit. Those who don't ask for it generally really want to be pursuit pilots—at least with a portion of their natures which likes to hold on to the feeling that military flying is a heroic, romantic business.

For it can't be denied that the pursuers have the other branches beaten when it comes to dramatic snap and brilliance. Those fast and nimble pursuit ships, of course, make the difference, together with the fact that "pursuit aviation is that branch of the air force which is organized, equipped, trained and employed to destroy hostile aircraft wherever found by offensive action." Pursuers go forth dramatically looking for aerial combat, and they take all comers. The other branches merely try to defend themselves. Their business is to run away and attend to other matters.

Students who don't get pursuit at Kelly immediately become zealously loyal to their own branches, and from then on their admiration for pursuers, if any, is secret.

"Aw, you pea-shooters, go on. All your brains are in your fingers and toes. You haven't enough sense to be observers. Machine-gun fodder, that's all. Good for nothing but to take the gaff while we do the important work!"

"The hell you say! Who couldn't take a few pictures and see when the artillery is overshooting a railroad bridge? If they thought you could fly a ship as well as we can, you'd be right up there in that pursuit formation with us. Fighting, keeping the enemy out of the sky—that's the important work, and we are the boys that can do

it. Why, you observers and bombers can't even take care of yourselves. We have to do it for you!"

"Can't take care of ourselves, huh?" snorts a bomber. "Just tackle us in formation and see how it feels. We'd give you pea-shooters something to take home with you—if you could get home! Besides, you'd never catch us in our new ships——"

And so, on and on, goes the good-natured feud between the pursuers and the rest of the Air Corps. With new bombing and attack and observation planes which are truly amazing when measured by the standards of only yesterday, the nonpursuit pilots no longer have to work so hard to keep themselves convinced that they don't want to be pursuers.

Moreover, the talk about the pursuers' waning importance, caused by the sudden loss of their speed margin over bombardment, threatened to take away some of their prestige. It wasn't fun to be actually outflown by bombers. Recently, however, the combination of cantilever monoplane construction plus fully retractable landing gears, plus tremendous new engines hooked to the new controllable pitch or constant-speed propellers, has boosted pursuit speeds to previously unheard of levels. Once more the pursuers can preen themselves as the fastest birds in the air.

The first flight one makes in a pursuit plane is a never-to-be-forgotten experience. Stepping from a large two-place ship of the basic training type into a single-seater provides a striking contrast. Every pursuit pilot makes the transition cold, for there can be no dual instruction.

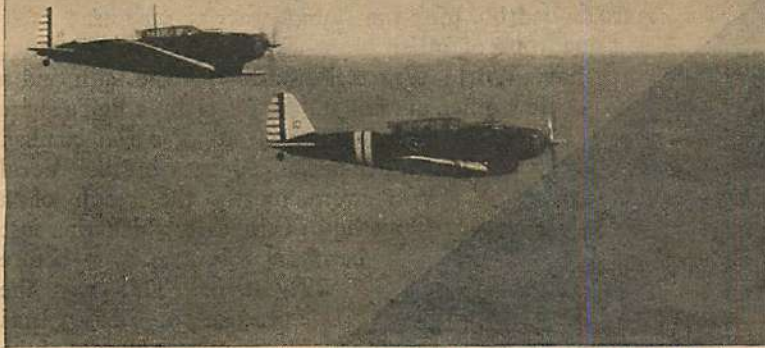
"There it is, it's yours," the instructor says, and the Kelly Field cadet has arrived at a long-anticipated moment. Suddenly the potent-looking little ship looks just as impossible for him to fly as it did months before when he was a goggle-eyed dodo on A Stage. But he puts on his parachute and climbs in.

The wings on each side look ridiculously short and terribly inadequate. The tail is startlingly close to the back of his head. He guns it just a little to turn around and the little ship jumps as if stuck with a pin. Out on the



# THE AIR

*"Pursuit aviation is that branch of the air force which is organized, equipped, trained and employed to destroy hostile aircraft wherever found by offensive action."*



Official photograph, U. S. Army Air Corps.

field and headed into the wind he opens the throttle slowly, for he has been warned not to crack the back of his head against the headrest by opening it too fast.

But it seems he can't gun it slowly enough. The plane surges forward with a tremendous rush, hops off the ground before he quite expects it, and climbs as if scared of the earth. He jerks back the stick just a bit, experimentally, and the little ship leaps upward with a suddenness and force that surprises him. And he gets his first real taste of the peculiar sensation which flying such a ship provides—the feeling that here is limitless power, and that at last he is free in space, free of the dead drag of gravitation. He has never felt that way in the larger ships. They seem to have minds of their own and pay more heed to the laws of gravity and aerodynamics than to his own will. There are so many things they are likely to refuse to do.

But this single-seater! It's as if the little wings, which he feels he could almost span with outstretched arms, were his own wings. So responsive is the ship to the controls, so readily does it perform his every wish, how-

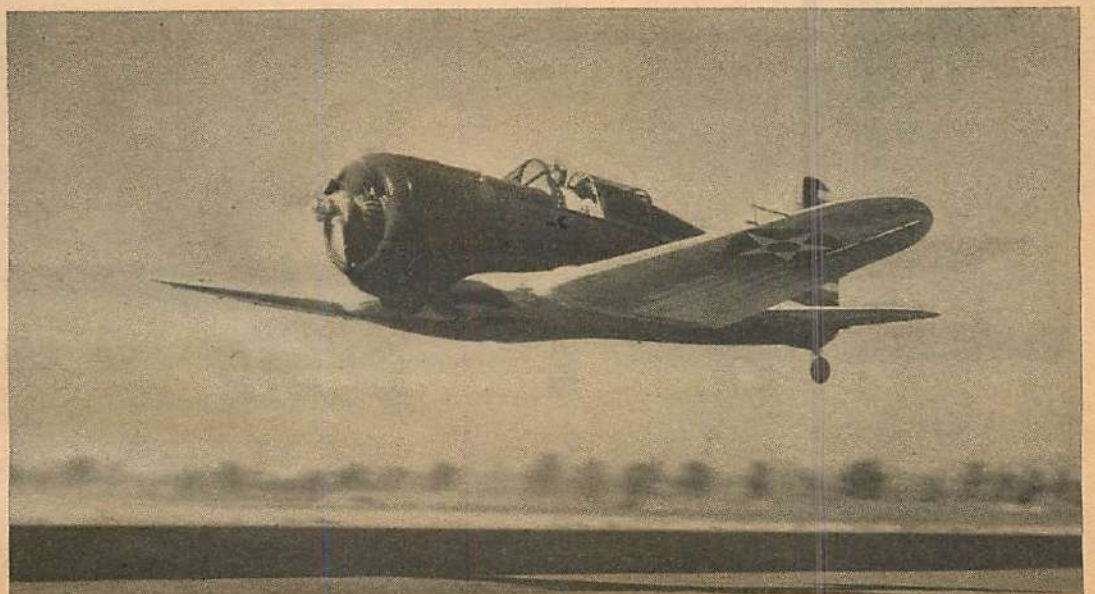
ever extreme it may be, that he feels that he himself is flying, as an angel might, freed from every limitation.

Climbing quickly to a good altitude, he does the squirrel cage—one loop after another without stopping, gaining altitude every time. Then he tries a snap roll, and it turns over three times before he can stop it. He slow rolls, and it is perfect. He spins and it winds up with a velocity that amazes him. He dives. The engine roars and the plane quivers as if with excitement. The air-speed indicator moves up to a figure he never saw before.

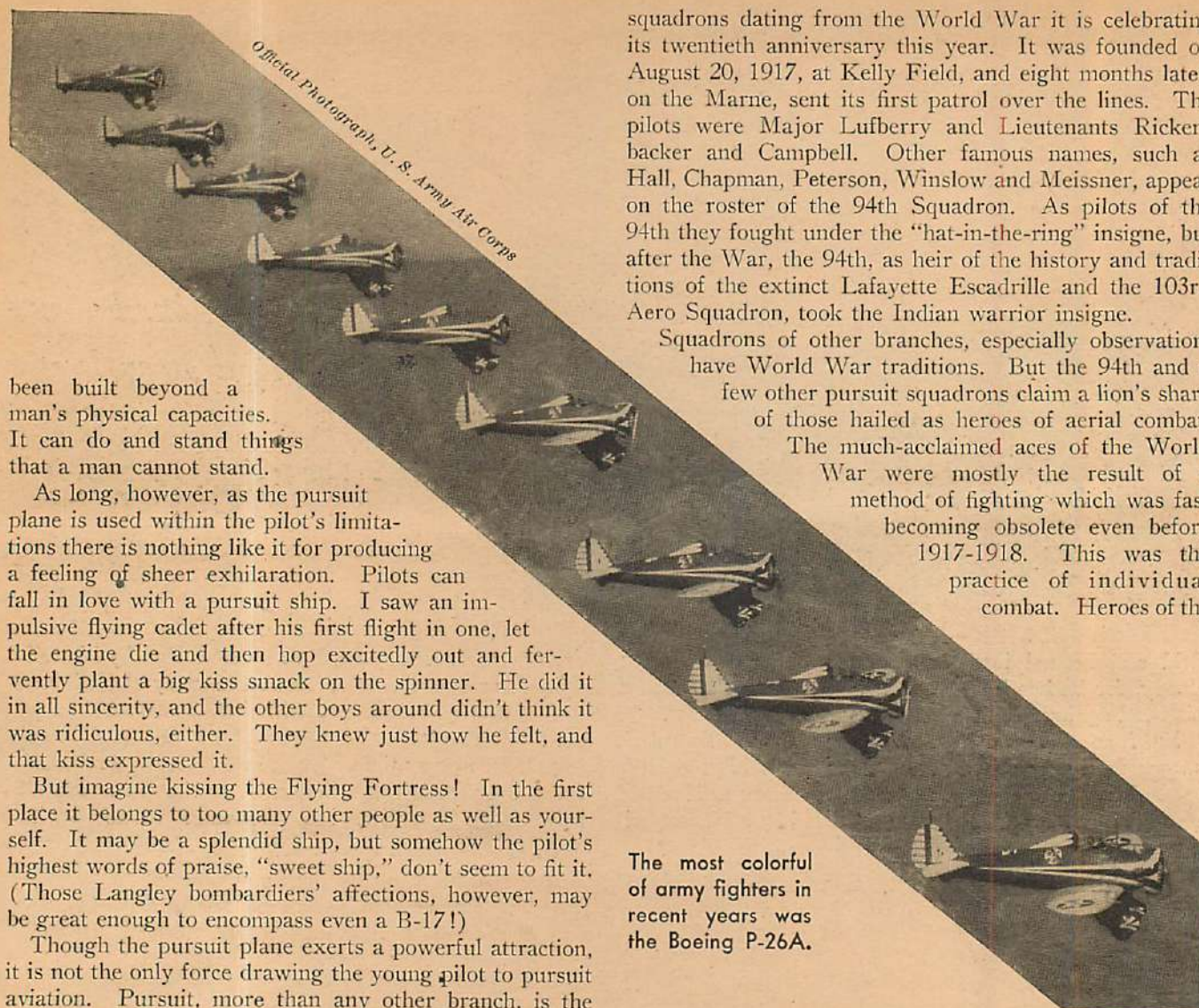
The tiniest movement of the controls makes the plane respond instantly with a hard, tense sort of jerk. The nose becomes harder and harder to hold down, and then he begins to pull out. Though he yells as hard as he can, he just has time to think how strange it is that he wouldn't know he was yelling except for the feeling in his throat, and then everything goes black.

He has blacked out in other ships, but never so suddenly before. And right there he learns what he never forgets about a pursuit ship. It is a splendidly capable machine, but in some respects it is too capable. It has

Above—Two-place, Conqueror-powered, Consolidated fighters sortie forth on practice maneuvers. Right—Scant feet above the ground an army test pilot jockeys an experimental Vought fighter at more than 200 m.p.h. This particular design was originated by Northrop.







been built beyond a man's physical capacities. It can do and stand things that a man cannot stand.

As long, however, as the pursuit plane is used within the pilot's limitations there is nothing like it for producing a feeling of sheer exhilaration. Pilots can fall in love with a pursuit ship. I saw an impulsive flying cadet after his first flight in one, let the engine die and then hop excitedly out and fervently plant a big kiss smack on the spinner. He did it in all sincerity, and the other boys around didn't think it was ridiculous, either. They knew just how he felt, and that kiss expressed it.

But imagine kissing the Flying Fortress! In the first place it belongs to too many other people as well as yourself. It may be a splendid ship, but somehow the pilot's highest words of praise, "sweet ship," don't seem to fit it. (Those Langley bombardiers' affections, however, may be great enough to encompass even a B-17!)

Though the pursuit plane exerts a powerful attraction, it is not the only force drawing the young pilot to pursuit aviation. Pursuit, more than any other branch, is the heir of the heroic tradition. To have one's name inscribed on the rolls of the 94th Squadron, for instance, and to fly a ship bearing the painted likeness of a wild Indian warrior, is not an honor to be sneezed at. For that is the insigne of the Lafayette Escadrille.

The 94th Squadron is now assigned to the First Pursuit Group at Selfridge Field. Like practically all the

squadrons dating from the World War it is celebrating its twentieth anniversary this year. It was founded on August 20, 1917, at Kelly Field, and eight months later, on the Marne, sent its first patrol over the lines. The pilots were Major Lufberry and Lieutenants Rickenbacker and Campbell. Other famous names, such as Hall, Chapman, Peterson, Winslow and Meissner, appear on the roster of the 94th Squadron. As pilots of the 94th they fought under the "hat-in-the-ring" insigne, but after the War, the 94th, as heir of the history and traditions of the extinct Lafayette Escadrille and the 103rd Aero Squadron, took the Indian warrior insigne.

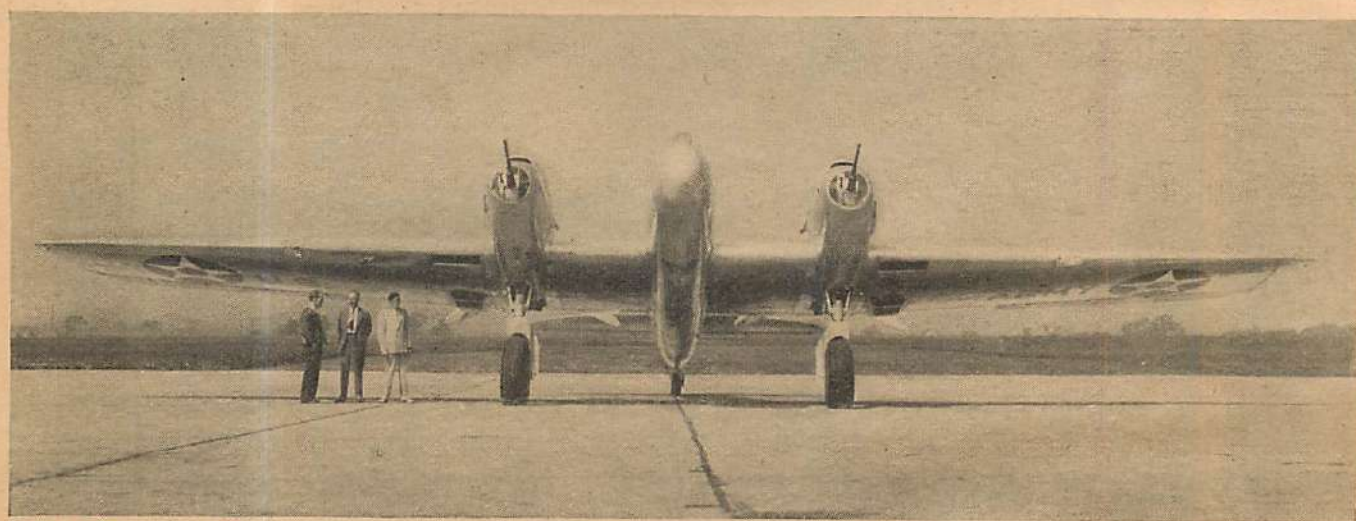
Squadrons of other branches, especially observation, have World War traditions. But the 94th and a few other pursuit squadrons claim a lion's share of those hailed as heroes of aerial combat.

The much-acclaimed aces of the World War were mostly the result of a method of fighting which was fast becoming obsolete even before 1917-1918. This was the practice of individual combat. Heroes of the

The most colorful of army fighters in recent years was the Boeing P-26A.

air lurked behind clouds or in the sun's glare and then came tearing down with guns blazing on some solitary and surprised enemy plane. After the duel, the victor took pains to have his victory confirmed and another notch went on the machine gun.

Beginning with the Battle of the Somme, in 1916, the



U. S. Air Corps Official Photo

The revolutionary design of the Bell, five-place fighter witnesses the most formidable offensive armament ever to be concentrated in a fighter.





Official photo, U. S. Navy

Germans and the Allies began sending out pursuit planes in ever-larger formations. Individual combat gradually gave way to group combat. But the exploits of individual pilots overshadowed this change. The ace, however, was much less conspicuous in the European forces after 1917, though he retained the spotlight in the American units until the end.

In another war there would probably be fewer aces. Pursuit planes would go out in groups of 75 or more planes each, and these usually would keep in close contact with one or more other groups, forming a wing. In actions against enemy airplanes, which would also be in formations, a whole squadron of 18 or more planes might be firing on the same group of targets at the same time. So it would be difficult to say with assurance which pilot's bullets did the work. Even when a single plane—such as an observation plane—was being attacked three pursuit planes would be detailed to open fire at the same time, one from behind and the others from the sides.

Only in the case of an attack on an isolated single-seater would a single pilot be likely to fire alone. The best way to attack an enemy single-seater is to dive "on his tail" from above. In an attack on a lone single-seater the pilot in the best position would attack first, and the next man in position next. But the chances are that lone single-seaters would rarely be encountered.

Air duels between two pursuit planes would not be

The pride of the navy are the Grumman F3F-1s, rugged, high-speed hornets that swarm on the aircraft carriers. Upon them rests a vital part of the nation's defenses.

sought in a future war. There would be organized fighting in formations and disorganized group fighting, sometimes called "mêlée fighting." It is an accepted principle that general disorganization would be the result of a battle between pursuit formations which lasted any length of time. Despite efforts to effect reorganization in the air by designating rallying points, there is no World War case on record of a disorganized pursuit formation being returned to control before landing.

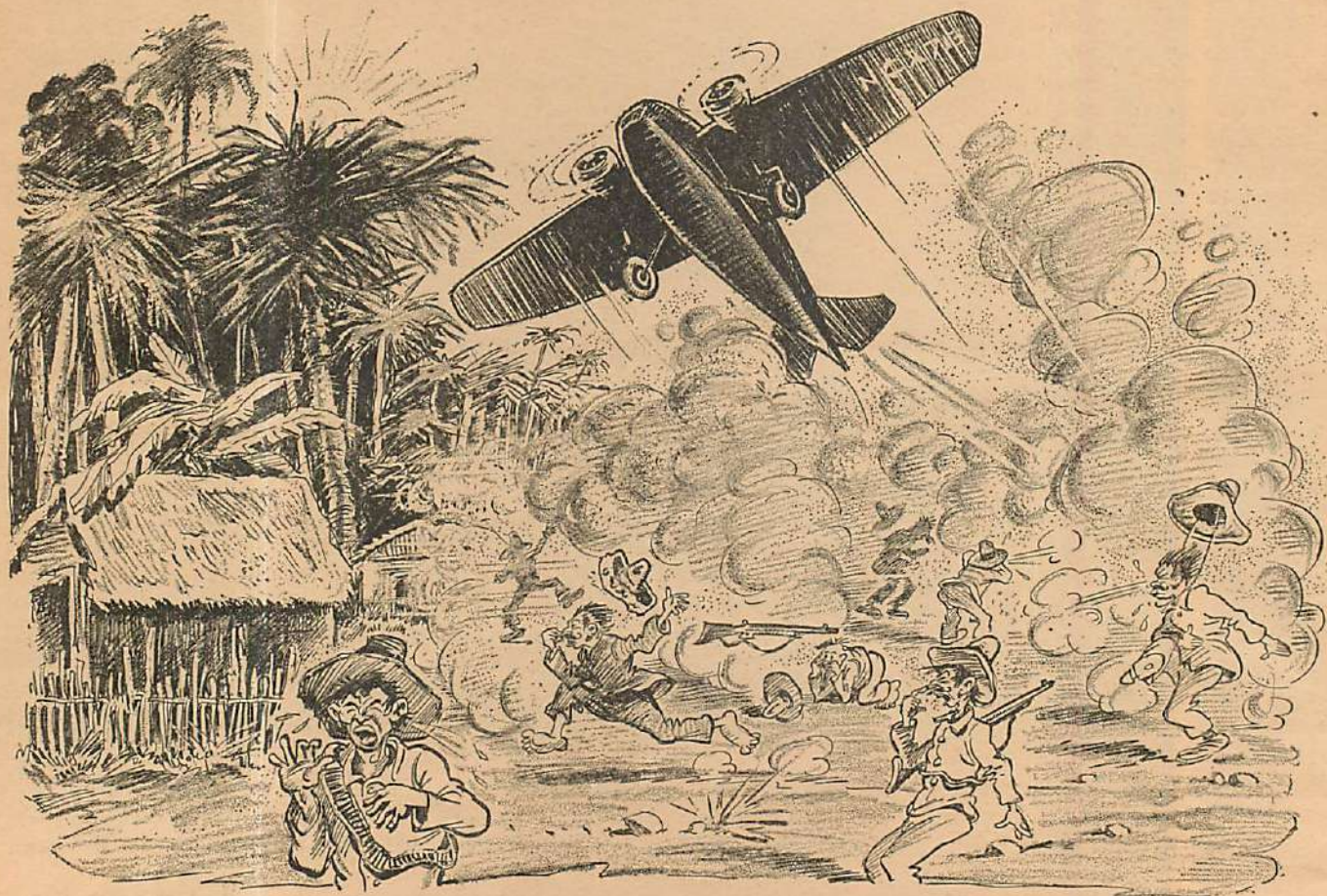
The problem of regaining organization in the air under all conditions is one which students of pursuit tactics have been trying to solve. Radio would be used in an attempt to preserve contact between leaders and (Turn to page 61)

A formation of navy Grumman F2F-1s. The F2F-1s boast the finest of service records.





# HOT STUFF



On the ground under the banana trees was a scene difficult to depict— No strategist could conceive such surrender—insurrectos were going into convulsions—

**L**ISTEN, you fatheads." Hartley, chief pilot for the Consolidated Fruit Co. at Puerto Bezondo, pointed at a low hull and streamer of smoke appearing at the entrance to the shimmering bay. "That scow will dock in an hour and when she does, she's unloading more grief than I've had in ten years."

Contrary to what one might expect, the group of Consolidated pilots lounging on packing cases and bales within earshot of Hartley's voice, on the little wharf, were no hard-bitten crowd of old-timers. With the exception of Hartley and "Swede" Larson, his assistant, they were all fresh-faced, keen-eyed youngsters.

"The quarantine officer's boat," Hartley continued, eying the steamer with apparent distaste, "just brought me the passenger list and he says there's one pilot aboard consigned to me. His name's Norton—Charles P. Norton. Does that mean anything to you clucks?"

"Not Hot Stuff Norton?" queried Parsons, the youngest of the group.

"Yes. Hot Stuff. And if you get anywhere near him you're going to get scorched. Why they wish that guy on me at a time like this, I don't know. I ask for a good pilot and what do I get?" Hartley glared round at the solemn-faced group. "I get a tornado, a cyclone, a buzz saw gone wild, all wrapped up in a bundle and

marked 'One Good Pilot.' He can't fly in the States for another year. He's grounded because he looped around a bridge, dived down on a county fair and stampeded all the cattle and horses on exhibit, and then ambled over to the race track for a free look at the races. They haven't found some of those horses yet!"

The siesta hour had passed and from behind the trees and lush, tropical growth fringing the bay could be heard the clank of tractors, the low rumble of machinery and the faint *toot-toot* of tiny locomotives. The rambling hills were dotted with the brightly painted shacks of the native laborers, nestling in the regimented rows of banana trees. As far as the eye could see the plantation seemed to have been laid out with mathematical precision—thousands upon thousands of acres planted in bananas, pepper and coffee. This was the largest *finca* or plantation of the great Consolidated Fruit Co.

"But Hot Stuff is a good pilot, Hart," injected the grinning Swede Larson.

"Sure he's good. He's better than that. He's too good. He gets funny ideas. He craves excitement. He looks upon the *vino* when it's very, very red, and he'll look upon the señoritas until they get very, very red." The chief pilot shook his head grimly. "As soon as that guy steps ashore, I feel something's going to happen."



He eyed his expectant, grinning "peelots" sourly. "And here's a word of warning for you youngsters. Give him a wide berth. He doesn't get that name for nothing. He's Hot Stuff, and I don't mean maybe! You'll save me and yourselves a lot of trouble if you let him go to hell in his own sweet way."

The company warehouses were crammed to the doors with the season's crops. It had been a good season—not too much rain—and the airplane crop dusting had limited the activities of the plague of fruit-destroying insects. Consolidated maintained a fleet of twelve planes equipped with great hoppers that distributed tons of finely powdered copper sulphate and dehydrated lime over the newly budding fruit. Bananas are the gold of these Central American countries and, like the gold of other countries, they are guarded with infinite care.

The pilots who operate the "crop dusters" play a hazardous game. In order to lay down the trailing clouds of poisonous dust, they fly at unbelievably low altitudes—from twenty to fifty feet—above the tops of the closely banked trees. They stagger off short runways with heavily loaded planes and follow a deadly routine. Back and forth, back and forth, pouring out billows and clouds of poisonous dust. The routine may be deadly but it is never monotonous. Alert every split second they are in the air, the pilots develop a supersensitiveness to motor sounds and an uncanny knowledge of the terrain over which they fly. A conked motor at that low altitude means only one thing—a crash. It is said among the pilots at Puerto Bezondo that every time a "duster" takes off, St. Peter sharpens his pencil.

Hartley turned to look out at the white ship slipping up the channel and saw O'Rourke, the genial, ruddy-faced plantation manager, grinning broadly. O'Rourke, in his rubber-soled sneakers, had slipped unnoticed into the group while Hartley had been talking.

"Hello, Hartley," he said in his quaint brogue. "What's this I hear about this Hot Stuff felley? Are ye exaggeratin' a little? Or is it the truth?"

"I'm afraid it's the truth, Mr. O'Rourke."

"Well, what with the revolution movin' in on us, an' a wild aviator in our midst, we shouldn't lack excitement. However, ye might explain to the buckaroo that there's a revolution on here and we're in a ticklish spot. Tell him he'll take no sides in any political arguments at all, and that we're merely innocent bystanders with instructions from New York that if we use force or fire a single shot whatsoever, even in defense of the property, it'll mean our jobs."

"O. K., Mr. O'Rourke. And how is our little revolution this afternoon?"

"Not so good. The Federal troops are on the run and they're gettin' closer every day. The president has closed the palace and if he doesn't come out soon an' stop these Cardenas guerrillas, he'll have no job either."

The clatter of lowering gangways interrupted the conversation and the group drifted slowly over to scan the descending passengers. Hartley and O'Rourke stood together idly chatting, when suddenly Hartley nodded toward a slender spare figure striding briskly down the gangway.

"There's Hot Stuff now."

"Not a vicious-looking lad, Hartley. Bring him over."

Hartley stepped to the foot of the gangway and touched the slight man's arm.

"Hot Stuff" spun around, stared and then clapped Hartley on both shoulders. "Hart! You old so-and-so! I haven't seen you since we flew for Pop Devine! How's tricks? When do I start sprinkling powder on the little bugs' tails?"

"Hello, Hot Stuff. Welcome to our city. Never mind about your baggage. We'll get it through later. Come on over and meet the manager, O'Rourke."

Following the introduction, O'Rourke shrewdly and closely observed the restless, slender figure whose short, clipped sentences conveyed the impression of alert, hair-trigger mental processes. He asked a few brief questions. Then, "Do ye speak the language?" he inquired.

"Yes. I flew Standard Oil pay rolls in Mexico for two years."

"That'll help," O'Rourke nodded. "Keep out of the sun, the cantinas and the hearts of the señoritas, and ye'll stay on the pay roll." To Hartley he added, "Fix him up with quarters, and I'll see ye at dinner time."

O'Rourke walked away to join a group of gesticulating native officials and left Hartley and Norton alone. Hartley put his hand on the young man's shoulder. "Look, Hot Stuff. You're working for me now, and there are a few things—"

"Wait, Hartley," Hot Stuff interrupted. "Let me get something off my chest first. We've known each other for a long time and I know what you're going to say. But don't say it. Listen. I had a swell job with Central Airlines and lost it. The Department grounded me for a year. You know that if Central kept me on a night run for eight months I was behaving myself. I'm on the wagon and have been for two years. Central had to let me go because the Department grounded me and suspended my license, otherwise I'd still be up there flying my old crate."

"I got into this mess because I decided to lead a clean, decent life. Don't laugh. It's on the level. In a few words, it's this: I'm crazy about a gal in Cleveland. Every time she looks at me I'm upside



*"As soon as that guy  
steps ashore I know  
something is going to  
happen."*

By  
Lieut. Comdr.  
George O. Noville



down, hanging in the belt. But she's afraid of me. I've got a reputation and everything. Finally, I wore her down and we got engaged. The day she promised to marry me I had to do something or blow up. I borrowed a ship from Jerry Fox and flew down to Akron and was just jazzing around when I saw this fair. I wanted those bozos to know how happy I was and I tried to show them. But they thought I was nuts instead of happy. Result—the Department grounds me for a year and my gal turns thumbs down on me. I moped around until this job showed up then went to see her. She told me if I could hold this job down for a year, and keep out of trouble, the engagement is on again. Otherwise, I can solo right out of her sweet young life.

"Hart, this is serious with me. I need this job and it means my girl—and she means everything. You tell me what to do and when to do it, then stop worrying."

Hartley had watched him closely while he talked. Maybe the kid really meant business this time. "You mean no liquor, no women, no——"

"No nothing," Hot Stuff interrupted earnestly. "I've got a job for a year and a wife when the year is over."

"Maybe," Hartley muttered under his breath. Then, "O. K., Hot Stuff. But this sounds too good to be true. I'll keep an eye on you, and just once you bust out of the traces—home you go."

"O. K., chief. Bring on your bugs."

At dinner that evening were Swede Larson; Fields, assistant to O'Rourke; Hartley; his "peelots," as he fondly called them; five overseers and three clerks or warehouse men. O'Rourke's seat at the head of the long table was vacant. It was a sultry night and the heavy perfume of ripening fruit and the odor of rotting jungle intermingled made the atmosphere oppressive and thick.

The conversation, however, was light. The "peelots" were avid for news from home—not home and fireside, but home flying fields. Did Patterson actually forget to lower the landing gear when he piled up that big Douglas? How about that Stearman-Hammond? Did it do all the things the Department hoped it would?

Questions and answers all through the dinner, and Hot Stuff knew all the answers. Before dinner was half over Hartley knew his youngsters were scorched by Hot Stuff's personality.

O'Rourke came in as the coffee was being served. His usually genial face was decidedly ungenial. Every one knew something was wrong when O'Rourke clouded up, but each refrained from questioning until Hartley finally burst out. "What's wrong, chief?"

"Plinty!" O'Rourke growled. "Everything's wrong, me buckaroos! This evening the insurrectos are movin' onto the *finca*. Cardenas, himself, bad cess to him!"

"Right onto the plantation?" a half dozen cried at once.

"Right in the midst of us! Cardenas sint one of his officers half an hour ago to inform me he was occupyin' the *finca* with his min. We are to remain indoors while he bivouacs his army under the banana trees. He demands food for his min and rum for himself, the son of a goat!"

"What's the next move?" Fields asked.

"How th' devil do I know? The Federals have about faced and are close behind Cardenas. If I furnish the insurrectos with food, the Federals will accuse me of aidin' the inimy and confiscate the property, if they win."

"And if you don't furnish food and grog?"

"I'll find out later. I've demanded a conference with Cardenas. I have a few things to take up with the gentleman—bribery bein' one of them."

After dinner the conversation mainly concerned revolutions, insurrectionists and the wake of destruction left in the paths of these pseudo wars. The company was bitterly criticized for the nonintervention order and the orders that left the men practically unable to defend themselves in case of attack. The absence of consular authority was discussed pro and con. The criticism and blasting ceased when O'Rourke rose and motioned to Hartley to accompany him.

For over an hour the group in the palmetto-roofed dining-room chatted of everything under the sun. Hot Stuff, however, was noticeably silent and restless. He puttered around the room, paused at windows and peered out, trying to pierce the black curtain of tropic night. Suddenly he lifted his hand and out of the ensuing silence came the thick, muttering voice of O'Rourke. Only an Irishman could curse as encompassingly as that.

The *finca* manager strode into the room belligerently with Hartley dejectedly trailing him.

"And so?" pertly inquired Hot Stuff.

"And so," snarled O'Rourke, "the dirty devil has us where we can't move. If we don't furnish grub and whatever else he wants, he'll burn down th' buildin's an' destroy th' *finca*. If we feed him an' his rag-tag army, th' Federals confiscate us.

"Ye better all pack yer bags an' be ready for th' next steamer. Ye can't take this one because Cardenas won't allow th' captain to clear. On top o' that, the Federals are surroundin' th' place an' to-morrow 'tis likely we'll be smack in th' middle of a Cintral American revolution. Now turn in, all of ye, an' don't stick yer noses outside of these buildin's to-night. I have enough troubles without worryin' about you felleys. I'm cablin' New York an' tellin' them of th' beautiful situation they've put us in."

"Gone with the wind!" murmured Hot Stuff to no one in particular.

O'Rourke lowered his brows. "What's that?"

"My job and a lot of other things—gone with the wind."

The manager's eyes twinkled for a moment. "'Tis not with the wind they've gone, lad—with the insurrectos."

The diners trooped out to the barracks that comprised the living quarters of the pilots, overseers and warehouse clerks. It was an oblong building with a porch running along one entire side, upon which all the rooms opened. Hot Stuff was bitterly hostile at the possibility of losing his job, and his companions were forced to caution him against talking too loudly concerning Cardenas' family on the maternal side.

The men gathered in small groups. Hot Stuff paced up and down in deep thought, finally joining the little group of warehouse men at the end of the porch.

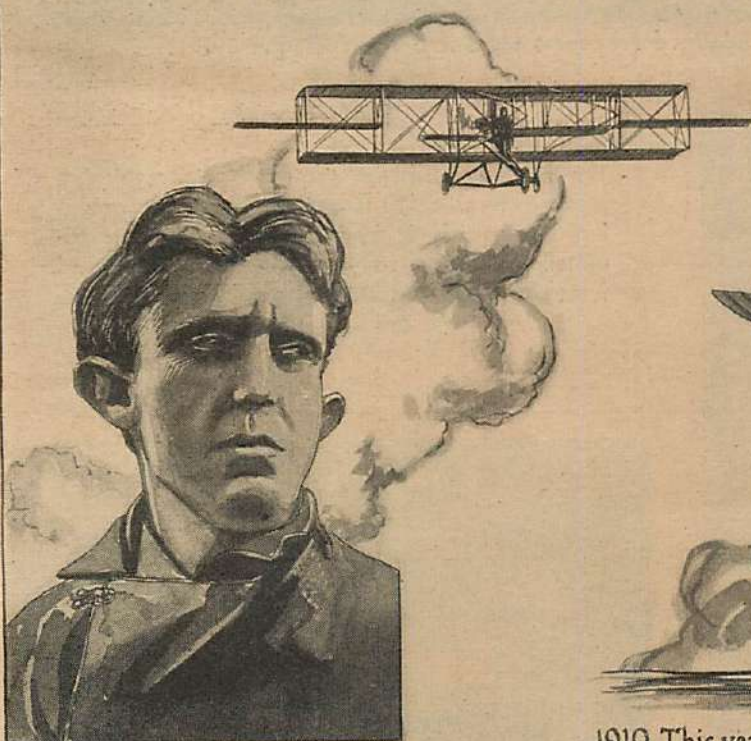
"Tell me again," he said to one of them, "what the company's idea was in grinding their cayenne pepper here, sealing it in air-tight cans and shipping it?"

The clerk went into a lengthy and detailed explanation that required half an hour. When he had concluded, Hot Stuff yawned, mouthed an unintelligible "good night," and strolled down the porch. As he passed Parsons he nudged him and jerked his head toward his own room. Parsons followed him inside (Turn to page 89)

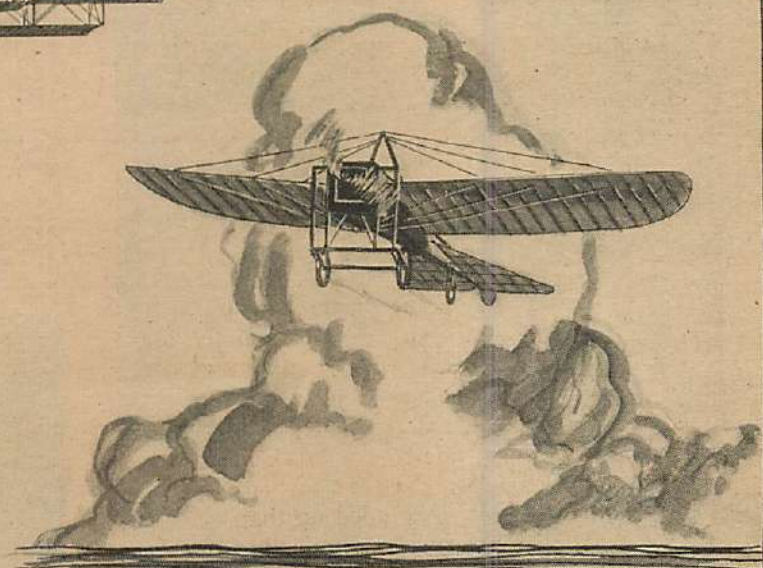


# Pictorial History of Man in the Air

1910 Hon. Charles Stewart Rolls of England was first to fly the English Channel from the English side as well as the first to fly across the Channel back, non-stop. He completed this flight June 2<sup>nd</sup>.



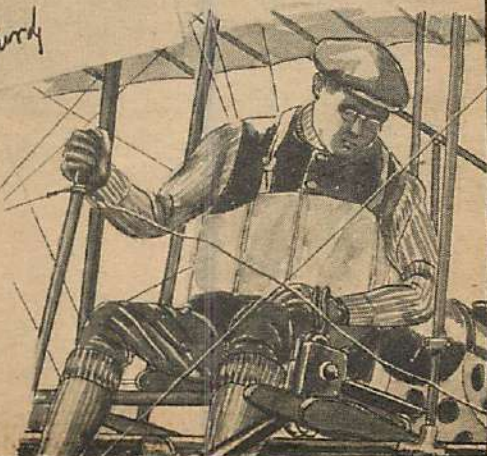
1910 Charles K. Hamilton, first to fly cross country in America. He flew from New York to Philadelphia and back on one day, in 3 hours and 17 minutes. June 13<sup>th</sup> 1910



1910 This year, also saw the first flight across the English Channel with a passenger. On August 17<sup>th</sup> John B. Moisant of America crossed from Paris to London with a passenger and his pet cat.

Another chapter in aerial achievement is recorded in the sending of this wireless message from an aeroplane. in flight  
J.A.D. McCurdy

1910 Another milestone of this great year was the sending of the first wireless message from a plane in flight. On August 27<sup>th</sup> J.A.D. McCurdy sent the above message to H.M. Horton at Sheephead Bay.

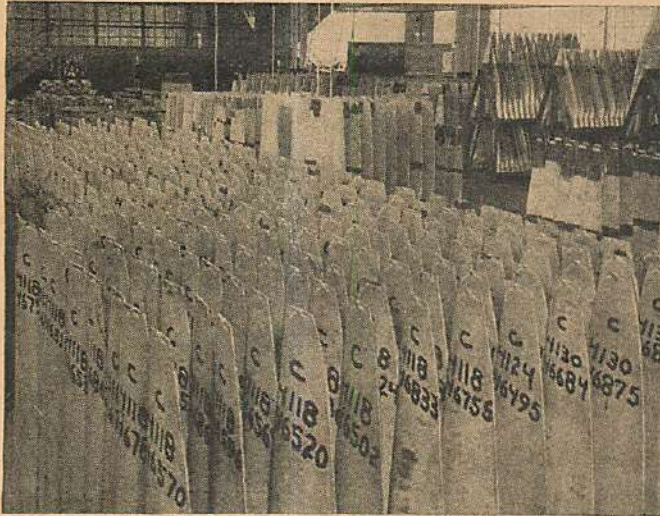




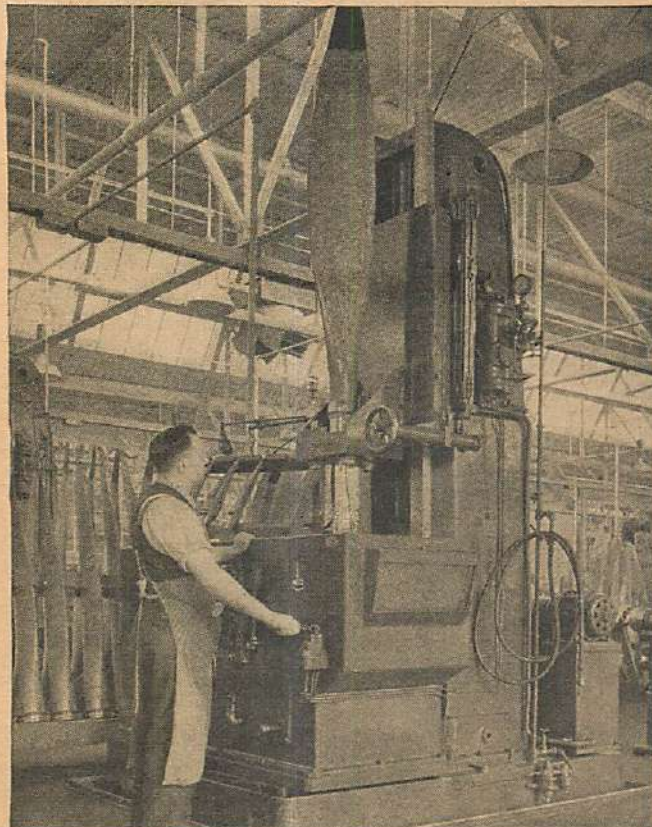


# PROPELLER PARADE

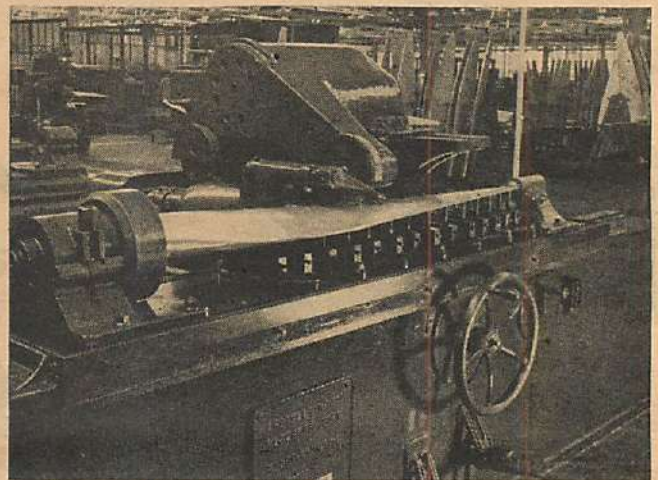
Day and night the new Hamilton Standard Propellers plant is a scene of activity.



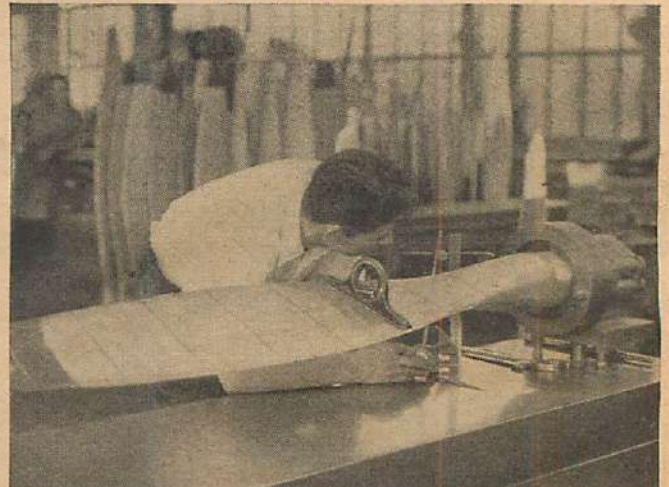
1. Blade forgings before machining.



2. Boring the taper hole in the blade shank. The hole diameter is accurate to within ten-thousandths of an inch.



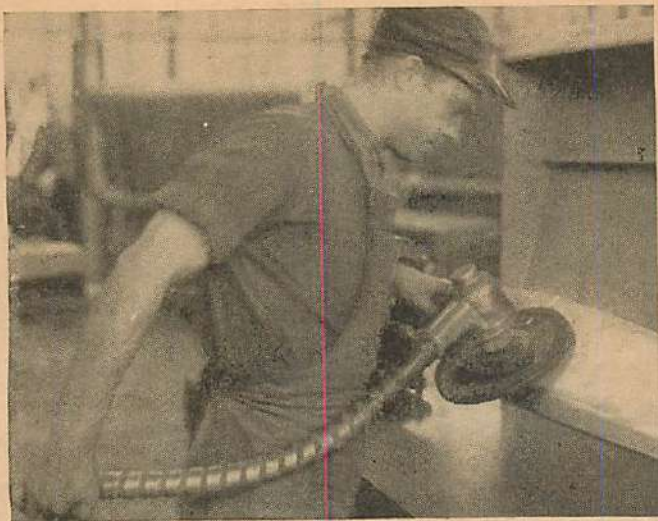
3. This machine profiles blades to the proper contour.



4. The blade forging angles and alignment are carefully checked at all blade stations.

The modern propeller may be a three-bladed affair as large as 13 feet in diameter, and weighing 350 pounds or more. It consists of approximately 200 parts, some of which must withstand forces as high as 150,000 pounds, yet it is built with amazing precision.





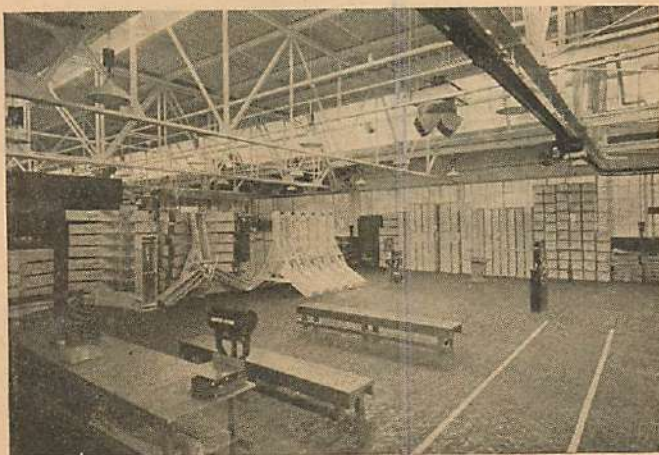
5. Grinding the blade to exact contour.



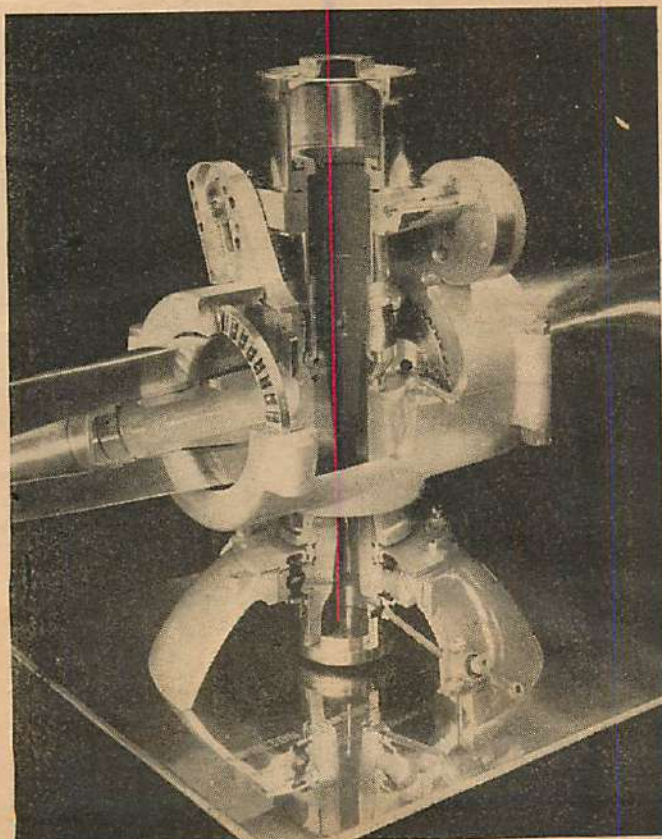
8. This machine transforms bar stock into small parts.



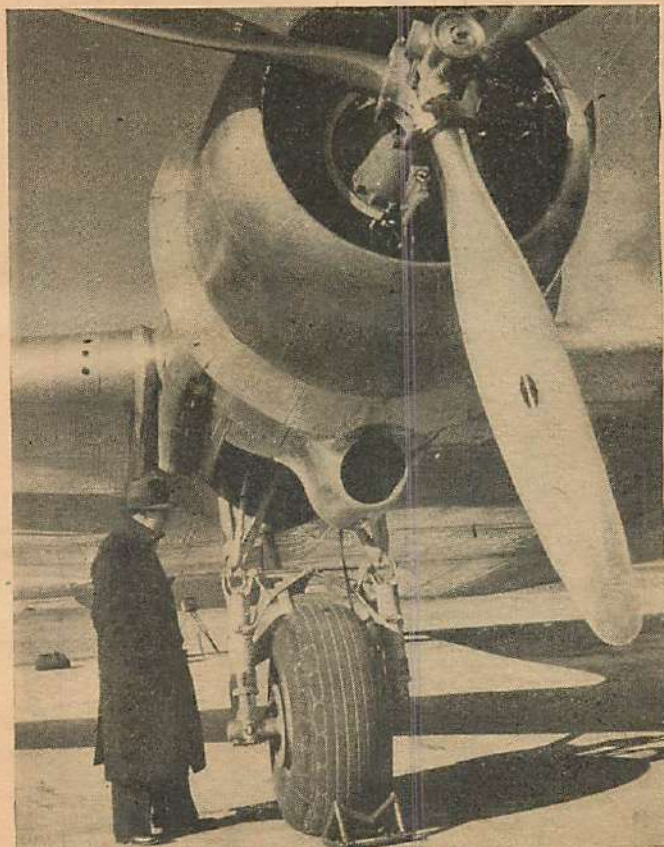
6. Template checking the grinding operation.



9. Propellers packed in their novel shipping crates.



7. Cutaway view of two-bladed, controllable-pitch propeller. The blade angles are adjustable in flight.



10. A typical installation: A constant-speed propeller on the Twin Wasp-powered "Mainliner."





Interior of a TWA Skysleeper. The stewardess in the background is preparing four of the eight berths. Aft of the sleeping compartment are nine chaise-longue chairs.

Ten years is the life span of practical air transportation. The development of the air liner is graphically illustrated by these United Air Line photos.

## Ten Years of Coast to Coast Flight

1927-33 hours

1930-30 hours

1933-20 hours

1937-15 hours

# FROM Acorn

Like the engineer and the iron horse, the modern transport pilot and his ship have become part of the transportation industry. This DC-3 is typical of the great planes in service on world-wide airways.



ONE gets out of breath trying to keep up with American air transport progress.

In the September issue of *AIR TRAILS* a picture of air travel was presented as it existed in early summer, recounting that arrivals and departures of transport planes at Newark Airport totaled 120 every twenty-four hours. Before the end of August transport operations there had increased to 142 schedules a day.

That's how fast things have been moving in recent years, so this old-timer will take any one's predictions as to the future—distant or immediate. Nothing in the way of prophecy will sound too fantastic, because I think I know, as well as any one, the history of the present miracle of air transportation. Directly and indirectly I have been a part of it. So, you youngsters who have dreams of making further contributions, I think you should have an understanding of how it all came about.

It was back in the summer of 1919 that General Billy Mitchell, idolized commander of America's cocky young War birds, frowned at a report on his Washington desk. It summarized a disheartening number of airplanes cracked up in various parts of the country. A major cause was behind almost every forced landing. The pilots had become lost on cross-country flights.

There were no two ways about it. America's young eagles, who were the nucleus of to-day's splendid Army



Powered by Wright G-100 Cyclones developing 1,220 h.p. each, the Skysleeper weighs, loaded, 24,800 pounds and is capable of 218 m.p.h. Including three stops en route, the eastward transcontinental time is 15 hrs. 10 min.; the westward 17 hrs.



# TO Oak <sup>IN</sup> Air Transport

By Capt. Samuel Taylor Moore

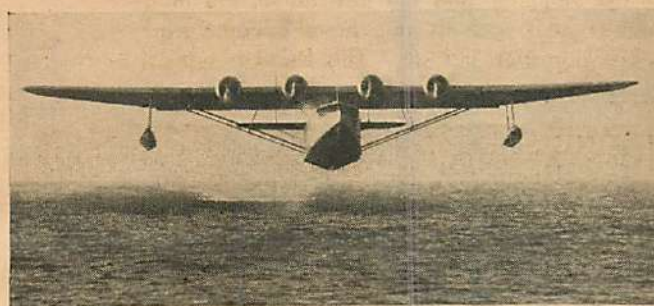
Right: Refreshed by a comfortable but time-saving trip aboard the Skysleeper, these disembarking passengers are but a few of the more than 90,000 carried monthly by domestic air lines.

Air Corps, could fight and could fly with the best. But as to navigation, 95 per cent were completely innocent. Almost without exception, War pilots flew only by contact—guiding courses by landmarks on the ground below. When fog and rain concealed such landmarks, it was "dud weather" and pilots remained grounded on home tarmacs.

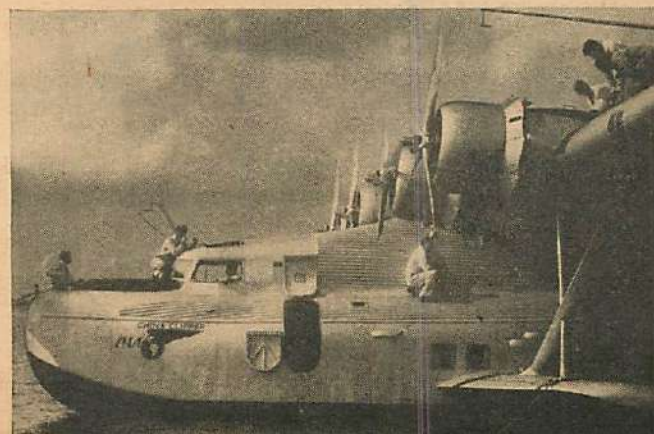
The idea to correct that deficiency was typical of the broad and instantaneous decisions of Billy Mitchell. He would teach navigation in the school of experience by staging a transcontinental race. The tragic toll of that race in the fall of 1919 in lives and smashed airplanes is something Billy Mitchell did not like to have recalled in later years. Yet the good which came of it was to be permanent. The route flown by those army pioneers was to provide the bases of the first transcontinental airway in the United States.

So-called "air mail" had been started during War days between New York and Washington. It was not until the army racers had paved the way that a transcontinental system began to be developed. But it was to be five years before a (Turn to page 67)

The China Clipper, probably the most well-known of all passenger-carrying aircraft, is one of a number of similar ships. Mighty as they are, they will soon be obsoleted by newer equipment under construction.



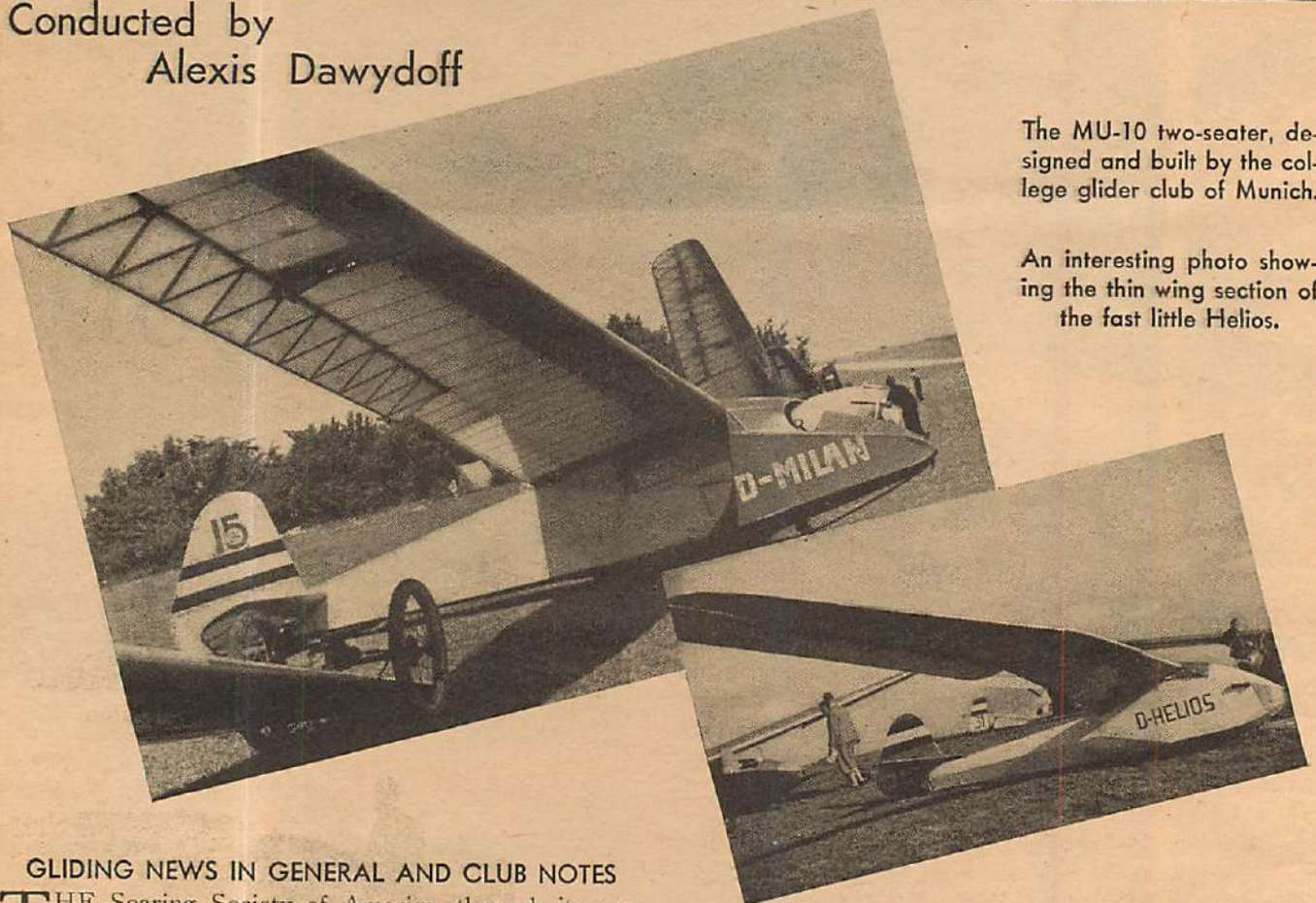
A Sikorsky Clipper of Pan American rises lightly from the water, bound for some far-distant foreign port.





# GLIDING AND SOARING

Conducted by  
Alexis Dawydoff



The MU-10 two-seater, designed and built by the college glider club of Munich.

An interesting photo showing the thin wing section of the fast little Helios.

## GLIDING NEWS IN GENERAL AND CLUB NOTES

THE Soaring Society of America, through its general manager, Lewin Barringer, announces that a new kind of active membership is now available. The dues are \$4.00 per year and include annual subscriptions to the magazines "Soaring" and "National Aeronautics," membership in the National Aeronautical Association, registration at contests, annual sporting license, and the issuance of "A," "B" and "C" licenses—all without extra charge.

The benefits of this \$4.00 membership are obvious. Every National contest, whether for power plane or motorless craft, is sponsored by the National Aeronautical Association, which represents the International Federation of Aeronautics. Without the sanction of this body no newly established record may be counted as official, hence participants in contests or those attempting record flights must be members and possess a sporting license. Again, at the National Soaring Contest each pilot is required to pay an entrance fee of half a dollar for himself and \$5.00 for his ship. Being an active member of the S. S. A. eliminates these expenses entirely.

For those not actively engaged in the sport but who nevertheless are interested, an Associate membership has been created whose annual dues are \$2.00 and which

## About Alexis Dawydoff

Born in Petrograd, Russia. Attached to British military mission in Russia during revolution as interpreter to R. A. F. and H. M. Navy, transferred to American diplomatic mission in the Near East. On arrival to United States, was connected with Sikorsky. Learned to fly in Curtiss Flying School in 1925. Flew all kinds of airplanes from Curtiss Orioles to Lockheeds. Had agency for Travelairs and all-metal Flamingos. When J. C. Penny, Jr., brought over German gliders, got interested in them and was one of the first men to soar in the country. Had the first glider school in the east. (Before Bowlus-Hirth.)





includes a year's subscription to "Soaring," the official magazine.

Next season the Society contemplates holding not one, but two National contests. The first to be held at Elmira, New York, some time between June and the middle of August and open to all ships: sailplanes, utilities and multi-seaters. The second at Frankfort, Michigan, between August 29th and September 7th, and open strictly to utilities and multi-seaters. Such a division was thought advisable because at last year's meet the weak thermal conditions gave sailplanes most of the advantage and prize money; a separate contest for utilities will enable *their* pilots to compete on a more even basis.

Lewin Barringer is considering an extensive trip through the Middle West to look for suitable soaring sites in the event it is decided to hold the National meet at a site more centrally located than Elmira. Many feel it would be only fair for all concerned to meet one another halfway.

The yearly meeting of the Soaring Society will be held in Washington, D. C., during the last week of January, at which time final plans for the 9th Annual Contest will be drawn up.

The Manhattan High School for Aviation Trades announces the organization of the School of Aviation Trades Glider Club. Mr. Nesca, principal, is its honorary president; Mr. C. Barg, the chairman; and Emil Lehecka, honorary member. The boys plan to build a licensable primary, with a secondary to follow. (The first official step after forming the club was to take a year's subscription to Air Trails.)

The Glider Club, organized seven years ago as part of the Boys Club, 211 East 3rd Street, New York City, reports activity again. It owns a strut-braced primary which members fly at Hicksville, Long Island, with Kurt Siemon as instructor and advisor.

Stan Smith, Silver "C" Pilot No. 236, recently soared his self-designed "City of Utica," a two-place craft, for more than an hour over Harris Hill, Elmira. Instead of a passenger, Stan carried an 80-pound sandbag in the other seat.

Harland Ross, designer of the Ross-Stephens sailplane, is spending the winter in Texas, flying his brother's Prueffling glider and building a new sailplane.

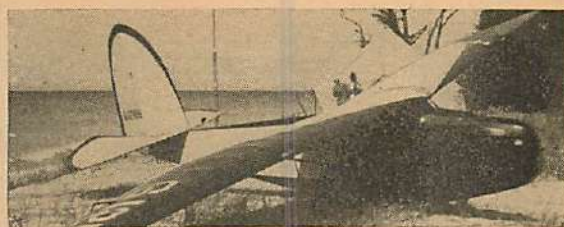
The Schweitzer Brothers are busy redesigning their small utility. They intend to give it a lighter wing loading and a greater rudder area, which ought to make it ideal for training purposes.

Eugene Ardel is planning to establish a gliding and soaring school, similar to the German Hornberg, in connection with the Broadmoor sport and training camp near Denver, Colorado.

Don Stephens of California is engaged in making a glider movie short, using a Waco primary on which an automatic motion-picture camera is mounted.

During Russia's 12th national soaring contest held recently near Moscow, all 42 sailplanes entered arrived by airplane tow—many of them having been flown from as far as 1,000 miles away. Russia now holds all of the world distance records for single and multiplace ships. These include the single-place glider record, 405 miles air-line distance, made by V. Rastorguyeff in a G-N7 on May 27, 1937, and the one for two-place ships attained by V. Ilchenko and V. Emerik in a KIM-3, 253 miles.

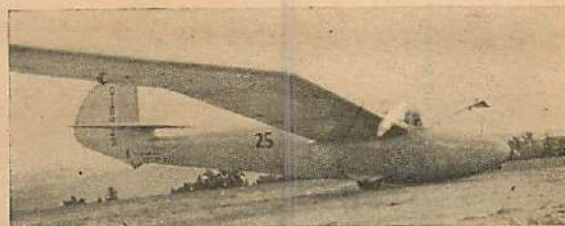
(Turn to page 66)



The Stephens-Franklin gull wing.



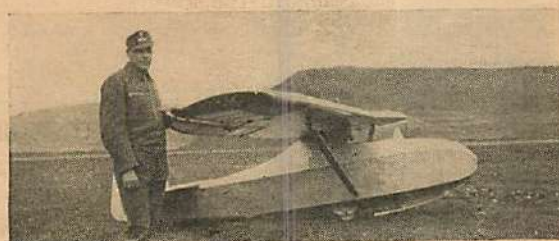
The two-seater Minimoa 2A.



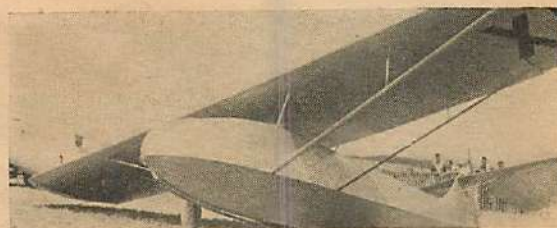
The standard German Minimoa.



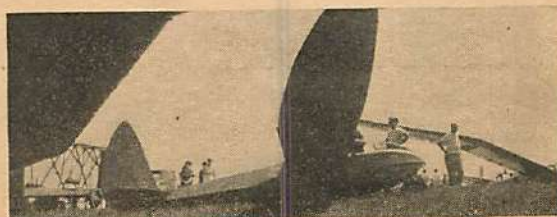
The latest Kranich two-seater.



The Hütter utility H-17 sailplane.

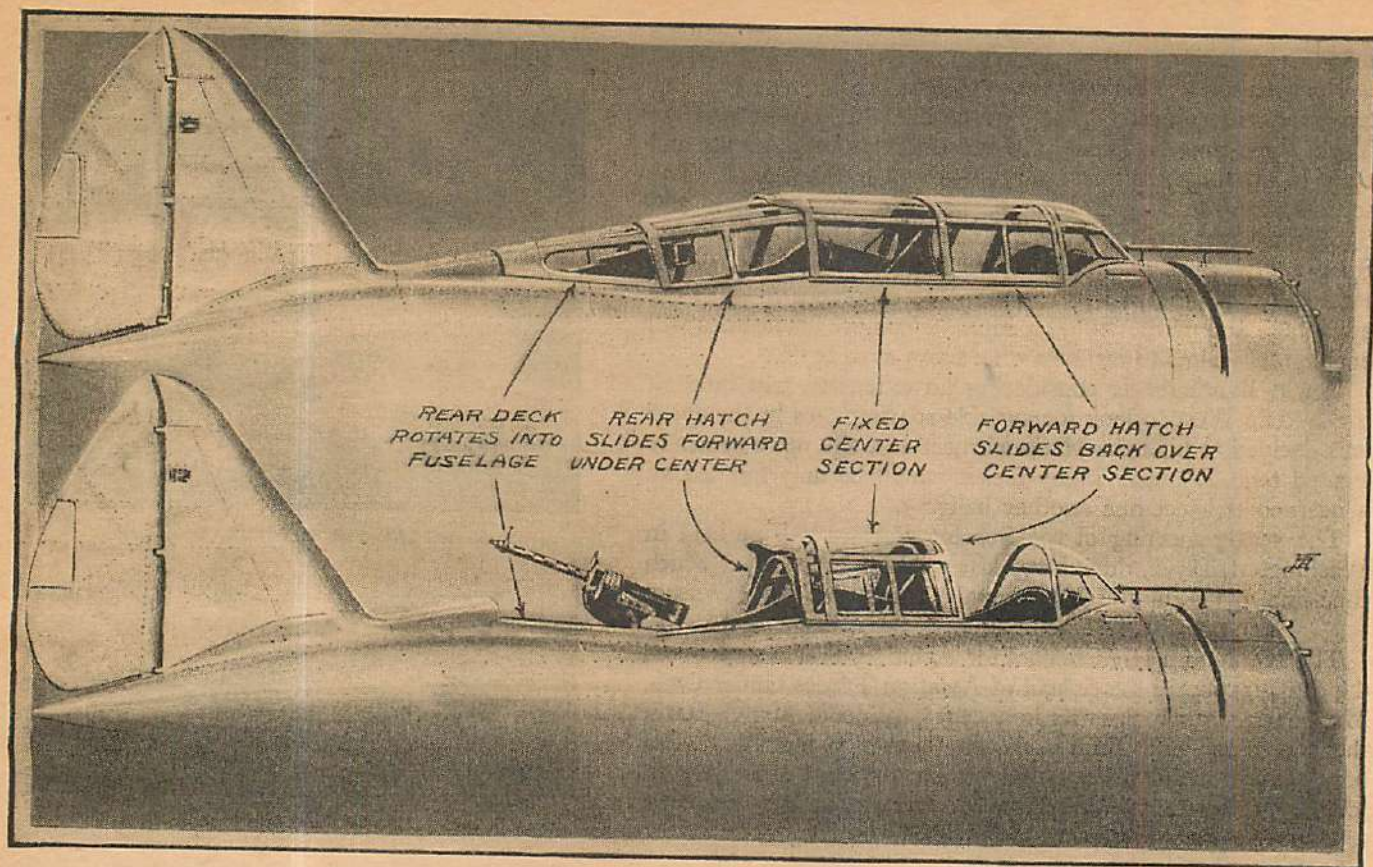


The two-place "City of Utica."



The American A. B. C. sailplane.





# Convoy-Fighter

A NEW development of the fighting airplane has been germinating in the minds of our more progressive pursuit designers for the past year or so. The appearance of the big YB-17 four-motored bomber focused the attention of air corps tacticians on the necessity of providing this formidable aerial weapon with suitable fighter protection. The tremendously long operating range of the huge egg-layer created a real problem.

It is obviously impossible for the conventional pursuit ships, with their limited tankage, to accompany a formation of the new bombers for more than three or four hours at the most. Inasmuch as one of the principal duties of the YB-17 squadrons in time of war will be the location and bombardment of hostile naval fleets far out at sea, the tacticians quickly recognized the need for a radically new type of fighter to convoy the big ships on this important mission.

Practical considerations point toward a multiseat model. The great distances covered during such overwater operations and the supreme importance of sending reasonably fresh pilots into the culminating action demands a second pilot to alternate at the controls during the preliminary flight. Another characteristic required of the new type is an armament of at least four and preferably six guns. This enormous concentration of fire power not only helps drive off aerial interceptors, but also serves as a powerful weapon against battleship gun crews. This last is of great importance as one of the fighters' chief missions is to close in and attempt to neutralize the effect of anti-aircraft batteries firing on the bombers above.

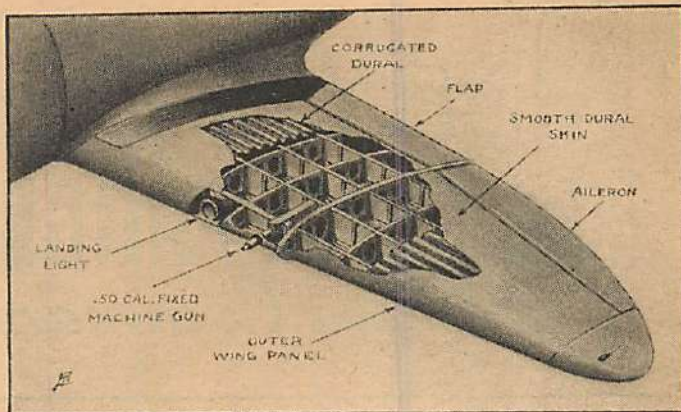
The high speeds attained by the latest type bombardment planes—250 m.p.h.—adds one more headache to the problem facing the pursuit-ship designer. In addition to an ability to fly at least 3,000 miles nonstop, with triple the usual military load, the new type fighter must have a maximum speed of over 300 m.p.h. This little edge in performance is vitally necessary when the fighter squadrons are used to intercept raiding enemy bombing fleets. Here, also, the enormous fire power of the new fighters is imperative to help overcome the highly developed defensive armament of the modern bombardment plane.

This difficult design problem posed by the air corps engineers has resulted in two schools of opinion. One group advocates the large, twin-engine, multigun, multi-place fighter of the Bell type (pictured and described in its original form in the November, 1937, issue of *Air Trails*). This formidable ship, named the "Airacuda" by its builders, is a veritable battle cruiser of the sky and carries out in aerial engagements a somewhat similar function to that of its naval namesake. The "Airacuda" is powered with twin 1,000 h.p. Allison chemically cooled engines driving pusher propellers. It carries a crew of five and is armed with two forward firing, flexibly mounted, 37mm. automatic cannons. A short range battery of two .30-caliber machine guns are mounted alongside the larger weapons, while two .50-caliber machine guns protrude from "heat blisters" of the Boeing type set in the sides of the fuselage aft of the wing.

The second school of thought is ably represented by



*New theories in aerial tactics have created the Flying Fortresses and Battle Cruisers of the air, and now Seversky produces the Convoy-Fighter, an efficient machine of concentrated destruction—the plane on the cover.*



the ship featured on the cover of this issue. It is the latest product of Alexander P. de Seversky, one of America's most successful designers of military aircraft. The new plane has been christened the "Convoy-Fighter" and richly does it merit the name. It is a small, fast, heavily armed two-seater, conforming in general appearance to the familiar Seversky design. The resemblance of the new ship to its older brethren is, however, merely superficial. The craft's "innards" are of entirely new and highly interesting construction.

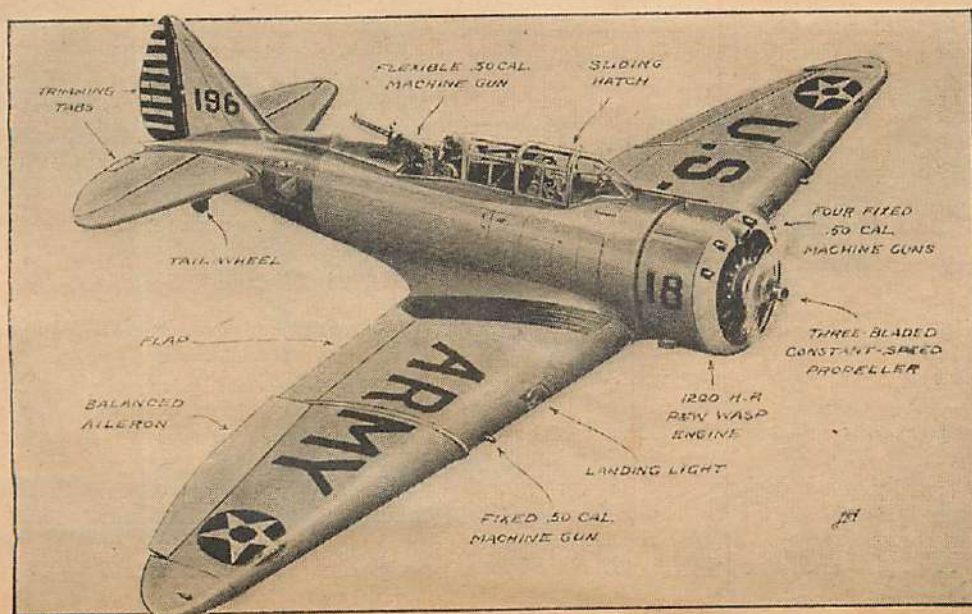
This convoy-fighter is powered with a single Pratt & Whitney double-row Wasp developing 1,200 h.p. at its best altitude. The engine is inclosed within a new type cowling designed to provide the highest possible cooling efficiency. It is fitted with a three-bladed Hamilton Standard propeller of the constant-speed variety. The construction is all-metal throughout. A semimonocoque, stressed-skin design gives unusual strength and rigidity to the fuselage structure, which has been sleekly modeled in the familiar Seversky "tear-drop" form. The tail group is of the full-cantilever type covered with smooth Alclad 24S-T plate. All control surfaces are provided with trimming tabs, adjustable during flight.

The wing construction of the new model is noteworthy for its strength and resistance to injury. It is a cantilever, multiple-spar structure, divided by dural ribs into a series of rectangular cells. This sturdy framework is covered with a stiffening layer of heavy corrugated

dural and finished off with a smooth, flush-riveted skin of lighter gauge.

The wing boasts a safety factor of twelve to one. This is double the regular Department-of-Commerce requirement. Seversky engineers claim, also, that this new cellular form of wing can be completely riddled by machine-gun fire without collapsing or losing its flight characteristics. No special gas tanks have been incorporated in the structure as the liquid-tight interior of the wing itself is designed to carry the fuel load. This eliminates unnecessary weight and vastly increases the ship's fuel capacity.

The cockpits of the Convoy-Fighter are placed in tandem and are completely covered with an ingeniously designed, transparent inclosure. This is divided into two fixed and three movable sections. A sliding hatch covers the forward pit and locks into the windshield during flight. A pull by the pilot slides it back in its tracks to a position over the fixed center section. A similar hatch protects the gunner's office and slips forward under the central unit. There is nothing unusual about this arrangement. It is standard practice in most two-seaters. The real trick lies in Seversky's solution of the rear-deck problem. It is obvious that a second and smaller rear hatch cannot be slid forward, also, without decapitating the gunner. Besides, there is no room for it under the already overcrowded center section. Some designers make no effort at all to cover (Turn to page 73)



By  
Frank  
Tinsley



# What's Your Question?

## By CLYDE PANGBORN

### Wing Commander



As soon as possible after being received, all questions will be answered by the Wing Commander of the Air Adventurers. Those of general interest will appear on this page; others will be answered by mail. Be sure to include your name and address.

*Question: Where could I obtain a book on the design of airplanes and the size and general details of modern motors? C. Z. C., Amarillo, Texas.*

*Answer: I suggest that you write to the Ronald Press, 15 East 26th Street, New York, and order their "Engineering Aerodynamics," by Walter S. Diehl, at \$7.00 a copy and "Aircraft Engine Mechanic's Manual," by C. J. Moors, at \$4.50. These are two very good volumes for the information you want.*

*Question: What, in your opinion, are the best aviation schools on the West coast? N. O'N., Chico, California.*

*Answer: From what I have been told, the new Aero Industries Technical Institute, Inc., of 5257 West San Fernando Road, Los Angeles, California, is one of the best in the country. They have a fine staff and an executive board that wins respect everywhere. I suggest that you write for their prospectus. Then there is the Boeing School of Aeronautics at Seattle; the Ryan School of Aeronautics at Lindbergh Field, San Diego, Cal.; the Curtiss-Wright Technical Institute at Grand Central Air Terminal, Glendale, Cal.; and I believe the Douglas Co. at Santa Monica is considering opening a special school.*

*Question: What air corps planes, now in service or being tested at Dayton, are equipped with the Joyce 37mm. rapid-cannon? R. F. P., Minneapolis, Minnesota.*

*Answer: As far as I know, and I admittedly know very little as to what is going on inside the hangars at Dayton, no service ship as yet has been equipped with the Joyce gun. There may be several machines using them in an experimental manner, but I have not learned anything about it.*

*Question: I was operated on for mastoid when I was five years of age, and I am wondering whether that will prevent me from passing a department-of-*

*commerce physical examination. I wish to become an aircraft salesman, but I understand that I would have to be a pilot to make any success at it. A. A., Toledo, Ohio.*

*Answer: I cannot answer any question concerning physical disability. My suggestion is that you take time to see a department-of-commerce physician in your area and find out officially whether you can pass. There is a possibility that you can after all these years.*

*Question: What are the four branches of the air service? C. W., Madison, Indiana.*

*Answer: Your question is not very clear. I only know of four branches of the air service. They are the army air corps, navy, marine and coast guard.*

*Question: Please tell me if I could change a 34-foot primary glider into a biplane with a wing span of 18 feet? W. S., Charleston, South Carolina.*

*Answer: Advanced aerodynamics would be involved in the conversion of a monoplane to a biplane. Unless aerodynamics are fully understood, I would not recommend undertaking the conversion.*

*Question: How many persons besides the pilot will the Lambert Monocoupe carry? Must you take a flying course to fly the Waterman Arrowbile? R. E., McLeansboro, Illinois.*

*Answer: The Monocoupe E-90 seats two, a pilot and a passenger. The Monocoupe seats four. Yes, you must be a licensed pilot to fly the Waterman.*

*Question: Where is the pressure greater inside a balloon in which either helium or hydrogen is used? A friend of mine declares that the pressure is greater at the bottom of the bag than at the top. If this is so, how can it give any upward lift? H. B., Elmont, New York.*

*Answer: Pressure inside the bag and the lift of the whole bag are two different things. We must first consider the pressure of the gas against the inside of the envelope. Under first impression one would think that the pressure would be equal inside, but then you must remember that the gas used actually has some weight, and so it presses against the bottom of the envelope to some extent. This slight pressure has nothing to do with the lifting power of the bag as a whole. The "lift" power is still there.*

*Question: Which is the faster ship, the Seversky P-35 or the British Supermarine Spitfire? Both firms claim that theirs is the fastest fighter in the world. S. J. S., Clover, South Carolina.*

*Answer: I can't answer that question, although I have heard, on reliable reports, that the Spitfire actually does 370 m.p.h. I do not believe that the Seversky will top that mark.*

*Question: Is there any chance for an enlisted man in the navy to become an aviation pilot if he reaches a grade of first class or chief petty officer? J. H. C., Long Branch, New Jersey.*

*Answer: At present 704 men are learning to fly at the Pensacola Naval Air Station. Of these, 170 are enlisted men from the fleet. Only 131 are regular naval officers and 403 are flying cadets. I think this will answer your question.*

*Question: Has the Fokker XFA-1 been adopted by any country yet? What is the top speed of the Hawker Nimrod? What was the fastest plane in actual service during the World War? E. C., Pensacola, Florida.*

*Answer: We have no record of the Fokker XFA-1 being accepted as service equipment anywhere. The Hawker Nimrod has a maximum speed of 192.5 miles an hour. The Sopwith Snipe, fitted with the A. B. C. radial, was the fastest War plane on the Western Front. It did 154 m.p.h. below 10,000 feet.*



time they bask in the protection of our armed forces and sit secure in the knowledge that theirs is the most progressive and democratic form of government in the world. But when all these national bulwarks are threatened, they are the first to raise the bleating cry of pacifism.

It's the lowest form of radical propaganda that can be spread. It rots the core of national strength, and we should have nothing to do with it. If we want an example, let us look across the sea to Great Britain and see what pacifism has done there. With a splendid navy, army and air force available as far as material and equipment is concerned, Great Britain's defensive strength has been drugged with the poison of the pacifists. They can't get recruits for any of the services. History may record that the downfall of the Empire, came not with the crumbling of a monarchy, but through the insidious propaganda of the pacifists.

What is happening in Britain may happen here. Already we have seen the statements made by the chief of the air corps that we are shy nearly 1,000 military pilots. We have seen that they are now checking the number of available air pilots in the commercial field. Both the army and the navy are attempting to recruit men for the services. But considering everything, few are tempted or feel the urge to assert their inherent right to defend our shores.

I am telling this to you because you are men and are old enough to determine right from wrong. This is not a plea for a wave of mob psychology and a mad rush to enlist. Far from it. But I do want to warn you that this canker of pacifism must be carefully considered if this country is to stand on its own strength and maintain its position in the world.

I have been months in getting up my courage to write these words, realizing that I stood a great chance of being misunderstood. It is easy to make broad statements and point out certain conditions abroad. One can easily draw horror pictures and twist figures and statements to prove a point showing that we are vulnerable from many sides. But the events of the past few weeks have taken the necessity out of my hands. We may not fear the volcanic rumblings of Europe, or the Yellow Peril from Asia, but we cannot ignore the undeniable threat of Fascism from the south nor the disease of pacifism from our interior.

So, I repeat again, we will not undertake any militaristic mission abroad. We will not line up with the Jingo nations. We will not join in the boastful chorus of the flag wavers. But we will not stand by and allow any foreign power or political group to invade our shores and batter down the glorious structure our forefathers began back in the days when Colonists left their plows and took up the musket.

That is all I have to say on this subject. I want you to read it over again and make certain that you have not

misinterpreted one sentence. Think about it, and then let us know what *you* think on this all-important subject.

Until next month, then,

Your Flight Commander,

*Albert J. Carlson*

## AIR ADVENTURERS NEWS

And now that we have delved deeply into the serious side of our organization, let's look over the mail and see how we are progressing and what our members are doing.

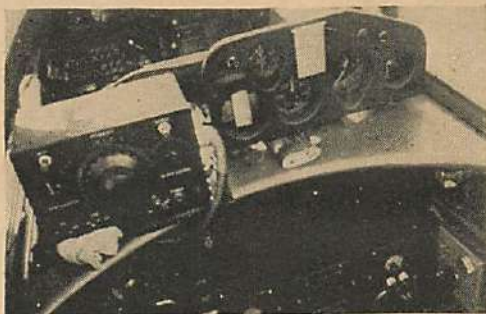
One of our greatest boosters is Donald McMartin of Hoosick Falls, New York, who has just passed his Flight-Lieutenant tests. Don seems to like all the features in our book and is now corresponding regularly with a pal in England who is also a great Air Trails booster. Don certainly reads us from cover to cover.

Lawrence O'Hanlon of Kearny, New Jersey, wants to know if he can consolidate the requirements for Craftsman Photographer and Craftsman Air Mechanic by sending in a picture of the plane he, himself, has built. It's a good idea, Larry, but be sure you complete both requirements in full detail.

An interesting letter comes from San Francisco. Victor Emanuel De Taille is out to become a great engine designer. He's going in for our Engine Mechanic ticket and has an idea, he won't tell us about, in which

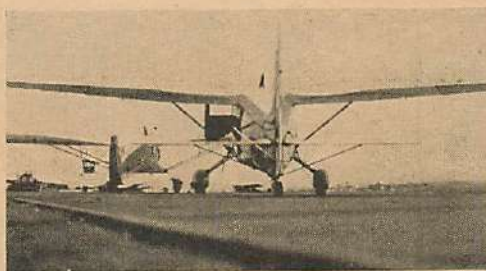
he will combine two different fuels and in that way develop the finest engine in the world. Well, don't forget Air Trails, Vic, when you have your engine photographed. We want to be the first to publish it.

We've finally found the member we have been looking for for months. He's J. D. Doyle, Jr., of Union, Mississippi. J. D. sends us a letter in which he states that he gets a big kick out of our advertising (Turn to page 86)



Above—Interior of rear cockpit of Douglas O-46A by Jerry Baer, Madison, Wisconsin.

Below—An interesting photo by W. H. Lemke, Fayetteville, Arkansas.



## (MEMBERSHIP COUPON)

To the Flight Commander, Air Adventurers,  
79-89 Seventh Avenue,  
New York, N. Y.

I am interested in aviation and its future developments. To the best of my ability I pledge myself to support the principles and ideals of AIR ADVENTURERS and will do all in my power to further the advance of aviation.

Please enroll me as a member of AIR ADVENTURERS and send me my certificate and badge. I enclose ten cents to cover postage.

Name..... Age.....

Address .....

☐ Check here if interested in model building.

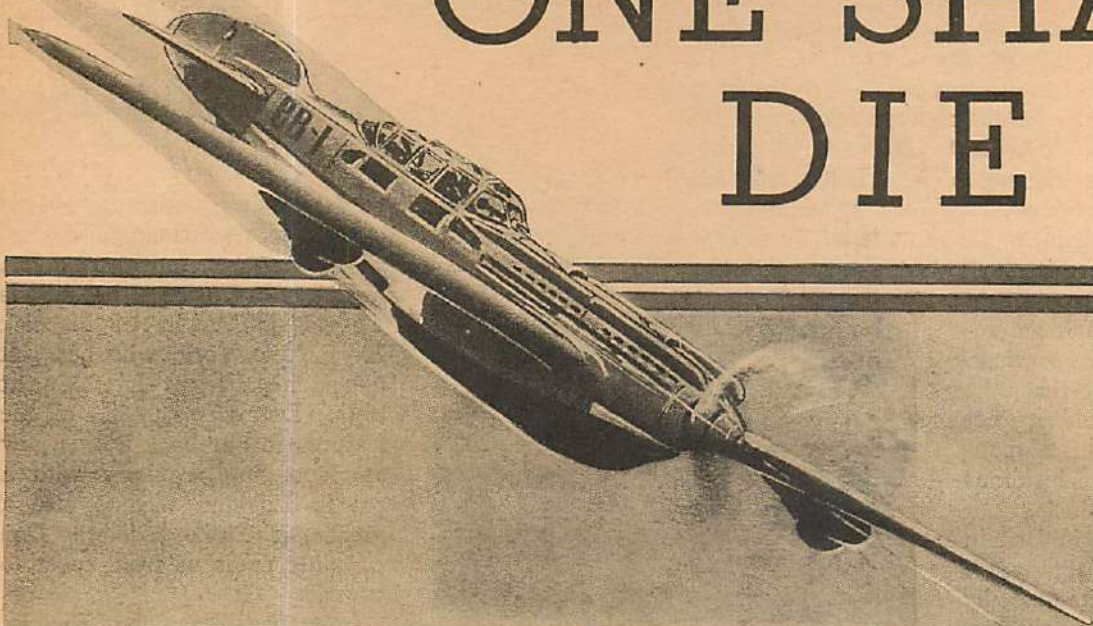
(This coupon may not be used after March 15, 1938.)



\* Cy Hawkins  
Ben Bates  
Sandy Sanders  
Red Ellwood

Mile  
Old Charlie

# ONE SHALL DIE



He raked a gray ship that came under his sights with a withering burst of fire—

By George L. Eaton

MARVIN K. HAWKINS, better known to his intimates on Barnes Field, Long Island, as "Cy"—because of his slow Texan drawl—looked down over the side of his red-and-black Snorter and studied the wind sock on the airport below.

He saw the surface wind was WSW and tried to determine the length of the run he would have on the field when he stuck his nose into it. After circling it twice he spoke into his intercockpit telephone to his sister in the rear cockpit.

"You better fasten your safety strap, Nan," he said. "It looks a little bumpy down there."

"That shouldn't offer any difficulties to one of Bill Barnes' intrepid men," she said. Her brown eyes twinkled with laughter.

"Phooey to you, kid," Cy said. "Fasten your belt."

But the grin that flashed across his own face belied the seeming force of his words. It was the first time in two weeks that he had detected any lightness in her voice—since that day two weeks before when he had picked her up at the girls' school she was attending in Virginia so that they might both reach their father's bedside before he died.

She had seemed to grieve even more than he when their father closed his fierce, old eyes for the last time. After the burial she had, at first, refused to return to school. But Cy had finally persuaded her that it was the best thing for her to do. Now he knew that he had been right.

He nosed down as his retractable landing gear slid out and kissed the rough ground with his landing wheels in a workmanlike landing. He blasted the tail around and taxied toward the single hangar before he killed his engines.

He held his sister's trim little figure in his arms for a moment as she slid out of the rear cockpit to the ground. Her brown eyes flashed with a laugh again as she touched his lips with her own.

"You're a swell brother, Cy," she said to him.

"You're a pretty good guy yourself, kid," he answered. "We've got to stick together now. There are only two of us left. It had to happen sometime, Nan, so don't feel too badly. Don't mope around all the time. Get out with that boy, what's his name?"

"Ted Richards," Nan said and she colored.

"He'll help take your mind off your sorrows from what you've told me," Cy went on. "Dad would want you to go right on doing all the things you've been doing."

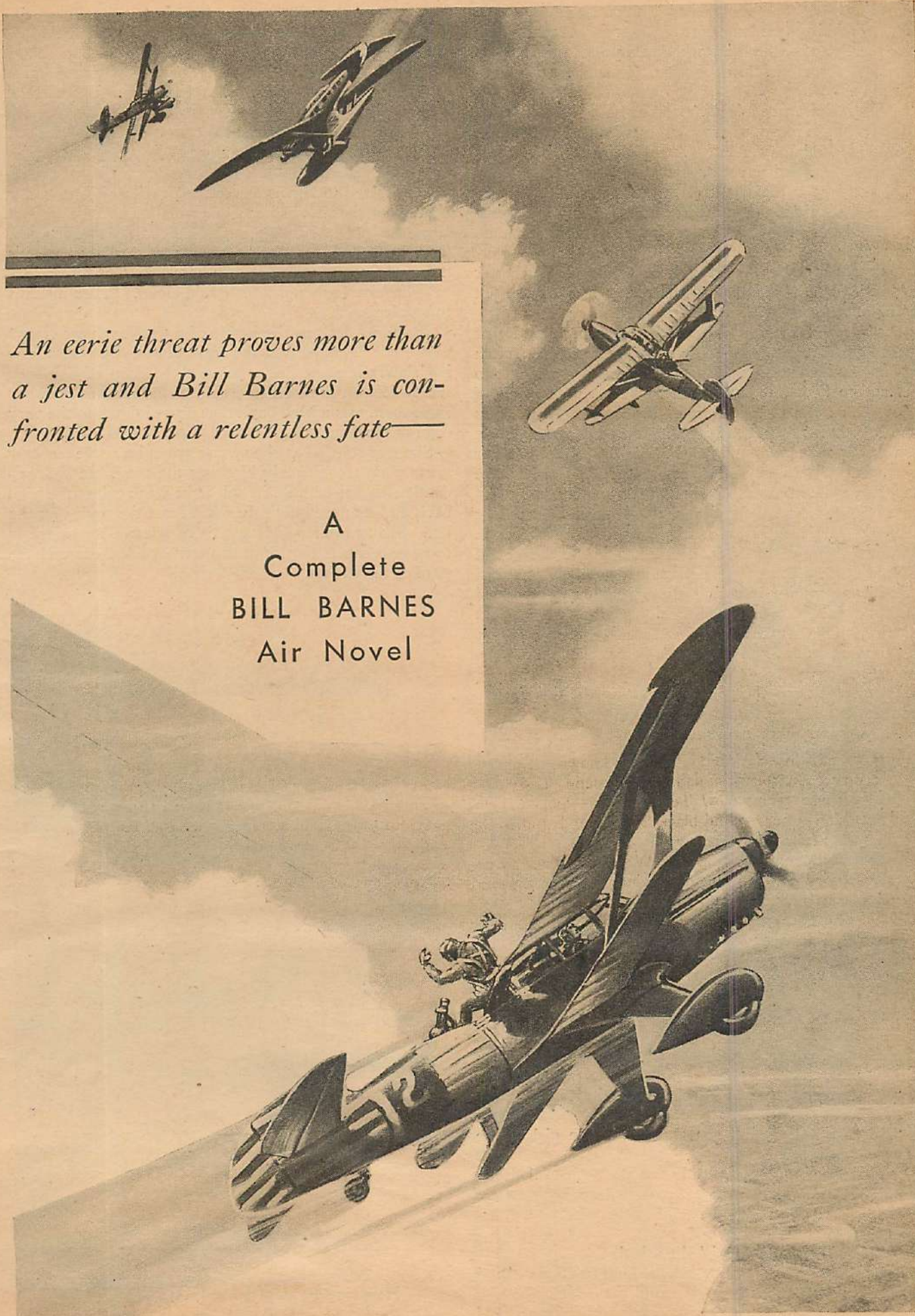
"I know it," she said. "You're going back to Texas soon?"

"To-morrow if Bill can spare me," Cy said. "There are a lot of things to be straightened out down there. Some things don't look so good to me. I'll let you know about everything, kid. You're sure your car is here?"

"Right over there by the hangar," she said. "It's the new one dad gave me this fall. Can you spare a minute to carry my bag over and look at it?"

"Can do," Cy said and picked up her traveling bag.





---

*An eerie threat proves more than  
a jest and Bill Barnes is con-  
fronted with a relentless fate—*

A  
Complete  
BILL BARNES  
Air Novel



They admired the long, low roadster for a moment before she climbed behind the wheel and pressed the starter. The motor roared into action and Cy smiled at her admiringly.

"You're quite an eyeful," he said as he kissed her again.

"You ought to get yourself a girl, Cy." She laughed.

"I got enough trouble," Cy said slowly. "Good-by, kid. You'll hear from me soon."

She flipped a gloved hand upward, threw the car in gear and swung it toward the road. She saw him going toward the hangar as she swung off the field and onto the road.

She eased the big car through the traffic of Winchester with the same instinctive precision her brother used in flying or fighting in his powerful Snorter.

A thousand thoughts rushed through her mind that had to do with her childhood on that interminable stretch of land and mountains her father had owned and left to her and to Cy. She thought about some of the perils of Cy's life as one of Bill Barnes' little squadron of fliers and her throat contracted with pain at the thought that something might happen to him. Tears came into her eyes, tears that nearly blinded her. She had to stop the car for a moment until she had wiped them away.

"He's all I have left," she said to herself. Then she thought of the blond head and blue eyes of Ted Richards.

Some of the dread of death left her as she thought of Ted and the life they were planning together. Cy had made her promise him that they wouldn't be married until they had both finished school that year.

"Give things a chance to age a little," Cy had told her.

"I'm sure about him now," she had replied. And she was sure.

It was dusk and the lights were on in the dormitories and sorority houses that lined the campus.

A cool fall wind whipped swirling eddies of fallen leaves into her face as she stepped out of her car in front of her own sorority house. She was glad to be back as she saw forms that she recognized moving across the lighted windows. Her feeling of fear and loneliness dropped away from her as she opened the door and saw flames leaping in the wide fireplace.

She stood there for a moment watching the girls in the living room. But she didn't go in. She thought that it was nice to be there with them. Then her loneliness swallowed her again as she thought that it couldn't last. In the spring they would all go home to their fathers and mothers and brothers and sisters. And she would be alone.

She thought of going to the telephone to call Ted Richards. Instead she started up the stairs to her room. She heard the telephone ring and stopped as one of the girls answered it.

"Nan Hawkins?" the girl said. "She isn't here. She's home."

"No, I'm not, Kiki," she shouted to the girl at the phone. "I just came in."

A half dozen girls called to her as she went to the telephone. Something made her throat contract again as she heard Cy's voice on the other end of the wire.

"Hello, kid," he said to her.

"What's the matter, Cy?" she asked.

"I'm stuck here," he said. "Something has gone wrong with—but you wouldn't understand. I'll have to stick around here overnight. I got in touch with Barnes Field and they're flying some stuff down to me the first thing

in the morning. If you'll come out and get me I'll buy you some food. What say?"

"Fine," she said. "I'm sorry something went wrong. And I'm glad, too, because I'm lonesome. Where shall I meet you?"

"You better come out and get me," he said. "I don't know anything about Winchester."

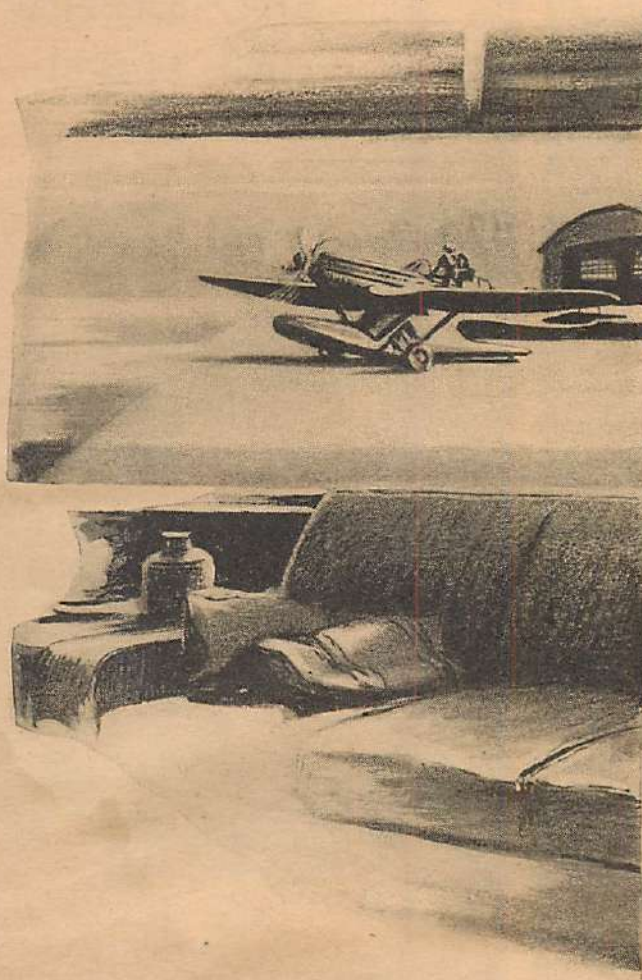
"Right," she said. "I'll start right away."

It occurred to her as she left the lights of Winchester behind her that it was peculiar Cy hadn't taken a taxicab from the air field into the city. Then she dismissed it from her mind. Probably he wanted to fuss with his precious Snorter until she got there.

"That's really his girl," she said aloud. "He's married to an airplane."

It was as dark as the inside of a dungeon now except where her lights pierced the night ahead. She was driving slowly because there was a sheer drop of eighty or ninety feet on the left-hand side of the road and on her right there was a high bank that dipped down to the very edge of the road.

She was startled as she swung around a curve and saw a car almost completely blocking the road. It had evidently skidded because its tail light was against the high bank and its nose only a few feet from the ravine on the left. She had to stop because there was not room for her to pass between the radiator of the stalled car and the edge of the ravine.



How long he slept he did not know— He awakened with a start—saw the front door of the infirmary open—



Two men stepped out of the car ahead as she put on her brakes and threw the car out of gear. One of them came toward her on each side of her roadster.

She didn't notice until they were beside her that they both wore colored handkerchiefs over their faces. When she did notice it she couldn't even scream because her heart had climbed up into her throat. She tried to scream as she saw that they each held a gun in their hands, but no sound came from her lips.

"Move over, kid," the man on her left said as he opened the door. He prodded her in the arm with his gun as she stared at him. Her lips formed her brother's name as the man rudely pushed her over and climbed in beside her.

"It's all a horrible joke—what he thinks is a joke," she said to herself as the man threw the car in gear without closing the door. The other man had climbed on the running board beside her as the car began to move.

The things that happened in the next few seconds were like the things that happen in a horrible nightmare. She saw that the man who was driving was heading the car straight for the edge of the unfenced ravine. She tried to scream again and grabbed at his arm. The man on her right caught her wrists and yanked her back in the seat.

The front wheels of the car were almost at the edge of the ravine when the man at the wheel slipped his legs out

from in under the steering wheel to the running board. The man on the right hit her a stunning blow on the side of the head as he dropped off the car.

The handkerchief over the face of the man driving the car slipped down around his neck as he stepped off the running board of the moving car and slammed the door shut behind him.

"Cy!" Nan Hawkins' voice screamed as the nose of the car dropped over the edge of the ravine and kept on—driven by the rear wheels.

Her voice rose in one long, blood-curdling scream as the car plunged. There were a half dozen ripping, roaring crashes as the car dropped, followed by one terrific one.

Then all was silence.

The two men ran to their parked car and their tail lights became red specks in the distance as the black ravine settled back to its peaceful quiet.

## II—WARNING

BILL BARNES eased the control column of the big silver sesquiplane forward and to the right and gently kicked his right rudder to bring the Lancer around in a





great, sweeping bank. The whine of the three-bladed, controllable-pitch propellers increased as he opened his throttles another notch and set his Sperry gyro-pilot to work.

His white teeth gleamed as his bronzed face cracked into a wide smile. His blue eyes probed the late afternoon sky ahead and then flashed across his instrument panel as he took a steel and elastic strap from his lap and fastened it around his neck. It was the same kind of strap that can be bought in any men's clothing store with a ready-tied bow necktie attached to it.

But there was no necktie on this strap. Instead there were two tiny microphones each about the size of a twenty-five-cent piece that nestled against Bill's throat to pick up the vibrations of his voice as he talked to the open air. He pressed a button attached to the control column and began to chant the call letters of his own air field twelve thousand feet below him.

"BB—BB calling Station BBX," he said like a man talking to himself. That smile flashed across his lips again as he realized what a tremendous aid these microphones that picked up his voice from the outer walls of his throat would be. No longer would a pilot have to hold the "mike" pressed tight against his lips to exclude other noises. He would have his hands free to fly his ship and could maintain two-way communication at the same time.

"BB calling BBX," he repeated. "Are you getting me, Tony?"

"BBX—— This is BBX," Tony Lamport, chief radio operator and superintendent of communications on Barnes Field chanted into his ear. "Go ahead, BB. Your voice comes in as clear as a bell, Bill."

"This is a great device, Tony," Bill said. "It is another one of those things that is going to make flying just a little easier."

"Just a minute, Bill," Tony said. He was laughing. "Young locknut out of the west wants to talk to you."

"Nuts to you, you kiwi," Bill heard young "Sandy" Sanders, the youngest member of his little squadron, say to Tony. "Hey, Bill! Another of those letters just came in. It says——"

"Never mind what it says!" Bill shouted at him. "I'll be in there in a few minutes to see it. I want to talk to Tony again."

"O. K., Bill," Tony said.

"I'm coming around and down for a landing, Tony. I want to try to come in on that new 'bent-beam' system if you think it's ready to be used."

"You can give it a try, Bill. If anything goes wrong you can forget it and come in for a regular landing in this weather."

"O. K.," Bill said. "I'll pick it up at a thousand feet."

He dipped the nose of the Lancer and a few minutes later made contact with Tony Lamport again. When he had picked up the two radio beams—the first a straight runway "localizer" which would keep the Lancer over the middle of the landing area, and the second a curved path of radio impulses down which he had to take the Lancer at the proper angle of descent—he took her in blind.

In the cockpit he had to center a vertical and a horizontal needle on respective dials—the first to give him warning of any deviation from the runway's axis, the second to show when his ship dipped below or rose above the radio ribbon that would bring it to earth at the right spot.

With his Sperry gyro-pilot set to take the ship in he had only to keep his two landing indicators centered by using the two knobs on his gyro-pilot to make corrections to the right or left or up and down. The two guiding beams did the rest.

"That," Tony Lamport said in his earphones as he felt the landing wheels of the Lancer kiss the runway at eighty miles an hour, "was pretty."

"It had to be," Bill said grimly. He wiped the perspiration out of his eyes as he blasted his twin Diesels and rolled the Lancer up to the apron.

Young Sandy's freckled face was flushed and his eyes gleamed with excitement when Bill entered his private office in the Administration Building. He jumped out of the chair behind Bill's desk with a piece of white stationery in his hand and began to talk. But what he said did not make any sense because he was so excited that his words ran together in a senseless sputter.

"Wait a minute! Wait a minute!" Bill said as he threw his white helmet on the desk. "Shut up! Let's see it. And keep still. No one can think with you jabbering like an ape."

His eyes narrowed thoughtfully as he gazed at the piece of paper Sandy handed him. On it was written just a single short sentence in a bold, large hand:

ONE OF YOU SHALL DIE!

That was all.

Bill turned it over and looked at the back. "Where was it mailed?" he asked.

"Louisville, Kentucky," Sandy said. "That's where the other two came from. It was in a regular stamped envelope. Tony and I looked it over for fingerprints."

"You dusted it?" Bill asked.

Sandy nodded his head.

"Let's see those other two again," Bill said. "None of 'em make any sense."

Sandy went to a steel cabinet, unlocked it and took out two more sheets of plain white paper. On the first was written:

Behold, I cry out of wrong, but I am not heard. I cry out aloud, but there is no judgment. He hath fenced up my way that I cannot pass, and he hath set darkness in my paths. He hath stripped me of my glory, and taken the gold from my head.

The second one was shorter. It read:

Such as sit in darkness and in the shadow of death——

Bill shrugged his shoulders and handed the three sheets of paper back to Sandy. "Some crank," he said. "A screwball who imagines we've injured him."

"Listen, Bill," Sandy said excitedly, "I know where those first two notes came from!"

"You do!" Bill said. "Then why in Heaven's name don't you tell me?"

"I mean," Sandy sputtered, "they're quotations. I don't know who sent 'em, but I know they're from the Bible. I looked them up in a cyclopedic concordance."

Bill's eyes widened for a moment and he gazed at Sandy as though he had never seen him before. "You did what?" he asked.

"I checked 'em up," Sandy said. "The longest one about, 'He hath fenced up my way that I cannot pass,' is from the 19th chapter of the Book of Job in the Old Testament. The second one is from the 107th Psalm. This last one, I figure, isn't a quotation from anything.



It just means that this screwball, whoever he is, is just going to start carving."

"Carving who?" Bill wanted to know. His blue eyes were gleaming with amusement as he saw that Sandy was deadly serious.

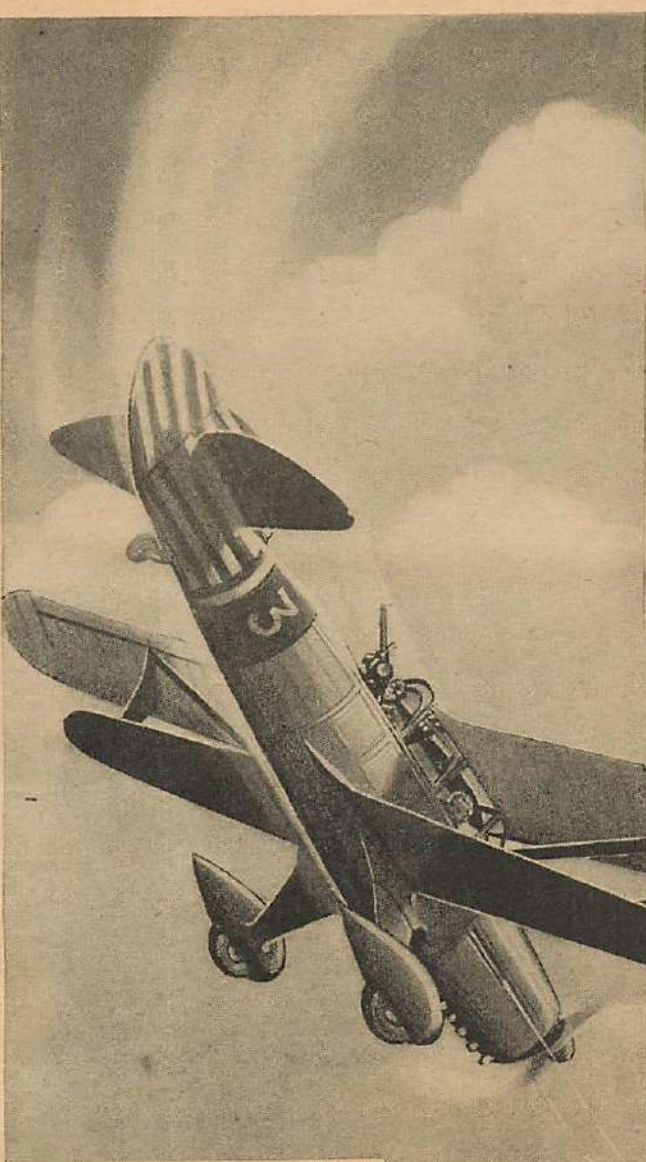
"I don't know who," Sandy said. "But this bird means business. Maybe he has only an imaginary grievance but he's going to do something about it."

"Forget it, kid," Bill said. "We've received hundreds of letters like those around here. You know that. Probably some old lady wrote them."

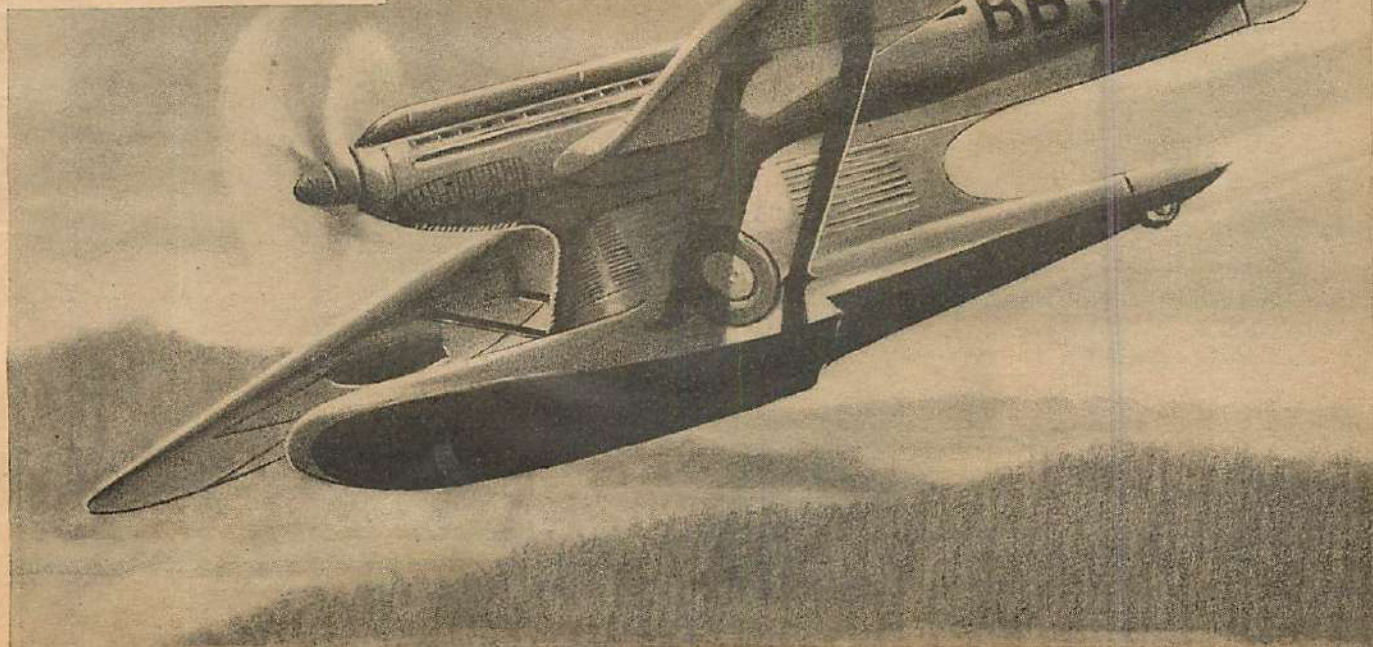
"You don't have to take my word for it," Sandy said seriously. "But we're going to have some trouble, Bill."

"O. K." Bill laughed. "Go up and ask Tony if Cy Hawkins has checked in yet. He ought to be coming in soon."

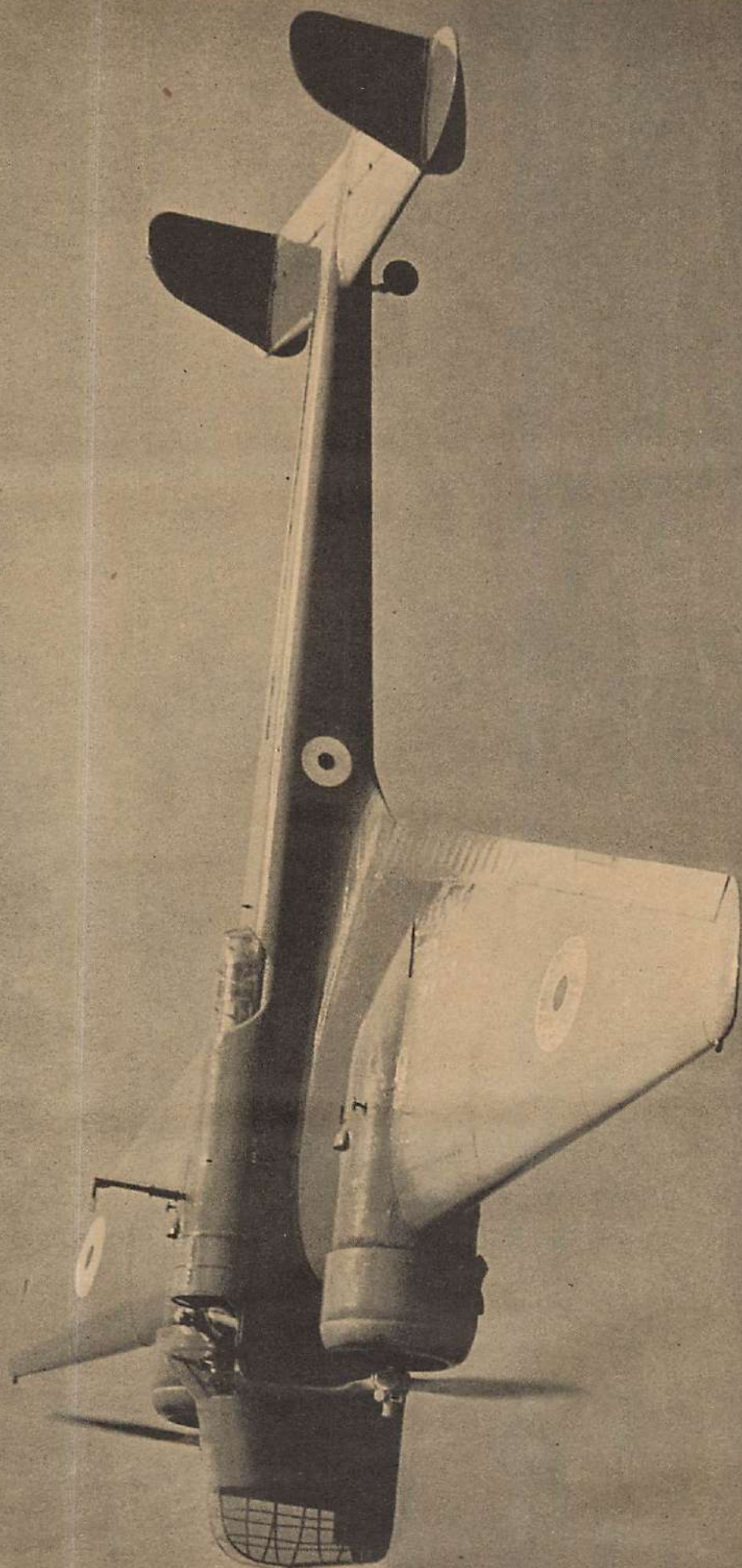
He sat back and watched Sandy go out the door and his expression was one of amusement. But he wasn't entirely amused. Too many times in the past. (Turn to page 74)



As Cy came around, the gray ship pounced on him from above like a hungry cat on a mouse—







AIR TRAILS GALLERY—The HANDLEY PAGE H. P. 52.



# MODEL MAKING—

*Air Trails Department of Practical Construction*

## Guest Writers

By Gordon S. Light

During the coming months this space will be turned over to members of the model hobby. Each month an outstanding modeler will write on a subject pertinent to the welfare of the hobby. The guest writer will be given free reign in the selection of subjects and presentation of his ideas. All viewpoints will be invited, regardless of whether or not they agree with the ideas and policies of the department.

Guest writers will be selected with a view toward presenting both sides of every problem. This column should be a sounding board for model opinions. If you disagree with ideas presented, write and tell us the reason. Or, if you agree with the writer, be sure to write and tell us. Your comments will be passed on to the writer. In this way all differences can be thrashed out and constructive conclusions reached.

In arranging for these guest editorials the outstanding modelers will be contacted. Their editorials will be based on considerable thought and much experience along the phase of the hobby they are qualified to discuss.

But it will be difficult to make this feature truly representative of the model hobby without the coöperation of the rank-and-file modeler. Your ideas are invited. The only necessary qualification is that you are a model builder—one with sufficient enthusiasm and interest to advance constructive ideas about some phase of the hobby especially familiar to you. Your contributions are invited to keep our selection of writers and subjects well rounded.

And, by the way—whenever the opportunity offers, please answer advertisements **THROUGH AIR TRAILS**. It will help us build our program if you'll coöperate on this.

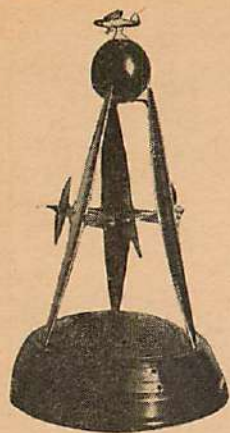
## 11 Model Building Items

<b>GUEST WRITERS</b> .....	<b>BY GORDON S. LIGHT</b>	<b>37</b>
<i>Introducing a new service to Air Trails model builders.</i>		
<b>THE duPONT TROPHY WINNER</b> .....	<b>BY ALBERT E. DILLON</b>	<b>38</b>
<i>Something new in gas models—a payload event winner at the Nationals.</i>		
<b>54 MINUTES!</b> .....	<b>BY RICHARD KORDA</b>	<b>42</b>
<i>Plans of another national championship model—a world-record holder.</i>		
<b>THE DISCUSSION CORNER</b> .....		<b>45</b>
<i>This month readers discuss "fuselage cross sections."</i>		
<b>THE CURTISS SBC-3 SCOUT-BOMBER</b> .....	<b>BY ALAN D. BOOTON</b>	<b>46</b>
<i>Another beautiful model by the country's leading flying-scale designer.</i>		
<b>THE NORDMEER</b> .....	<b>BY WILLIAM WINTER</b>	<b>51</b>
<i>By popular demand—replica plans of Germany's transatlantic trail blazer.</i>		
<b>MODEL MATTERS</b> .....		<b>54</b>
<i>Club notes, model activities everywhere, news of recent contests, pictures. This is your page. Send in your notes, news, snaps.</i>		
<b>THE CONTEST CALENDAR</b> .....		<b>55</b>
<i>A schedule of competitive events which keeps Air Trails readers up to the minute.</i>		
<b>THE QUESTION MARK</b> .....		<b>56</b>
<i>All model building questions answered by mail.</i>		
<b>PRACTICAL MODEL DESIGN</b> .....	<b>BY FRANK ZAIC</b>	<b>57</b>
<i>An authority on model aerodynamics discusses spiral stability problems.</i>		
<b>THE SOLUTION</b> .....	<b>BY LAWRENCE N. SMITHLINE</b>	<b>58</b>
<i>Bringing to builders the finest indoor fuselage models.</i>		

## AIR TRAILS ADVERTISERS—FEBRUARY, 1938

Aero Industries Technical Institute	Back Cover	International Correspondence Schools	1-95
Aeronautical Chamber of Commerce of America, Inc.	85	Johnson Smith & Co.	96
Aircraft	3rd Cover	Lincoln Airplane & Flying School	93
Air-Foto	73	Litwin Bros.	93
Aviation Institute of America, Inc.	3	Luscombe School of Aeronautics	93
Cleveland Model & Supply Co.	81	Max Mehl	89
Comet Model Airplane Co.	73	Mechanix Universal Aviation Service	93
Coyne Electrical School	63	Megow's	2nd Cover
Curtiss Wright Technical Institute	65	Model Aeronautics Publishing	73
Federal	89	National Compass Co.	73
Fleischmann's Yeast	89	Newell Pharmacal Co.	81
Gun Model Co.	93	Ryan School of Aeronautics	5
Heathe Model Airplane Co.	71	Scientific Model Airplane Co.	68-69
Howard Engine Co.	89	Skyway	89
Imperial Model Aero Supply	81	United Air School	89
		Universal Aircraft Co.	89





The duPont Trophy.

# The DU PONT TROPHY WINNER

*Plans for building a duplicate of the payload event winner at the Nationals—  
a scale model of the Corben Super Ace*

## ABOUT ALBERT E. DILLON

Fifteen years ago Mrs. Dillon began missing her paring knives. But it wasn't difficult to track down the missing kitchenware. She merely looked for her son. She could be sure he had the knives, busy carving out a model of the Jenny—the favorite airplane of the day. From that time on Albert—"Pete," to practically every one—was a model "bug." He continued modeling through the painful spruce-and-silk era. In 1927 he turned to balsa and tissue, turning out ROG models that flew successfully. Unfortunately, his modeling took a slump when he graduated from high school in 1931.

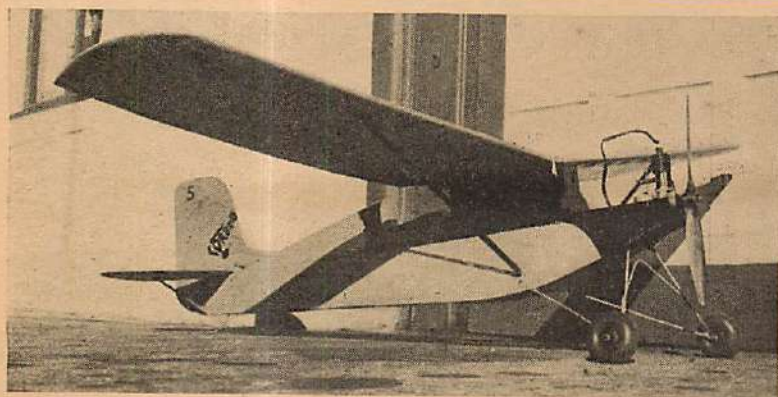
Gas models brought him back into the model fraternity. They seemed to be just his line—a natural reaction since Pete operates a garage in Jackson, Michigan. With more optimism than wise judgment he entered the 1936 Nationals in Detroit. He left Wayne Airport after the contest with a 60-second flight to his credit and a serious resolve to get more experience.

He spent the next year flying his Corben in all kinds of weather and under every possible setting. And when the 1937 contest season began, Dillon was among the winners. At the 1937 Nationals he had the satisfaction of bringing his year of model work to a successful peak by winning the duPont Payload Contest. His Corben performed smoothly despite the burden of a 2¼-pound dry cell attached to the bottom of the fuselage.

Between his garage and his gas models, Pete keeps the activities of the Jackson Gas Model Club running smoothly. As president, he is doing good work in spreading the model doctrine throughout Michigan.

A PAYLOAD event makes severe demands on a model. First is stability under a wide variety of weight loadings, motor settings, and flying conditions. Strength and ruggedness of construction is a second requirement. The entire structure must withstand considerable rough handling. The landing gear in particular must be "tough." It must absorb the shock of "hot" landings with the increased weight of the payload. An additional requirement is that the model be small enough to give the motor an ample reserve of power for carrying the payload. The wing should be of the high-lift variety with sufficient area for lifting the increased weight.

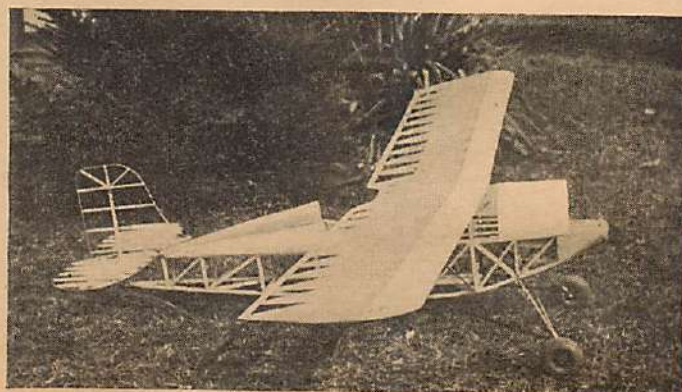
The Corben Super Ace isn't the ideal model for a payload event. But it came closer to filling the requirements than any other model entered in the payload event at the last National contest in Detroit. That is why Dillon took the duPont Trophy home with him. So until the gas modeling experts develop a special payload type of model, the Corben Super Ace is leading the field. It's an attractive model particularly easy to build and fly, since it has been on the market in kit form for the last 1½ years. Dillon built his model from a kit, making only minor changes that a year of steady flying proved necessary. Dillon describes the Corben as the most consistent flying model he's ever seen. Here's the Corben's record for the 1937 season: 2nd place, Battle Creek, Michigan, Gas Model Contest;



By  
Albert E. Dillon

*In collaboration with*  
Gordon S. Light

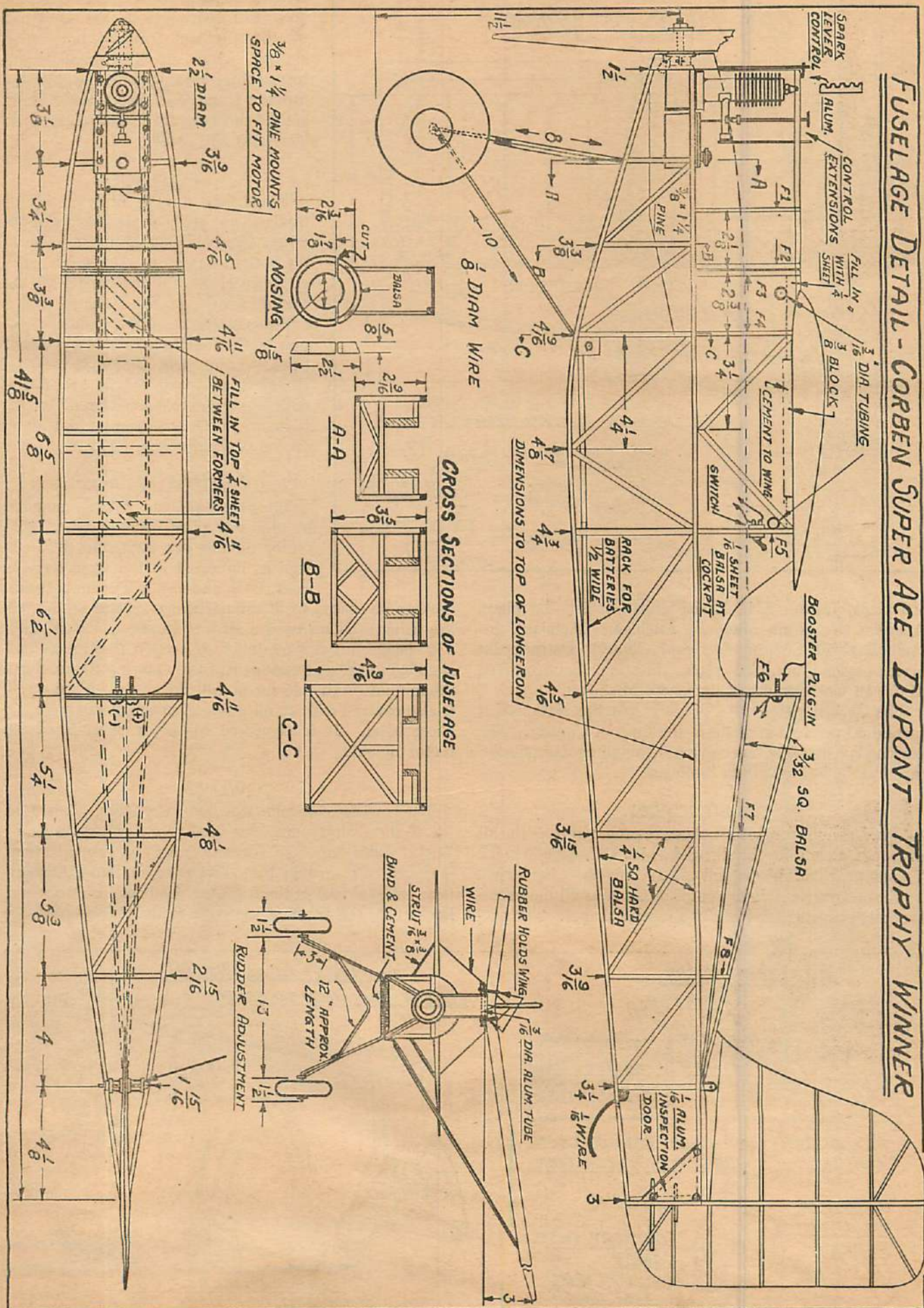
*17th consecutive Air  
Trails trophy-winning model*



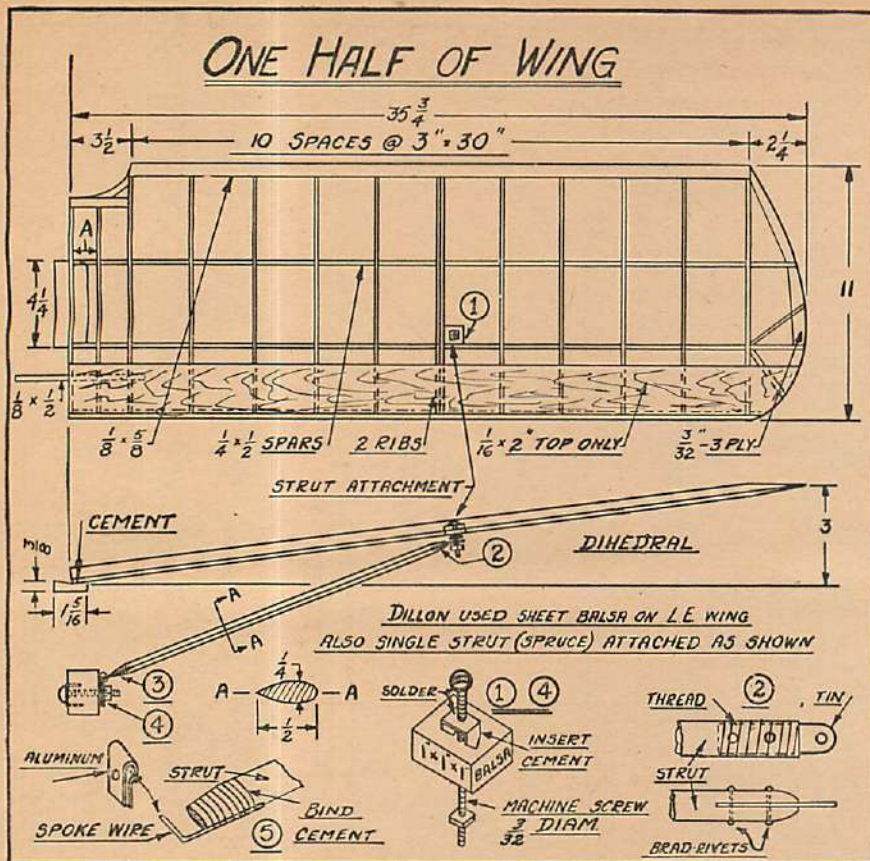
The presence of a scale model in the ranks of gas trophy winners is a pleasant change. Above, left—The model with cowl removed. Directly left—The frame-work.



FUSELAGE DETAIL - CORBEN SUPER ACE DUPONT TROPHY WINNER







terns have been crowded into one page because of space limitations. Only half of the fuselage formers have been shown. Draw up the complete pattern before cutting out the fuselage formers from  $\frac{3}{32}$ " sheet balsa. Balsa is used throughout the construction unless otherwise noted.

### FUSELAGE

Dimensions in the drawing of the fuselage are given from the top of the center longeron to the outside edge of the bottom longeron. In the top view of the fuselage, the dimensions are the overall widths of the fuselage at the indicated stations. First build the bottom of the fuselage from  $\frac{1}{4} \times \frac{1}{4}$ " hard balsa. Later, add the formers (F1, F2, etc.) and complete the top fairing with  $\frac{3}{32} \times \frac{3}{32}$ " balsa stringers. Twelve stringers are used—spaced uniformly on top of the fuselage formers.

### MOTOR MOUNTS

The motor and gas tank are mounted to pieces of pine  $\frac{3}{8} \times 1\frac{1}{4} \times 10$ ". These motor mounts are built into the fuselage as indicated in the cross sections A-A, B-B, and C-C. The mounts will

3rd place, Jackson Gas Model Club Contest; 1st place, Aviation Round-up, Marshall, Michigan; 1st place, duPont Payload Contest, National Contest, Detroit; 1st place, payload and 3rd place, duration, Southwestern Michigan Gas Contest, Kalamazoo, Michigan.

The Corben weighs  $4\frac{1}{4}$  pounds. At the Nationals it carried 50 per cent payload in the duPont Contest. The payload consists of a large dry cell, weighing  $2\frac{1}{4}$  pounds, taped to the bottom of the fuselage.

### CONSTRUCTION

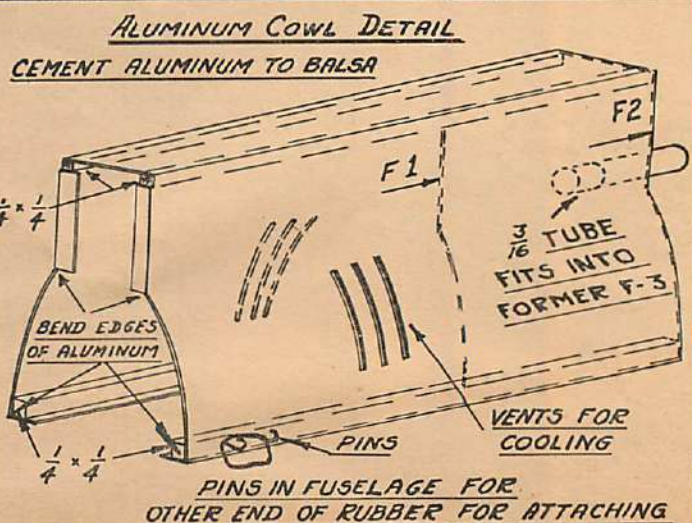
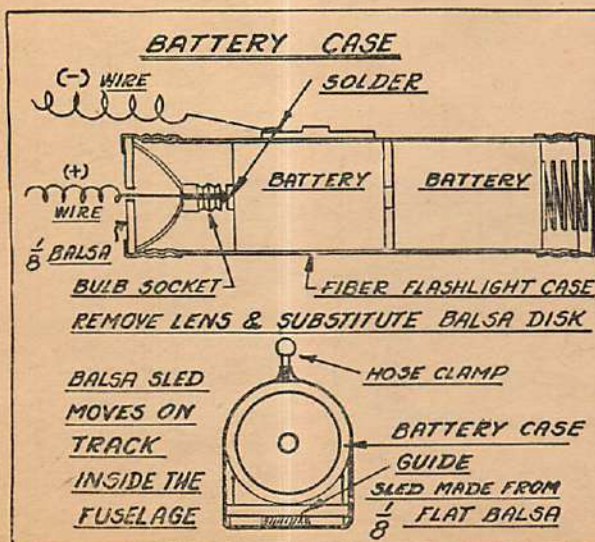
The drawings for this article were prepared from the kit drawings, except for the changes which Dillon made in the landing gear and the method of attaching the wing struts.

The one page of full-size patterns contains all the necessary rib, propeller, and fuselage former shapes. The pat-

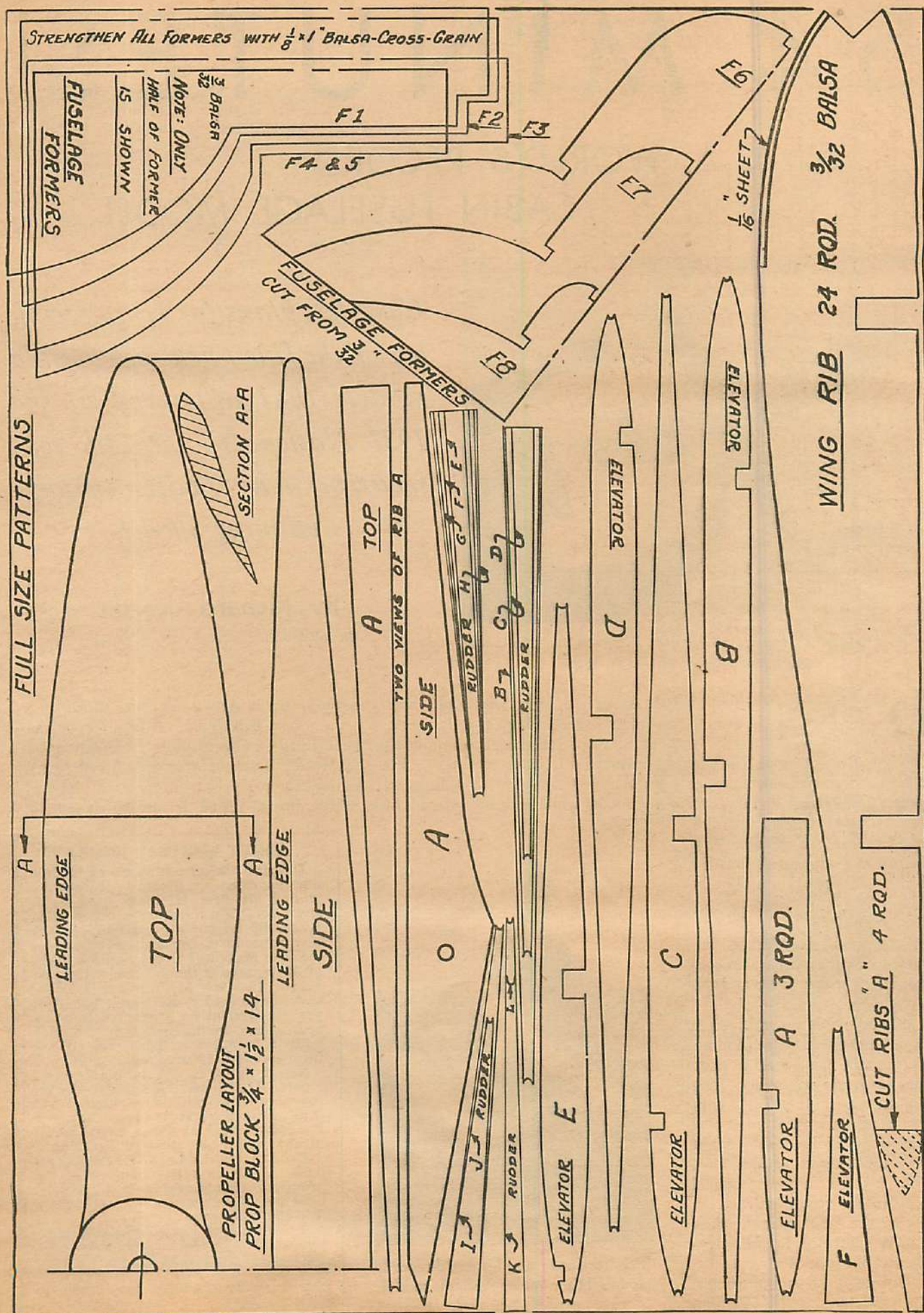
terns have to be spaced to fit the particular type of motor you are using. Dillon used a Brown Junior which requires  $1\frac{1}{2}$ " between motor mounts. At section B-B an oil wall is added to prevent motor dirt from entering the fuselage. Aluminum or tin-can metal will do nicely. Former F1 is also covered with an oil wall. A nosing is cut from  $\frac{5}{8}$ " sheet balsa. It is cemented to the front ends of the motor mounts.

### COWLING

The cowl is removable for motor servicing. It is built up of sheet aluminum, cemented to a light structure of  $\frac{1}{4} \times \frac{1}{4}$ " balsa and  $\frac{3}{32}$ " formers. A  $\frac{3}{16}$ " diameter tube is cemented to former F2. This tube fits into F3, which is an integral part of the fuselage. Rubber bands and pin hooks hold the front of the cowl to the (Turn to page 90)









# 54 MINUTES!

## N. A. A. WORLD'S RECORD CABIN FUSELAGE MODEL



The model that made the longest flight at the Nationals, setting the highest N. A. A. mark.

*Complete plans for reproducing one of the finest new weight-rule models that appeared at the 1937 Nationals—the 18th consecutive Air Trails trophy-winning model*

By Richard Korda

*In collaboration with Gordon S. Light.*

**D**URING the 1936 Nationals in Detroit, Korda flew a fuselage model out of sight after twelve minutes.

Several weeks passed without news of the model. He had given it up as lost when he received a letter from a farmer living about ten miles from Wayne County Airport. The farmer had discovered the model while he was harvesting his wheat. He managed to catch a glimpse of it before it disappeared into the binder. Unfortunately, he didn't see it in time to stop the machine. The only part of the model which was salvaged was the return slip containing Korda's name and address.

Flying models out of sight is a favorite Korda pastime. During the past several years he's turned in many long flights. Last July in Detroit he set a new fuselage model record of 54:13. This flight was the longest of the meet and is the highest official N. A. A. record turned in under the new weight rules. Korda competed in the open-class cabin fuselage event.

During the 54-minute flight the model covered 5½ miles

and was recovered undamaged. In the afternoon of the same day the model flew out of sight after eighteen minutes to place third in the Moffett Elimination contest. For the Moffett finals Korda was forced to substitute an old model for his lost Elimination job. He placed fifth in the finals. And, ironically enough, his



Richard Korda and his world-record model. His formula: A simple model expertly handled.

### ABOUT RICHARD KORDA

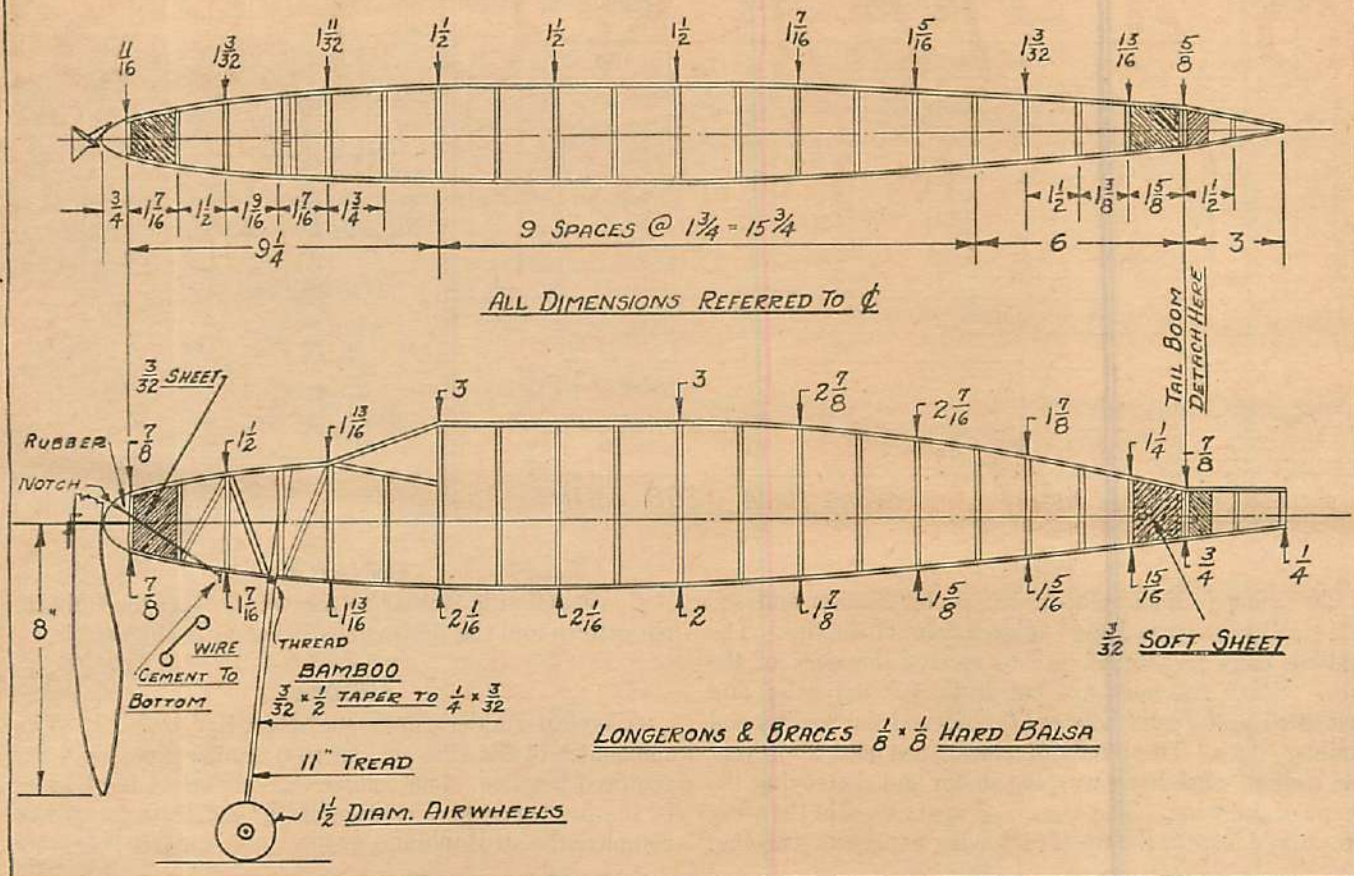
Despite having ten years of modeling experience, Richard Korda attended his first National meet as a spectator! This was in Akron, in 1934. Evidently he got a good idea of contest procedure, for the next year he won the Mulvihill Trophy with a flight of 24 minutes at the St. Louis National Meet. This was his first and last contest in the senior division. The next year at Detroit he graduated into the open class—taking second in the stick with 5 minutes and second in the fuselage with 12 minutes.

Speed flying is one of his favorite sports. He "dusts" his speedsters over the course at speeds as high as 75 m.p.h. For the last two years he's won the speed event at the National meets of the Junior Aviators of America.

Korda is married and lives in Cleveland. He is an active member of the group of championship builders who have put Cleveland on the model map. And like most true champions, his skill and enthusiasm have added much to the welfare of the model hobby. He offers one criticism of the present contest rules—the weight rule should be raised to two ounces for every 50 square inches.



## FUSELAGE DETAILS KORDA 54 MIN. RECORD HOLDER



54-minute model was returned to the airport immediately after the contest.

In the last three National meets, Korda has had five out-of-sight flights. Four of these wandering models have been returned safely. The fate of the fifth was described in the beginning of the article.

Korda has developed a fine contest-flying technique. Under his care a model delivers its peak performance. A simple, rugged, dependable model expertly handled is his formula for winning contests.

### CONSTRUCTION

Fuselage is built of  $\frac{1}{8} \times \frac{1}{8}$ " hard balsa longerons bent and pinned to the outline of the sides of the fuselage. It will be necessary to break the top longerons at the cabin window. Note that the top of the fuselage is flat for a distance of 7" to the rear of the cabin window. The front and rear ends of the fuselage are covered with  $\frac{3}{32}$ " soft sheet balsa. The tail boom joins the fuselage with a  $\frac{1}{4}$ " plug which fits inside the longerons. The boom is secured in place with strips of "scotch" cellophane gummed tape.

The rear rubber hook is an interesting departure from the conventional design. A bamboo piece  $\frac{1}{16} \times \frac{1}{4} \times 2$ "—inserted through notches in the sheet balsa—sides 1" from the rear of the fuselage. The bamboo rear hook provides more bearing surface

for the rubber and prevents cutting. Aluminum plates are cemented to the inside of the fuselage to prevent the bamboo stick from cutting the balsa.

Cut the nosing from a block  $\frac{3}{4} \times 1\frac{3}{4} \times 1\frac{11}{16}$ ". Cement a piece of  $\frac{1}{4}$ " flat balsa to the inside of the nosing to fit inside the fuselage. The nosing is attached by a rubber band, which fits into a notch in the nose block and extends to the bottom of the fuselage where it engages a wire hook cemented across the bottom. The propeller bearing is made of brass and pressed into the nose block. Punch the hole through the nosing to give the propeller shaft 1 degree negative and 1 degree right thrust.

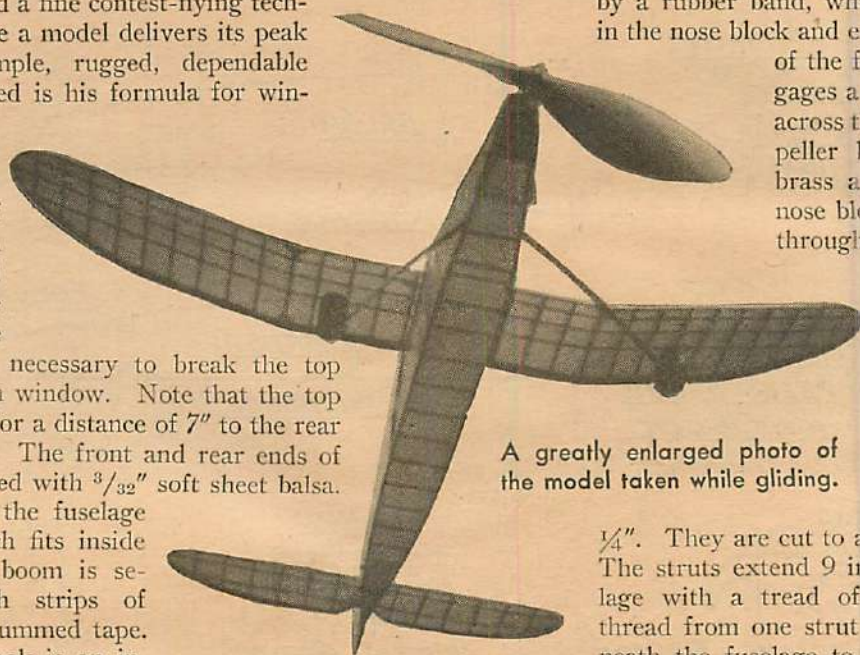
### LANDING GEAR

Bamboo struts are tapered from  $\frac{3}{32} \times 1\frac{1}{2}$ " to  $\frac{3}{32} \times$

$\frac{1}{4}$ ". They are cut to an oval cross section. The struts extend 9 inches from the fuselage with a tread of 11 inches. Wrap thread from one strut to the other underneath the fuselage to prevent tearing out

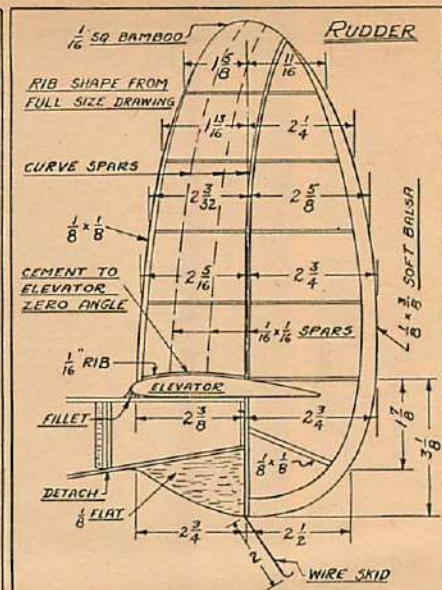
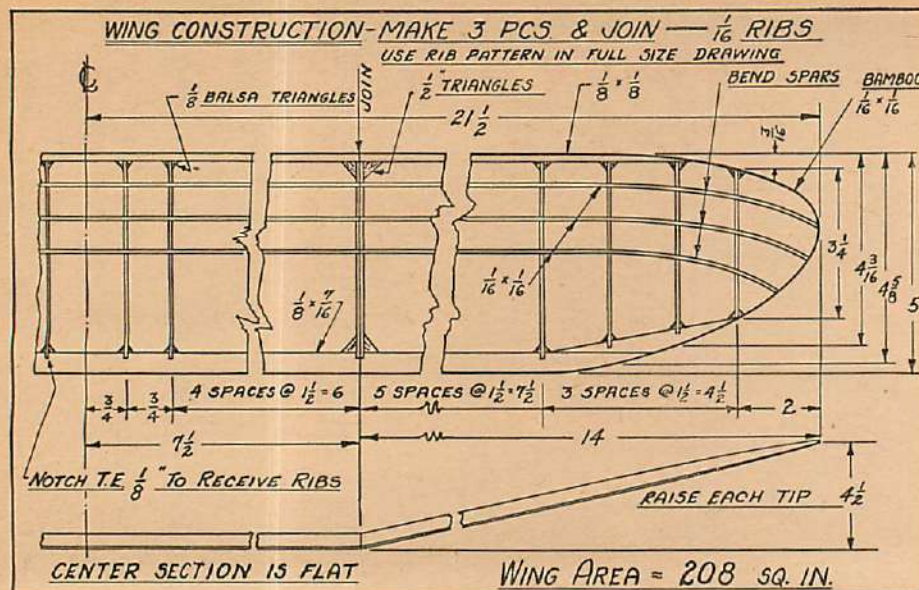
the struts on hot landings. If cemented thoroughly, no additional binding is required.

This particular method of construction is both simple and sturdy.



A greatly enlarged photo of the model taken while gliding.





## WING

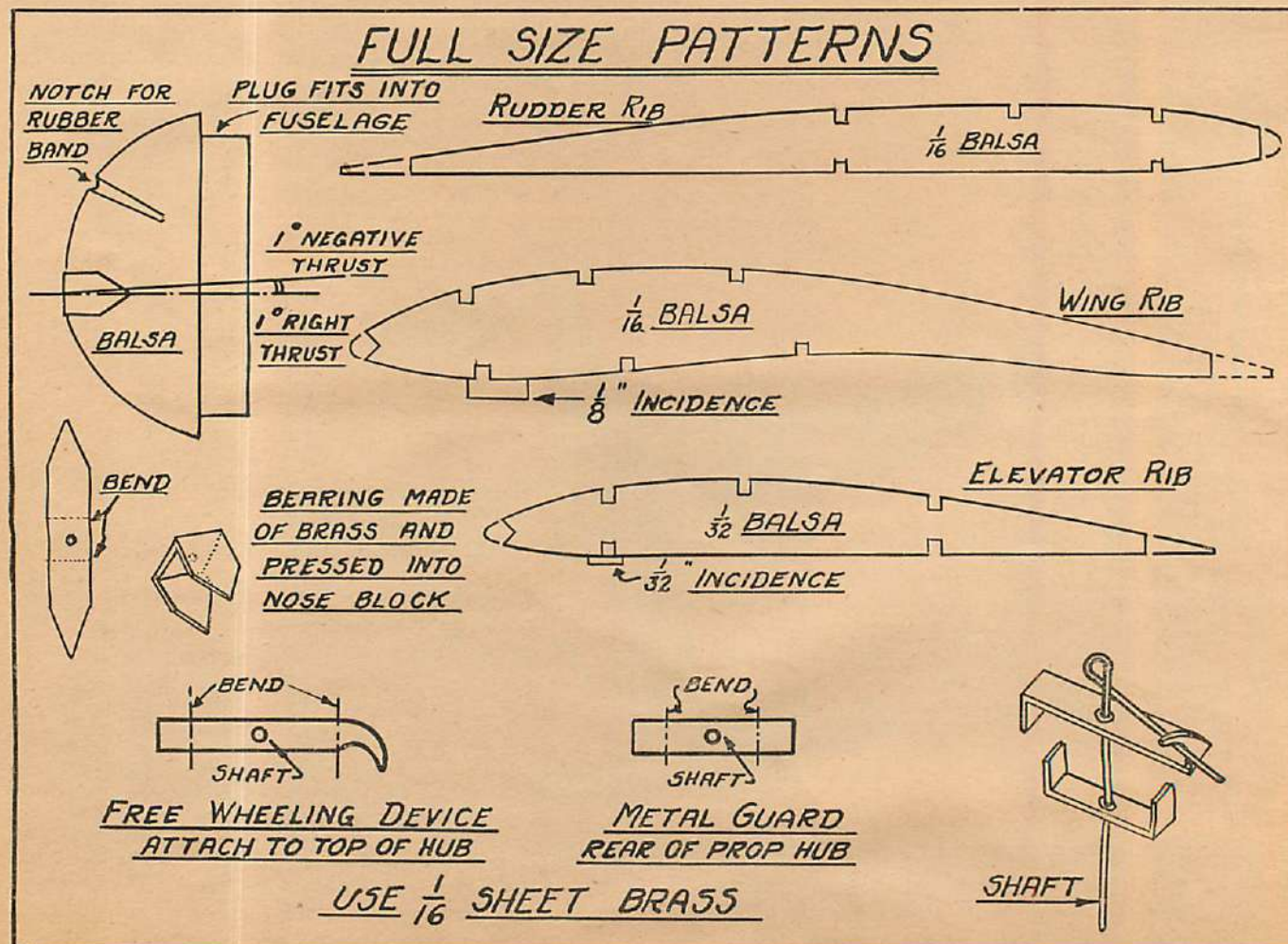
The wing is made with a 15" center section and 14" tips. Ribs are spaced  $1\frac{1}{2}$ " apart, except at the tips. The trailing edge is notched  $\frac{1}{8}$ " to receive the ends of the ribs. Small triangles are cut from  $\frac{1}{8}$ " flat balsa and cemented to the joint between the rib and the leading and trailing edges. These reinforcements are used to prevent the trailing edge from warping down and destroying the shape of the wing. The  $\frac{1}{16} \times \frac{1}{16}$ " spars used in the wing are curved back at the tip of each wing to prevent warping.

## ELEVATOR

Construction is similar to the wing. Use the full size rib pattern and the dimensions included in the sketch.

## RUDDER

A typical rudder rib is shown in the drawing. The remainder of the ribs are cut to a similar shape and the required lengths. The rudder extends below the bottom of the fuselage where a piece of  $\frac{1}{8}$ " flat balsa is used to complete the streamlining. (Turn to page 87)





# The Discussion CORNER

*The model art progresses through exchange of ideas. The Discussion Corner is a monthly sounding board for your opinions. For March the subject is twin tails. Other topics are listed below. Think about them, then write your opinion in 150 words or less and send it to The Discussion Corner. One dollar is paid for each answer printed.*

I PREFER an elliptical cross section with the maximum diameter twice the minimum. I deduced my choice from the following factors: 1—In a tractor, the airstream leaves the propeller in corkscrew fashion around the fuselage—hence, a round cross section. 2—In climbs, dives, and similar maneuvers the airstream strikes the fuselage from either above or below—therefore, a diamond or streamline cross section. A compromise between the two is an ellipse.—DENTON STOCKTON, Los Angeles, California.

For the past six years most contests have been won by models with square or rectangular-shaped fuselages. One reason for this choice of shape by past winners is the increased weight of an oval-shaped fuselage. However, with the increased weight rules, the oval-shaped fuselage should be a better choice since the increased structural weight will no longer prove a handicap.—E. T. ROBINSON, Broad-acre, Ohio.

The increased difficulty in building an elliptical-shaped fuselage is not rewarded by greater duration. The diamond is the easiest and most efficient shape to build. All the fuselage sides should be made the same for best results. A model with a diamond fuselage shows quicker recovery from bad maneuvers than models with square or elliptical fuselages.—DEAN ZANGKER, Wichita, Kansas.

The square or diamond fuselage shapes are most efficient—my choice being the square. This shape has more surface to aid in supporting the model for longer glides. A model with a square or diamond shape is as good looking as one with a rounded or elliptical fuselage.—GEORGE B. WALDEN, JR., Indianapolis, Indiana.

The most efficient fuselage shape is a streamline or tear-drop shape with the blunt end pointing downward. A fuselage of this shape will have very little drag at any angle of attack at which the model flies.—WILLIAM ELLIOT, East St. Louis, Illinois.

Theoretically, the elliptical section is the most efficient. However, for practical use, I prefer the diamond shape. It combines good streamlining with ease of construction. For models built under the new weight rule, the balsa-

covered elliptical fuselage will provide strength unequaled by a tissue-covered job. This increased strength is necessary in view of larger rubber motors.—GEORGE MICOTT, Allentown, Pennsylvania.

I prefer rectangular cross section with a depth to width ratio of about  $2\frac{1}{2}$  to 1. This offers a minimum of drag at high angles of attack. When a "low belly" is used, it adds greatly to the stability by lowering the center of gravity and center of lateral area. This construction makes for a simple job.—WILLIAM HOLLIS, Chicago, Illinois.

I prefer the square cross section because: 1—It is easy to build a model of this type. 2—Plans are simple to draw, as there is no need for a top view of the fuselage.

3—The square cross section affords a convenient place to mount the wing. Diamonds and triangles are desirable shapes, also.—MILAN SEDIO, Minneapolis, Minnesota.

The parabola is the most efficient geometric figure for supporting weight. The closest figure to the parabola that can be used in a fuselage cross section is the ellipse. Therefore, the ellipse is the most efficient shape from the viewpoint of strength. The airflow past an elliptical fuselage is relatively smooth compared to square or triangular shapes. Thus for strength and smooth airflow—use an elliptical cross section.—JIM JOHNSTON, Brandon, Manitoba, Canada.

COMING UP are these topics:

For April—Does the diamond type fuselage model improve efficiency? What do you consider to be the best method of design for reducing the interference drag of wing and fuselage junction? Answers must reach us by January 15th.

For May—Is the one-bladed propeller likely to improve contest times to the extent that it should be incorporated in all designs? What do you consider to be the chief advantages and disadvantages of this newly developed device? Answers must reach us by February 15th.

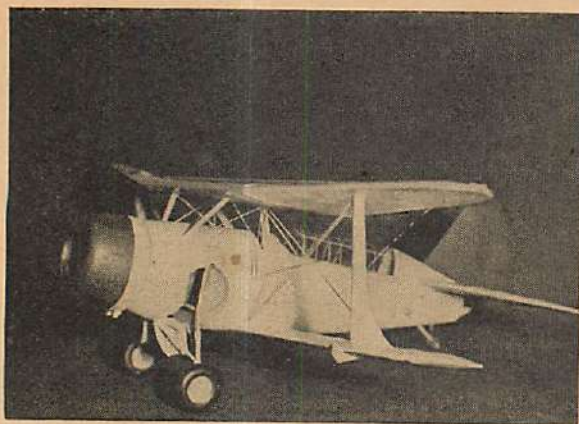
For June—Do you feel that the newly developed "streamline" airfoils offer advantages in model design over the accepted undercambered sections? With what airfoil sections have you obtained the best results? Answers must reach us by March 15th.

## *This Month's Topic*

In designing the outdoor model what fuselage cross section do you consider to afford the maximum efficiency?



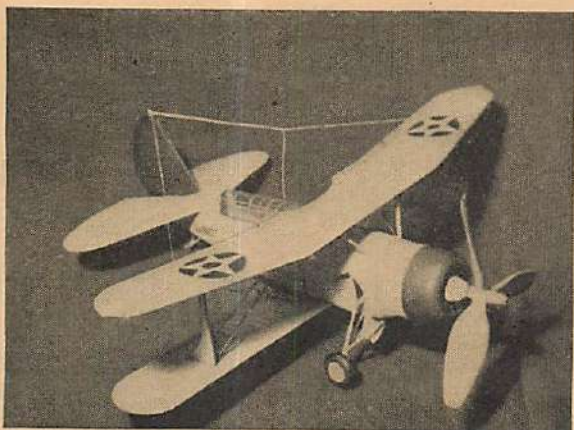
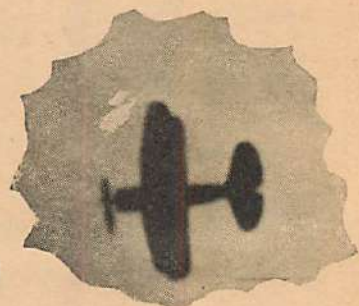
# Curtiss SBC-3 Scout-Bomber



*A flying scale model whose details and performance will satisfy the most discriminate model builders.*

By

Alan D. Booton



TWO squadrons of the SBC-3s are now being built at the rate of 20 per month and will be stationed on the two new aircraft carriers, *Yorktown* and *Enterprise*, after the carrier acceptance tests have been completed.

The SBC-3 has all the new features of the scout-bomber, including the auxiliary gas tank and retractable landing gear. The ship is all metal and retains the natural metal finish except for the chrome yellow top of the upper wing and the necessary squadron markings.

The model has been designed to conform to the exterior appearance, pleasing under close scrutiny and a snappy little flyer. The plans include adaptations for a true scale model.

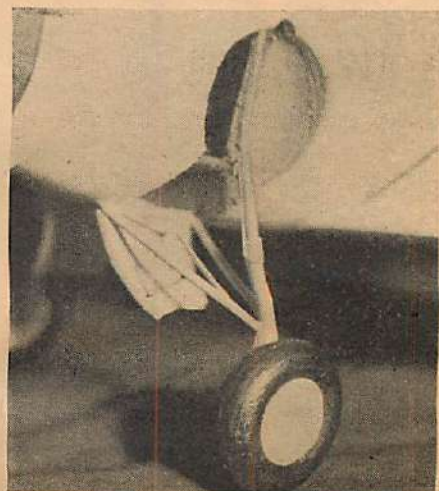
## FUSELAGE

Cement two  $1\frac{1}{8} \times 3 \times 11$ " soft balsa blocks together with several drops of cement—keeping in mind that the blocks must be separated later. Cut cardboard templates of the top and side fuselage outlines to use when scribing the lines on the block. Use the joint where the blocks were cemented together as a center line and mark off the top and bottom with the top template. If a bandsaw is to be used, lightly cement the two sides back on until the side cuts are made.

Scribe template A to the front of the blank and start carving at B toward the front and then toward the back, checking each section with the respective cardboard templates. Sand the fuselage to the final shape, then dope and sand (Turn to page 88)



Did you know that good flying scale models have been known to fly out of sight? While the SBC-3 is not a design adapted to such phenomenal performance, it yet affords the finest flights to be had from an ultrade-tailed model. Words are not necessary to describe the photos; they speak for themselves. The flight shot is enlarged three diameters!



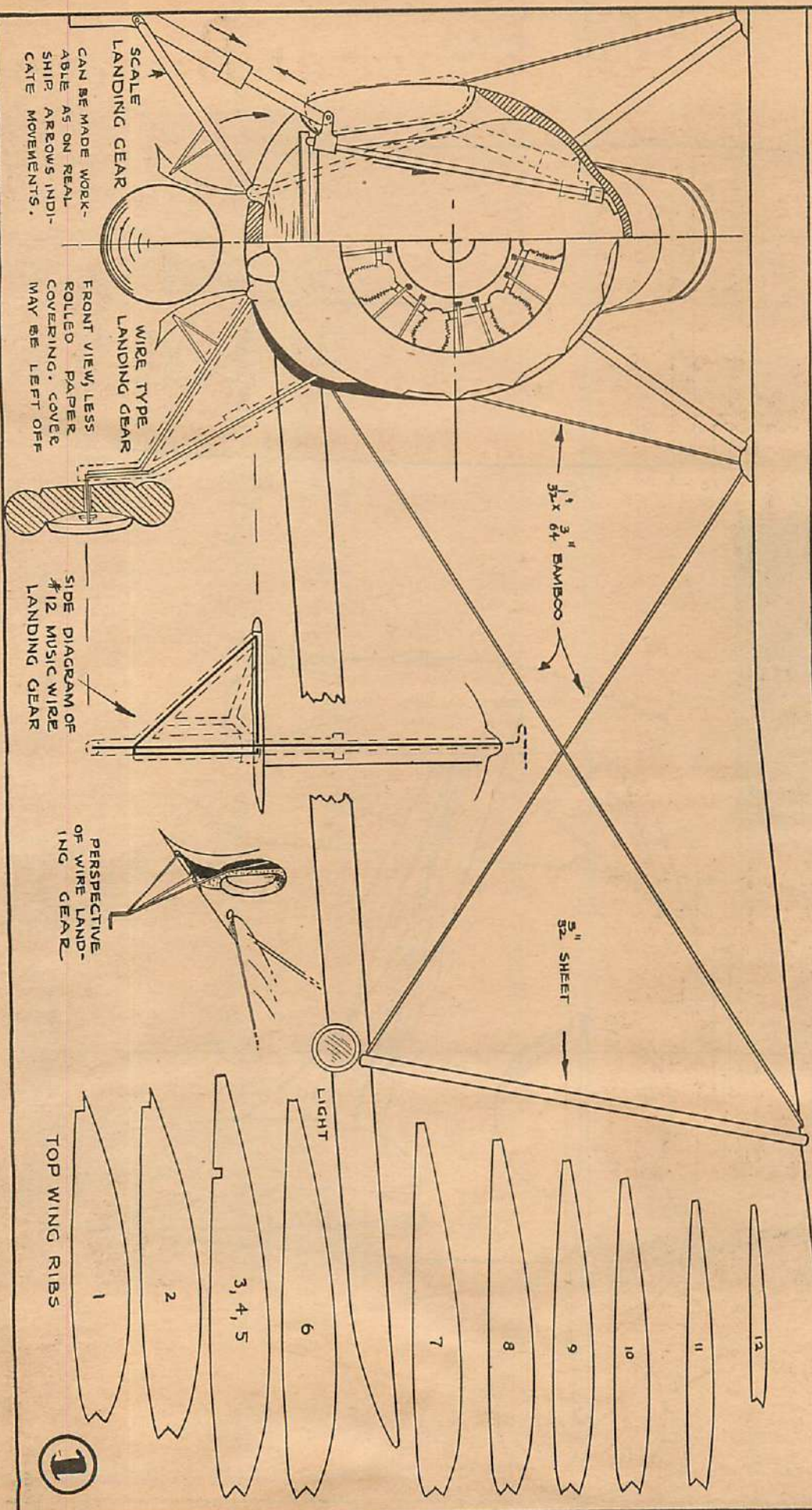


# PROP. for FLYING

FRONT

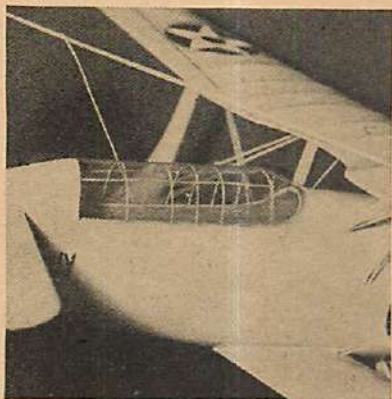
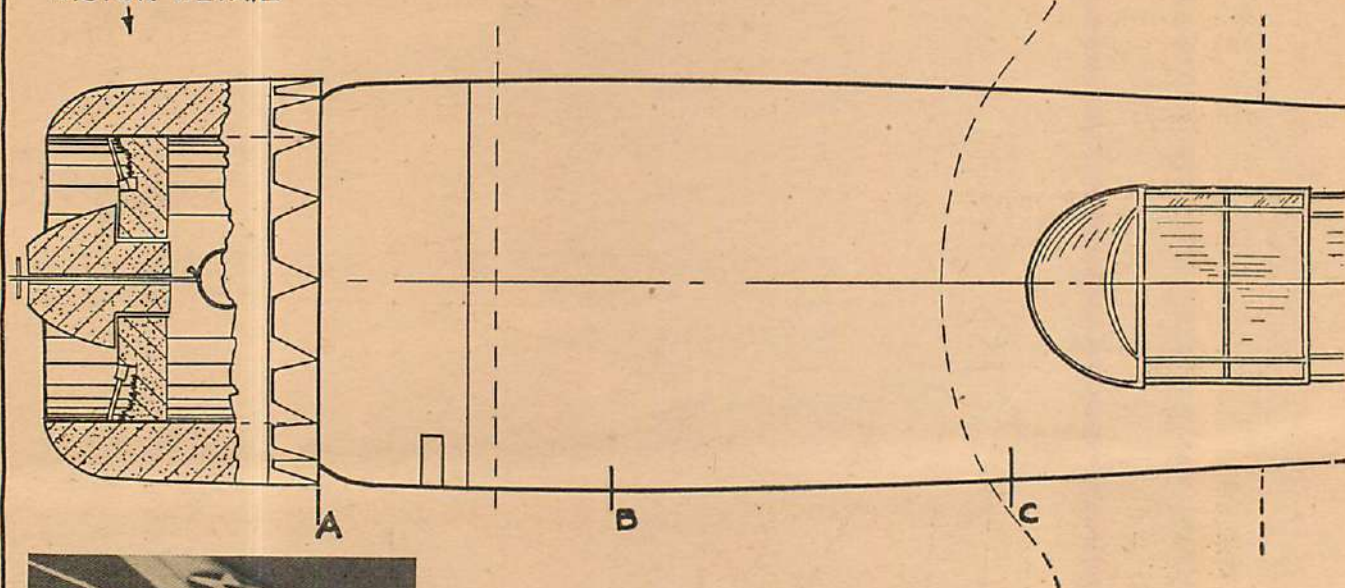
SIDE

LOWER WINGS RIB

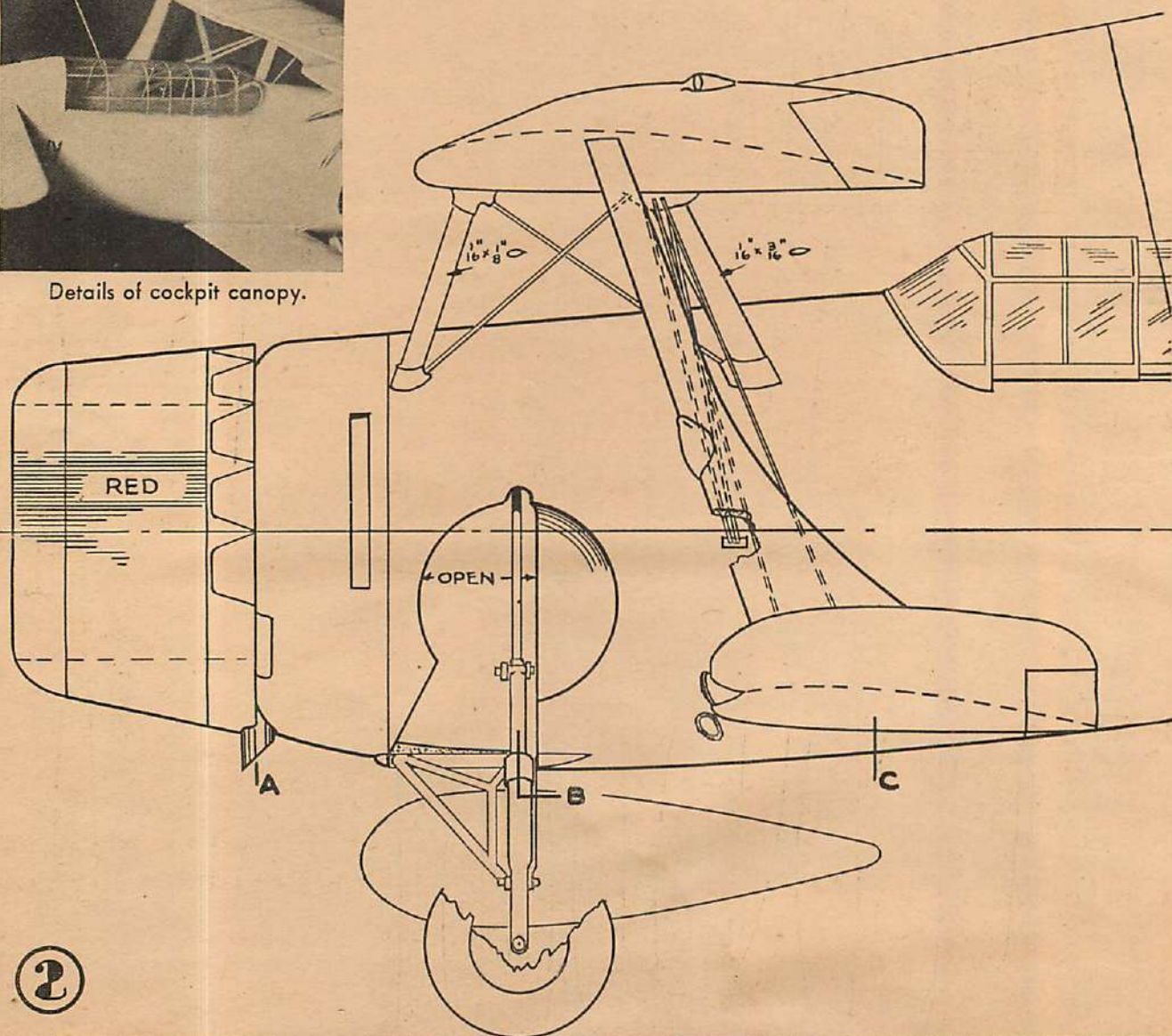




MOTOR DETAIL

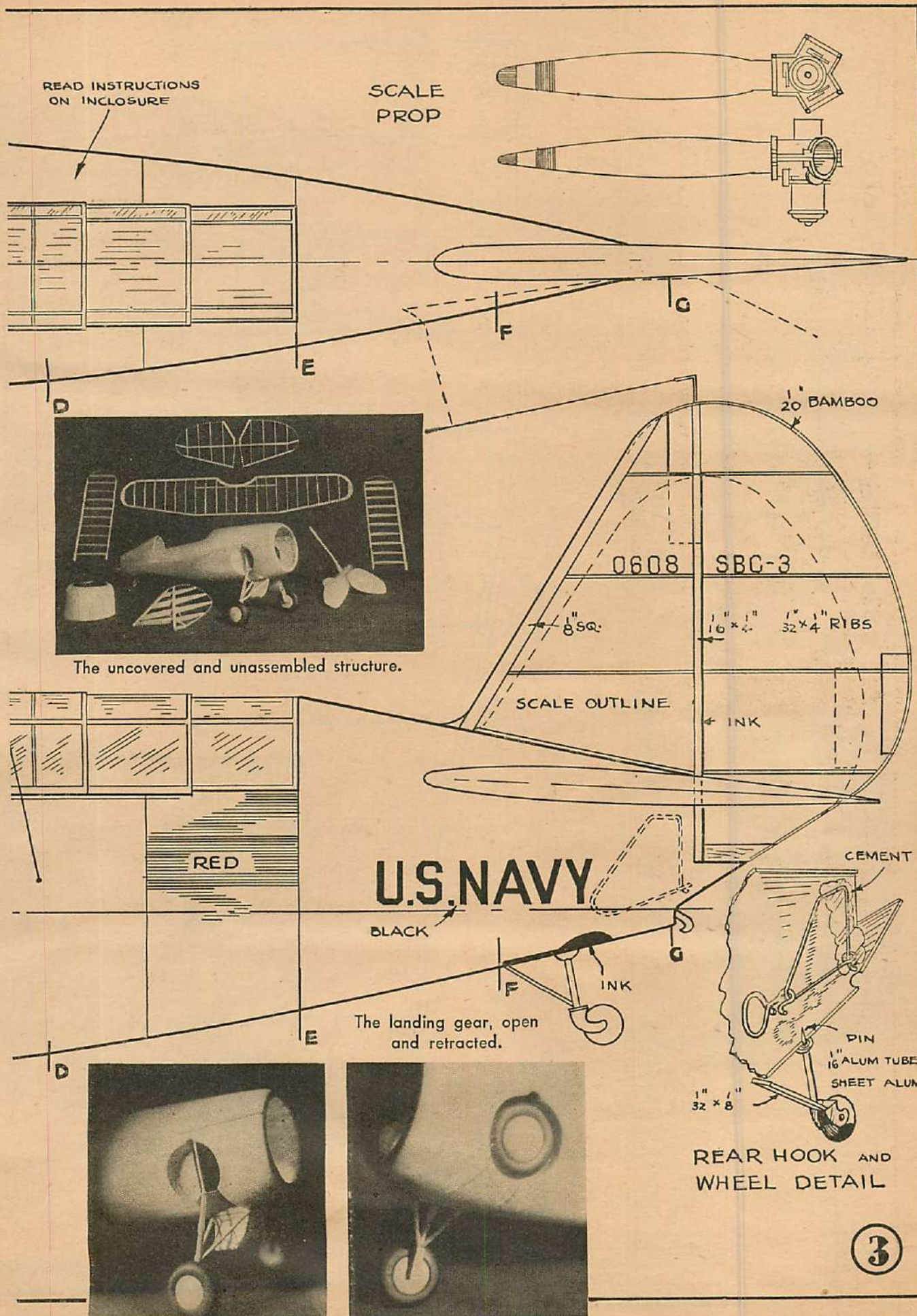


Details of cockpit canopy.



②











## Contest Calendar

**READERS AND CLUBS.** Notices should be mailed to the Contest Calendar, Air Trails, 79 7th Ave., New York City, at least 6 weeks in advance; news of winners and results immediately after the events.

**SCALE MODEL CONTEST** sponsored by the Scripps-Howard Junior Aviators, and open to all Canadian and American model builders; subject: Maj. Al Williams' Grumman Gulfhawk; no entry fee or previous registration required; contestants to compete under 3 divisions: up to 14 years, 14 to 18, and over 18; \$250 cash prizes; contest closes March 31, 1938. Cities not having local Junior Aviator Chapters are invited to compete through local model building or N.A.A. groups. Local winners are eligible to enter the finals. Complete information can be obtained from National Junior Aviator Editor, Press Bldg., Cleveland, Ohio.

**SPECIAL CONTEST** for nonflying scale models sponsored jointly by the N.A.A. and the International Air Show, Inc., to be held at the International Air Show in Chicago, January 28th to February 6th. Contest open to models of any man-carrying airplane, accurate in scale but with a wing spread of not more than thirty-six or less than eighteen inches. Any type allowable, provided the actual plane has or does exist. Three classes of competition: Seniors, from 16 to 21; Juniors, 13 to 16 years old; and Novices, 12 years or under; trophies, cash prizes, merchandise awards, and air trips for juniors and seniors. Models may be shipped express prepaid to Pat Sweeney, Contest Director, International Air Show, International Amphitheatre, Chicago, Ill. Models will be returned to the builders after close of show. For further information address William R. Enyart, contest chairman, National Aeronautic Association Headquarters, Dupont Circle, Washington, D. C., or Mr. P. J. Sweeney, Contest Manager, International Air Show, International Amphitheatre, Chicago, Ill.

**FIRST NATIONAL MODEL AIRCRAFT CONFERENCE**, National Aeronautic Association Headquarters, Washington, D. C. Date tentatively set for February.

**ANNUAL CONTEST** of the Ace Model Club, Marshalltown, Iowa. Tentative date July 4th; announcements to be made later. For further information address Ace Model Club, 19 South Center Street, Marshalltown, Iowa.

**FIFTH ANNUAL OUTDOOR FLYING CONTEST**, Lebanon, Pa., August 27th. Sponsored by the Lebanon Exchange Club; a full list of outdoor events—gas and rubber-powered models. Information from Contest Director, Lebanon Exchange Club, Lebanon, Pa.

model and it always turned in a satisfactory performance"—is the way the S. M. A. C. correspondent described this interesting model.

### San Diego Aeroneets

The San Diego Aeroneets held their first meeting October 17th, at Camp Kearny Mesa. Weighing in started at 7:00 a. m. and flying began at 8:30. A large crowd of spectators watched the four scheduled events—gas, rubber-powered fuselage and stick, and hand-launched glider. Thermals were few—flights being mostly climb under power and then glide. Alan Hems turned in a nice flight of 6:20 to take the stick event. He flew an open-frame single tractor.

Gas model flying started about 9:30 a. m. Leighton Webb took first in this event with a Brat-powered monoplane. His time was 4:08 using  $\frac{1}{8}$  ounce to the pound.

The hand-launched glider entrants fared poorly. Alan Hems took his second 1st of the meet with a flight of :29. As an added feature of the meet, the gasoline allotment was boosted to  $\frac{1}{4}$  ounce per pound. This is the amount

allowed by the N. A. A. rules. Elbert Weathers took first with 9:57.

#### Gas Endurance ( $\frac{1}{8}$ ounce)

- |                   |      |
|-------------------|------|
| 1. Elbert Weather | 4:55 |
| 2. Paul McKool    | 4:15 |
| 3. Mel Mattson    | 2:30 |

#### R. O. G. Fuselage—rubber-powered

- |                    |      |
|--------------------|------|
| 1. Leighton Webb   | 4:08 |
| 2. Daniel Halacy   | 2:07 |
| 3. Warren Williams | 1:48 |

#### H. L. Stick

- |                    |      |
|--------------------|------|
| 1. Alan Hems       | 6:20 |
| 2. Daniel Halacy   | 2:57 |
| 3. Warren Williams | 1:24 |

#### H. L. Glider

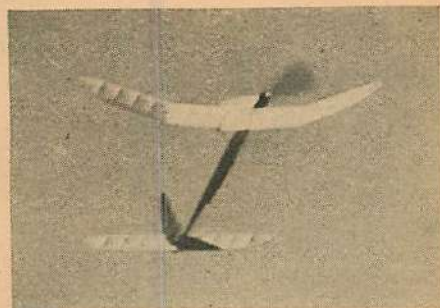
- |                  |     |
|------------------|-----|
| 1. Alan Hems     | :29 |
| 2. Daniel Halacy | :28 |
| 3. William Moser | :12 |

Daniel Halacy, who sent the report on this meet, used a one-blade propeller on his model in the rubber-powered fuselage event. It would be interesting to learn more about his experiments along this line.

### Linden, N. J., Notes

Linden Model Aircraft Club, Linden, New Jersey. Carl Frank has been elected president of the L. M. A. C. for the 1937-38 season. Other officers are: Silveo Colletti, vice president; Charles

Right—H. W. M. Taggart, Toronto, built this 1936 Texaco winner from plans in the June and July Air Trails. Stringers were substituted.



Pictures of the San Diego Contest.

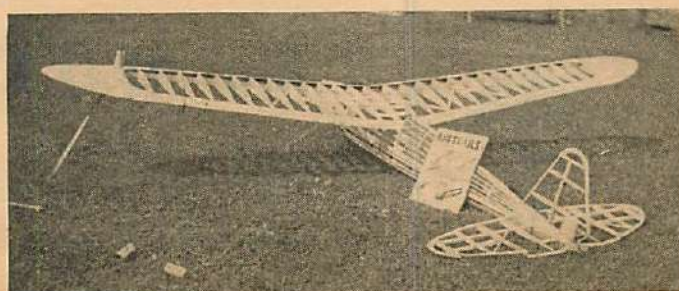
Top—Hem's stick model gets off on its winning flight of 6:20.

Above—Williams launches his twin pusher—the only one entered—to win 3rd place.

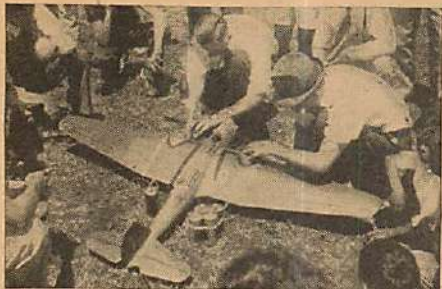
Below—Peter Ogrinz, New York, built the Inspirer from plans in the October and November Air Trails. With 10-second timing it thermalized for 15 minutes.



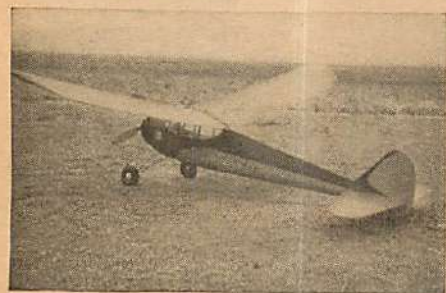
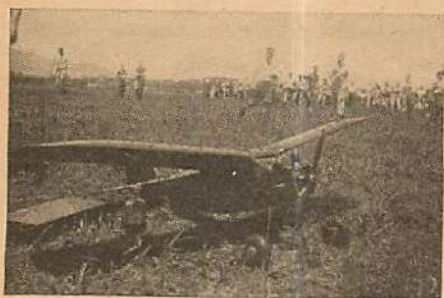
Friedrichshafen bomber by the Model Aero Club of St. Joseph, Missouri.







Hawaiian contest pictures. Top—Twin, Elf-powered Martin Bomber; Above—Shigeo Oka starts his eight-foot, Brown-powered parasol. Below—Robert Fukuda's five-foot gas model.



After favorable comment on a previous picture, another is presented showing Pete Bower's six-foot gas model. Mr. Bowers lives in Los Altos, California.

Sprague, secretary; and Ralph Mann, treasurer.

Frank Yuhasz recently recovered his T. D. Coupe gas model which was lost during the Union County Gas Meet last August 22nd. The model withered the two months in the open in remarkable fashion. Frank feels it has earned the right for retirement for the rest of its life—so, no more contests.

Roy Messinger was high-point winner of the L. M. A. C. during the outdoor season with 295; Richard Egles, second, with 294; and Frank Jones, third, with 149. Alex Pawlikowski received a subscription to Air Trails for placing first in the Junior Point System.

## Philadelphia Contest Results

Philadelphia Model Aeroplane Association held an indoor meet November 8th at the 108th Field Artillery Armory. The interesting feature of the meet was that all the entrants were novices—newcomers into the model hobby. This contest was intended to initiate them into contest procedure before they advance into the regular junior and senior contest. Naturally, the duration of the flights were not high. But, nevertheless, the beginners showed considerable interest and enthusiasm.

### R. O. G. Stick

1. Harold Snyder
2. Robert Wallace
3. Donald Walters

1:11

### H. L. Stick (Tractor)

1. Louis Stackhouse
2. Francis Zanger
3. Richard Joice

1:54

### H. L. Stick (Pusher)

1. Walter Speak
2. William Fleming

1:50.6

## First Annual Aero I. T. I. Contest

With many prominent aviation industry figures on hand, the First Annual Aero I. T. I. Model Plane Contest was held on November 20th at the Aero Industries Technical Institute, new aircraft industry training school in Los Angeles.

The contest attracted hundreds of model builders of southern California and provided lively competition among builders of both gas-powered and rubber-powered models. Handsome trophies were awarded in both divisions.

Fred K. Hardy, of Burbank, Calif., was the first prize winner in the gas model division. Irwin Ohlsson, of Los Angeles, was runner-up. Prize winners in the rubber-powered division were Bill Fox, of Los Angeles, first; and Don Wiebe, also of Los Angeles, second. All received trophies. Special award winners were William S. Rhodes, of Los Angeles; Ralph Pickard, of Hawthorne, Calif.; and Jack Bitterly, of Santa Barbara, California.

Judges of the contest were John K. Northrop, president of the Northrop Corporation and designer and builder of many famous military planes; Hall L. Hibbard, chief engineer of the Lockheed Aircraft Corp., and designer of the renowned Lockheed "14;" and Dr. Arthur Klein, professor of aeronautical science at the California Institute of Technol-

(Turn to page 94)

Right—Entrants in the South-eastern Gas Model Meet, Charlotte, North Carolina. Alan Booton, standing fourth from left.



## The QUESTION MARK

All questions pertaining to model construction problems should be addressed to Gordon S. Light.

Answers will be given promptly by mail, thus avoiding delay.



# Practical Model Design

*To know designs the model builder must understand spiral stability problems.*

By Frank Zaic

*Author of the Model Aeronautics Yearbook.*

IN a recent issue we covered the functions of the stabilizer. We found that its size was not at all critical, as we make it a practice to be generous with the stabilizer area. This practice of being generous with the stabilizer has led some of us to be likewise with the rudder. The function of the rudder is a bit different from the stabilizer and it is very important that it be as close as possible to its correct value. We cannot say to have the rudder area so much of the wing's area. There are too many factors involved in this. To clearly understand the action of the rudder we must understand torque, dihedral, skidding and side area.

Torque is the principal source of instability. To realize its power all we have to do is to hold the propeller and watch the ship rotate. Now, the tendency for the ship to revolve while it is flying is still there, but we control it by the dihedral, or having one wing lift more, or using a counteracting rudder or side-thrust adjustments. Although by this it would seem that we have several means of controlling the torque, the actual truth is that the wing does all the work. The other adjustments are simply means of shifting the model so that the wing will take effect. The manner in which the wing counteracts the torque is as follows:

First: We must realize that the lift force is always perpendicular to the airfoil. This will give us forces as shown on the drawing. Note how the total lift is vertical when the plane is level. The torque tends to upset the model by rotating it in opposite motion of its rotation. When this happens, the lift component naturally angles and in conjunction with the weight of the model force acting through the C. G. it produces a force diagram as shown. Here we see that the torque produced a side force. Notice the direction of this force. You will recognize the position of the model as being that of circling with the torque. But have you ever wondered why the ship banks more at the beginning of the flight? The secret lies in the dihedral effect.

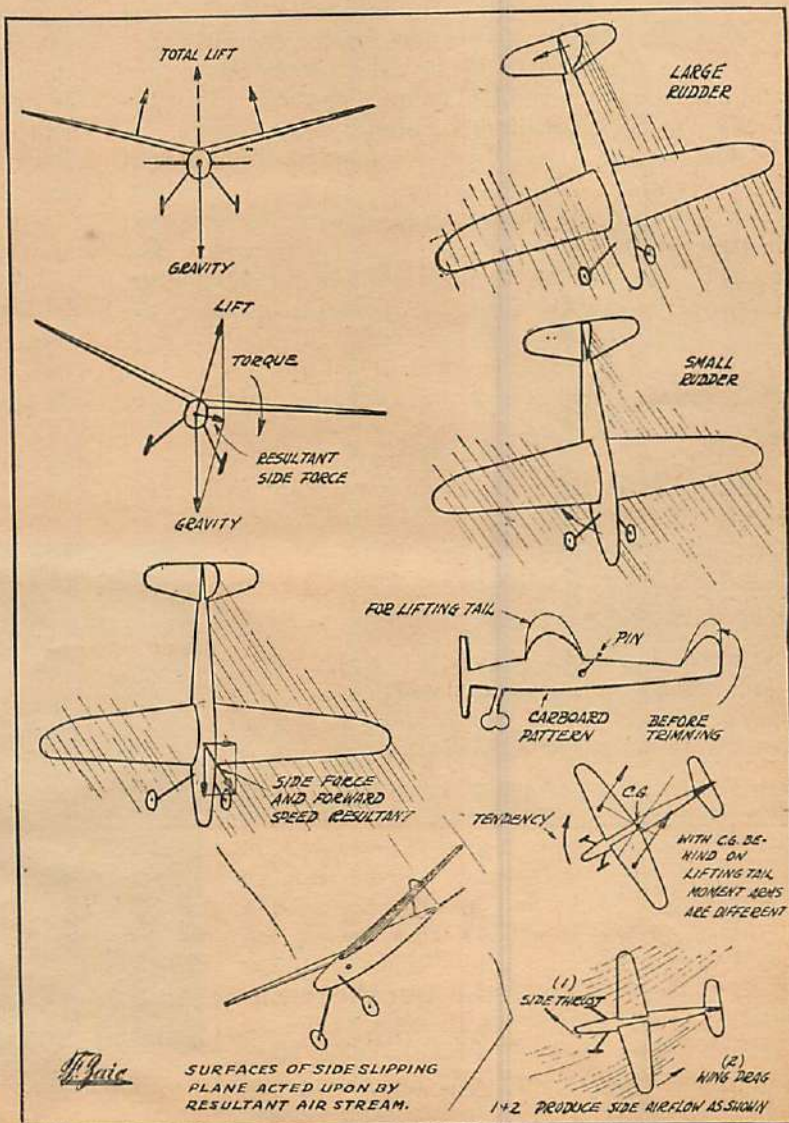
We now know that torque produces a side force. Consider a plan view of the model while it is under torque influence. From the drawing we can see how that side force and the forward propeller force produce a diagonal. From your

study of mechanics you will realize that the model does not move in the direction the propeller is pulling it, but along the diagonal direction.

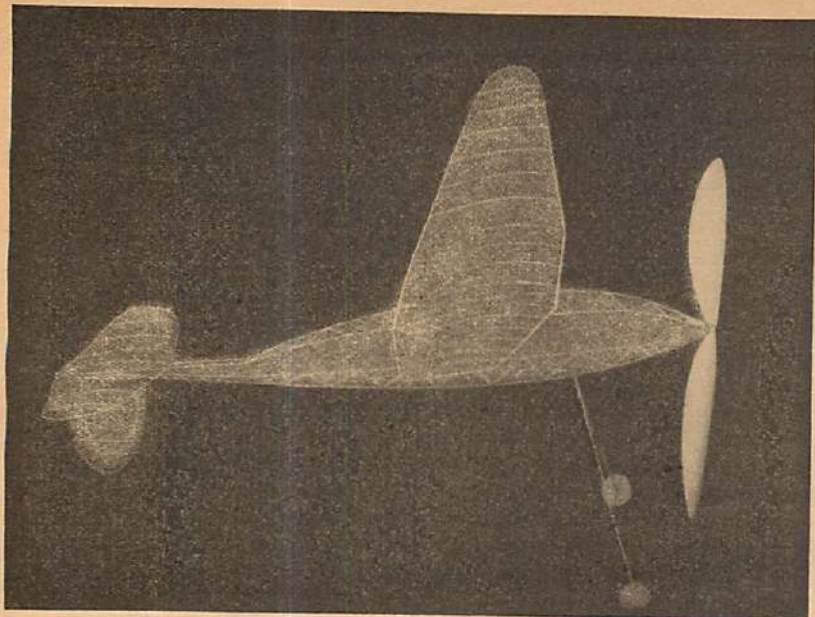
The major portion of the dihedral-spiral-stability study depends on your realizing the fact that the model is in a sidewise motion. If the model is moving in this direction we can very easily see that the air does not strike face on, but along the sides. Taking a view along this new path we would see the model as shown.

Taking another glance at the sketch, you will note that the "inside" wing has considerable under-camber portion exposed, and that the "outside" wing has the upper part exposed. This is equivalent of having the angle of attack change on each half. The inside wing has positive and the outside negative. From the previous articles you can realize how much more lift the wing with positive camber has. In fact, the difference is just equal to the torque.

It is evident that the greater the torque, the greater will be the side force and with it a greater increase of angle of attack or exposing of under surface. You can easily demonstrate this principle to yourself by taking a three-fourth-front view of the model. At zero torque you should face the model, and with increase in torque slowly rotate the model with the inside wing coming toward you. This sidewise motion of the model is known as "skidding." And the point we must bear in (Turn to page 72)







*An indoor model designed to eliminate delicate bracing. An exceptionally rugged project for newcomers to try their skill*

By

Lawrence N. Smithline

## The SOLUTION

**M**ODEL BUILDERS have definite preferences in model types. Most modelists go in for tractors, probably because they are the easiest to build and to fly. The more exacting model builder, however, prefers the fuselage model. He believes that the added time and trouble required to build and to correctly adjust the fuselage model is worth the difference in appearance.

This fuselage model departs somewhat from general indoor practice. Heretofore, fuselages have either been covered with tissue or else tissue or wire has been used in their construction to absorb the rubber torque. The construction used on this model does away with the bother of bracing the fuselage, although it increases the weight approximately .003 ounces.

The rest of the model is conventional so let us get into the business of building it for our next trek to the armory.

### WING

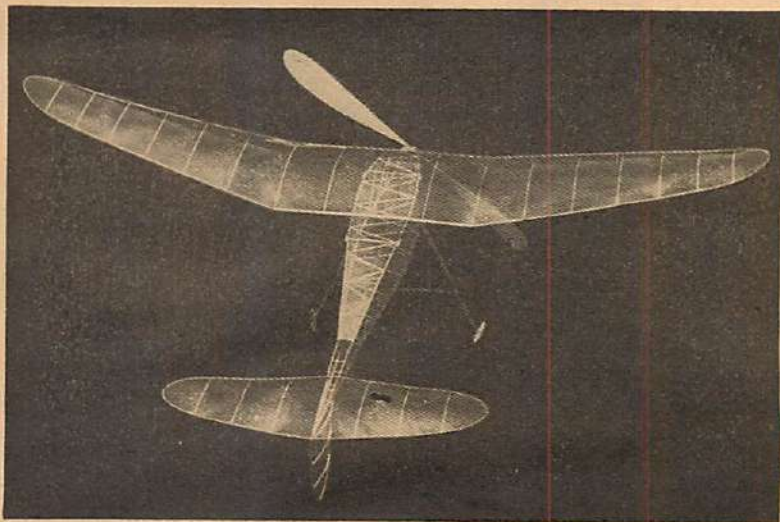
The wing for the model is made of straight edges for simplicity. The loss of efficiency due to this type of construction is probably small. Its advantage lies in the fact that it cuts down the building time.

The first job in building is to make a full-sized drawing. Cut spars for the midsection from very light  $\frac{1}{16}$ " sheet balsa,  $\frac{1}{8}$ " wide. Tip spars are cut from the same sheet,  $\frac{1}{8}$ " at the root tapered to  $\frac{3}{64}$ " sq. at the ends. Round all edges and pin them to the drawing. Cut ribs from stiff  $\frac{1}{32}$ " balsa stock with a template of the shape in the drawing. The process of cutting ribs is as follows: Place the template on the sheet of balsa and cut along the edge of it. Then move the template  $\frac{1}{32}$ " away, but parallel to the cut just made. Slice along the template again, forming the rib. Cement the ribs in place, cutting off  $\frac{1}{3}$  the excess from the leading edge and  $\frac{2}{3}$  from the trailing edge. Now make a cardboard template of the tip and bend two strips of  $\frac{1}{32}$ " sq. soft balsa, soaked

in water, around the template. Join the tips to the main spars and then cement the outermost ribs in place. The wing may now be covered. After the covered wing has been removed from the microfilm hoop, crack the light-cement joints at the intersection of the center section and the tip sections. Raise the tips and firmly cement them in their new positions. Make clips from .010 wire, as shown in the drawing, to fit the fuselage blocks and cement them to the wing spars, thus completing the wing.

### FUSELAGE

Make a full-sized drawing of the fuselage, making sure that both solid and dotted lines are shown for the cross braces. In this type of fuselage the left- and right-hand sides are different. The dotted lines denote the right side and the solid, the left. Pin two long, light strips of  $\frac{3}{64}$ " sq. stock on the drawing for the longerons and cement in the cross braces, of the same stock, on the solid lines. Then build the other side, using the dotted lines



The photos of the completed model show clearly the angular fuselage cross pieces.



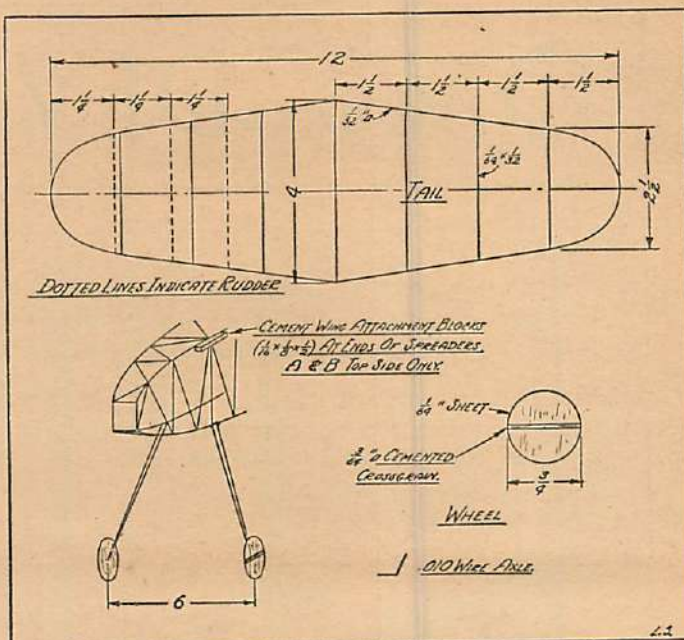
as the guide. Put in the spacers at the front and rear of the fuselage and after they have dried in place cement spacers "A" and "B," top and bottom, in place. You will note that the ends of all the cross braces converge to a point where others meet and that not even one goes to a space where there are no others.

The plugs come next. Make the rear plug by cementing two sheets of  $\frac{1}{64}$ " stock together, the grain running oppositely. Then cement, on one side only, slivers of  $\frac{3}{64}$ " stock (as shown in the drawing) to fit the rear of the fuselage. Cement in the rear hook, which is bent from .016-diameter wire, to the shape shown on the drawing. The first step in making the front plug is exactly the same as that of the rear. Then, after a plug similar to the rear is made, cut out the center part (between slivers) and build up the front section as shown in the drawing. Then cement the thrust bearing, which is of the double bearing type, in place.

Lay out the boom as shown on the drawing and build it of  $\frac{1}{32}$ " sq. light stock. Cement the extension in place and then cement the boom to the rear plug. Make sure that you cement the flat side of the boom on top.

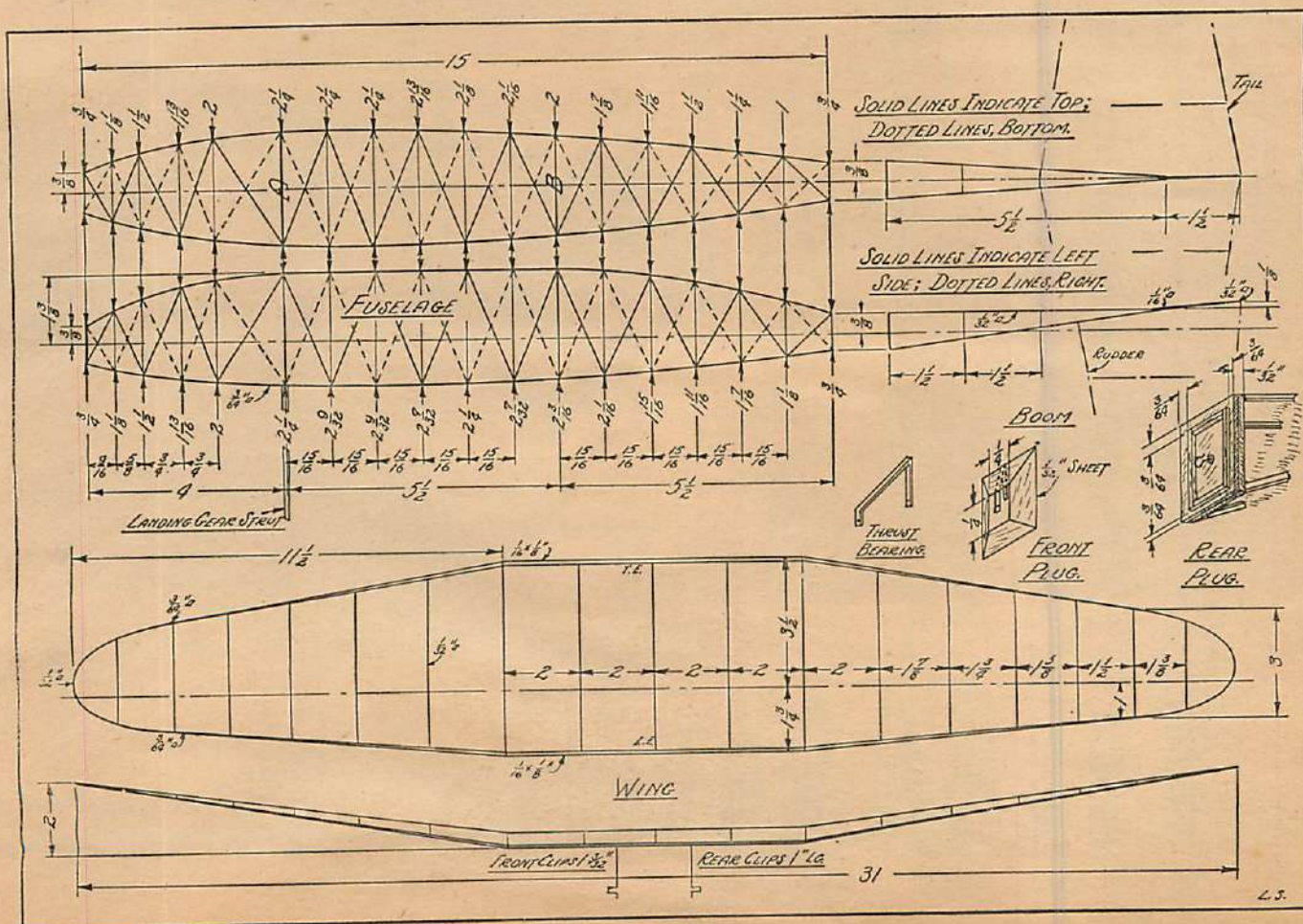
You may now cover the fuselage and boom.

The landing gear consists of two strips of balsa,  $\frac{1}{16}$ " by  $\frac{1}{8}$ " at the upper end, tapered to  $\frac{3}{64}$ " sq. and 7" long to which wheels are attached by axles. The wheels are  $\frac{1}{64}$ " sheet balsa with a cross-grain brace. The axles are made of .010 wire as shown on the drawing. Place the wheel on the axle, cement the axle to the landing-gear spar, and cement the spar to the fuselage in the position shown on the drawing.



## TAIL AND RUDDER

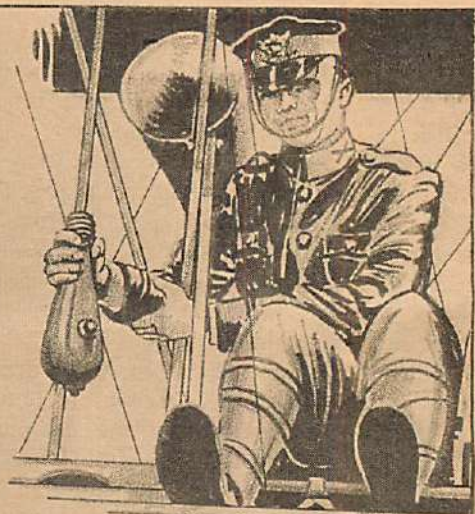
Make a full-sized drawing of the tail. Then make a cardboard template of the shape and bend around it two strips of  $\frac{1}{32}$ " sq. soft stock about 15" long which have been soaked in water. After the water has evaporated, pin the formed tail spars to the drawing and cut out the ribs from  $\frac{1}{64}$ " stock. Cement the ribs in place and then cement the two halves together. (Note that there is only one rib in the center.) Make the rudder in exactly the same way. That is, draw it up, bend a (Turn to page 92)



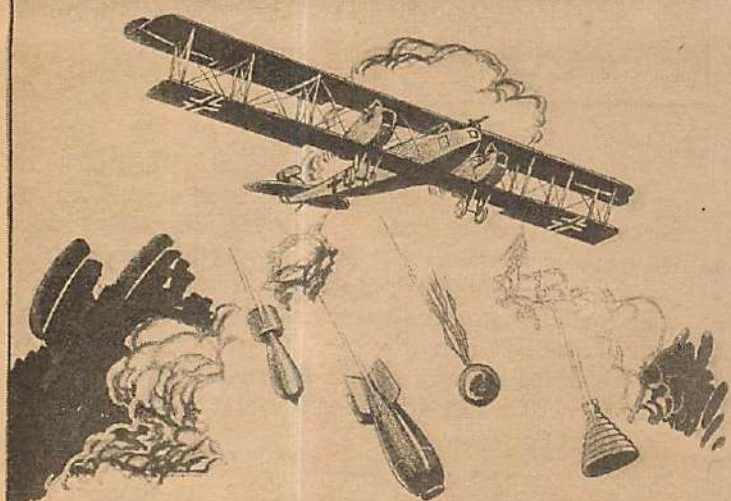


# BOMB DEVELOPMENT

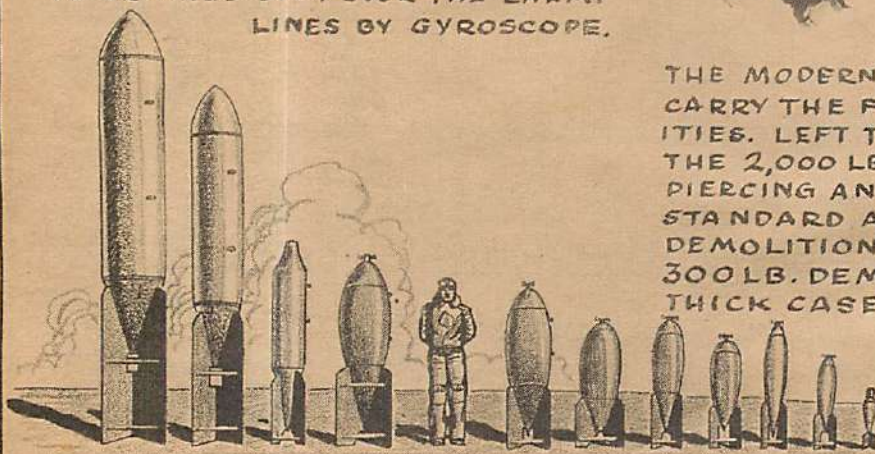
THE UNITED STATES FIRST AERIAL BOMB WAS DEVELOPED IN 1910. DESIGNED TO BE DROPPED OR THROWN FROM THE ARMY'S FIRST WRIGHT PLANE IT WAS FITTED WITH SEVERAL DETONATORS IN CASE IT LANDED OTHER THAN UPON ITS NOSE.



DURING THE WORLD WAR GERMANY DROPPED MANY TYPES OF AERIAL BOMBS RANGING FROM THE FIRST SMALL ROUND ONES STEERED BY STRIPS OF CLOTH, AND THE QUEER "BEE-HIVE" BOMB OF THE "ZEPS" TO THE LATER AND MORE EFFECTIVE "EGGS" OF THE LATER YEARS OF THE CONFLICT.



THE ALLIES IN RETURN SHOWERED GERMANY WITH OVER 5000 TONS OF FRAGMENTATION, DEMOLITION, AND INCENDIARY BOMBS. THESE RANGED FROM TWENTY POUNDS, UP TO 1000 POUNDS. ANOTHER SIX MONTHS OF WAR WOULD HAVE SEEN THE INTRODUCTION OF A PROVEN PILOTLESS AERIAL TORPEDO THAT WOULD FLY 50 MILES, SHED ITS WINGS AND FALL - A GIANT T.N.T. BOMB. THIS WAS STEERED AUTOMATICALLY TO A PRE-DETERMINED SPOT OVER THE ENEMY LINES BY GYROSCOPE.



THE MODERN BOMBERS OF THE U.S. ARMY CARRY THE FOLLOWING IN VARIOUS QUANTITIES. LEFT TO RIGHT: THE 4000 LB., AND THE 2,000 LB. DEMOLITION, 1,100 LB. ARMOR PIERCING AND THE 1,100 LB. DEMOLITION, STANDARD AND THICK CASE 600 LB. DEMOLITION, STANDARD AND THICK CASE 300 LB. DEMOLITION, STANDARD AND THICK CASE 100 LB. DEMOLITION, AND THE STANDARD 25 LB. FRAGMENTATION BOMB. THE PILOT GIVES AN IDEA OF THE SIZES WHICH RUN FROM 2 FT. FOR THE SMALLEST UP TO 14 FT. FOR THE LARGEST.



# DESTROYERS OF THE AIR

(Continued from page 13)

members of formations. Other methods are being studied, such as the preservation of a small reserve formation in the vicinity of combat around which detached individuals or elements might reassemble. However, it is not considered likely that reorganization could always be achieved.

Pilots trained to fight in teams, though unable to locate the reserve or the main body, would be instructed to join together spontaneously in small formations and continue on their way, or to their home airdromes. The chances are that a pilot lost from his formation would not be long in finding a small group to which he could attach himself. These formations would employ mass tactics in meeting a similar enemy formation, until disorganization again occurred. In the general mêlée only one single-seater could conveniently be on the tail of another at a time. But in fast planes he would be in this position for such a short time that other friendly pilots, taking pot shots as the enemy came in range, might fire as many shots as the man on the enemy's tail. Thus it seems likely that the romantic master of the art of aerial dueling, with his string of confirmed victories, has passed into history to return no more.

When it is stated that pursuit planes would go forth to battle in formations of 75 to 100, it seems on first thought that it would be impossible. How can so many planes, flying from 200 to 300 miles per hour, be kept in formation—even in peace-time maneuvers? How do those military pilots manage to fly the elaborate formations which have become a familiar sight over the nation?

The answer is that each man, with only a few exceptions, has only one other man to watch, and each takes his cue from that man.

The basic unit of a pursuit formation is the element of three planes. In most formations it flies in an inverted Vee. The leader is No. 1, the right-wing man No. 2, and the left-wing man No. 3. (In some exhibition formations individual planes in elements may be "echeloned" either to the right or the left.) An echeloned formation, whether an element, flight, or larger unit, is one in which the component units fly all on one side of the leading unit, and on a line which extends outward, backward and generally upward about 45 degrees from the line of flight. An echelon may be an echelon of single planes, of elements, of flights, or of squadrons—though each unit in a large echelon may not necessarily itself be in echelon.

After the element, the next larger unit is the flight. In close-formation

drill, as distinguished from tactical fighting formations, which are somewhat different, the flight is generally an echelon of two elements.

The squadron formation in close-order drill is normally composed of 18 planes, flying as an echelon of three six-ship flights.

The group formation is made up of two or more squadrons. (The tables of organization call for four squadrons to a group, but the General Headquarters Air Force at present doesn't have enough planes to fill out its three pursuit groups completely.) The normal drill formation is an echelon of squadrons, and the formation for aerial reviews is a column of squadrons, flying one behind the other on the same level.

In addition to the planes of the pursuit squadrons composing the group, there are those belonging to the group headquarters squadron, carrying the group commander and his aides. The headquarters' squadron is assigned five planes.

Formations, especially practice formations, are not invariably made up of the same number of planes—the number available for service often having a lot to do with the number which take the air. Instead of 18 planes, a squadron of pursuit is allotted 28 planes by the tables of organization, 9 to each of three flights and one to the squadron commander. A portion of the planes are always out of commission. During the World War the American units kept only 50 to 60 per cent of their planes in commission. A present-day squadron is supposed to be able to keep 18 or 20 of its more easily maintained modern planes ready to fly at all times.

The next unit larger than the group is the air force wing. It does not fly as a single formation, for it may be composed of two or more groups including different classes of aviation. There are three wings at present in the G. H. Q. Air Force.

The First Wing, based at March Field and Hamilton Field, has no pursuit, being made up of bombardment and attack groups, together with two reconnaissance (air force observation) and two air base (maintenance) squadrons.

The Second Wing includes the 1st Pursuit Group at Selfridge Field, and the 8th Pursuit Group at Langley Field, as well as two bombardment groups (at Langley and Mitchel fields), and reconnaissance and air base squadrons.

The Third Wing, based entirely at Barksdale Field in Louisiana, includes the 20th Pursuit Group, an attack group, an air base squadron, and Third Wing headquarters and headquarters'

squadron. First Wing headquarters is at March and Second Wing headquarters and the G. H. Q. Air Force headquarters at Langley.

Returning to the matter of close-formation flying, let us take a look at the picture of 18 Boeing P-26s. That is one squadron, three flights of two elements each, echeloned to the right. A group of four squadrons in echelon would be that squadron and three more squadrons, arranged the same way and extending on out and up on the same straight line.

Every wing man in the whole formation is watching his own No. 1 man, and all he has to do is to sit right there on that wing. A wing man can follow his leader in a pursuit ship even through slow rolls, loops, and any other maneuver in which constant control is maintained throughout. His job in ordinary formations is comparatively easy.

Each element leader in the formation keeps his element in line with the others ahead of him, watches the distance, and at the same time keeps his eye open for signals from the element leader just ahead. The leader of the first element in the formation runs the whole show. He decides what to do and gives the signals. Element leaders repeat the signals all the way back, and then the lead element starts the maneuver and all the others follow in their places.

Suppose our formation, which is echeloned to the right, wanted to make a 90 degree turn away from the echelon, that is, to the left. It is obvious that if all the elements remained in their positions those on the outside, having more distance to travel, would be left behind. If the turn was into the echelon, the elements of the formation, being on the inside of the leader's turn, could not fly slowly enough to avoid getting ahead of him. Therefore, on all turns the elements cross over within the flights, the flights cross over within the squadrons, and the squadrons cross over within the group.

In all echeloned formations, the following units cross over to the opposite side of the leader in all turns. For all planes are traveling at the same speed and must travel the same distance to avoid getting out of place ahead or behind. The result of a turn properly made is that the group ends up in exactly the same kind of formation, but echeloned on the opposite side.

In turns away from the echelon each unit crosses over slightly behind the unit ahead, but in turns into the echelon each unit crosses over directly above the unit ahead. This makes it essential that no man be above or below his proper position. Many a military pilot has had his closest shaves on inside cross-over turns.

In 180 degree turns, units in the for-



mation cross over only once. This turn is more difficult than the 90 degree turn, and turns of 180 degrees into the echelon are for the most part avoided.

In a 90 degree diving turn away from the echelon, the leader starts the turn slowly, at the same time dropping the nose to the degree of dive he desires. The element behind him follows, crossing over on a line just above the lead element. If the dive is steeper than 45 degrees, the following units echeloned out and up at 45 degrees, will find themselves below the leader's new line of flight (though actually above him in relation to the earth). Hence flights cross over under the air-track of the flights ahead, and the whole formation ends up echeloned on the opposite and in a howling dive. Formations recover from dives ordinarily by doing a 180 degree "pull up," that is, a 180 degree climbing turn in which they generally cross over twice.

formed by pursuit formations in peacetime drill. One especially spectacular exhibition trick is the "huddle." It is performed by a "flying wedge," which is a Vee of three elements, with a fourth element close behind in the fork of the Vee.

The huddle takes place over a certain point. Just before the wedge of ships gets over the point the rear element does a loop and dives straight ahead, crossing over the point of the huddle. In the meantime, the Vee of three elements has gone on past the point a short distance, where the lead element does a half roll and comes back in the opposite direction, crossing the point a good distance under the element which has just performed the loop. The two side elements have done 270 degree diving turns away from the formation, and now come diving back toward the point at exactly the same time that the other elements are also approaching the

tude, and dive on enemy pursuit formations or meet them on a level. The second flight would attack close behind the first.

A group of four squadrons would normally fly with three squadrons arranged as described above and flying on a level, one behind the other. The fourth squadron would be broken up into six elements which would be posted as lookouts, two ahead and one on each side, two or three miles away from the main body, and two a shorter distance behind.

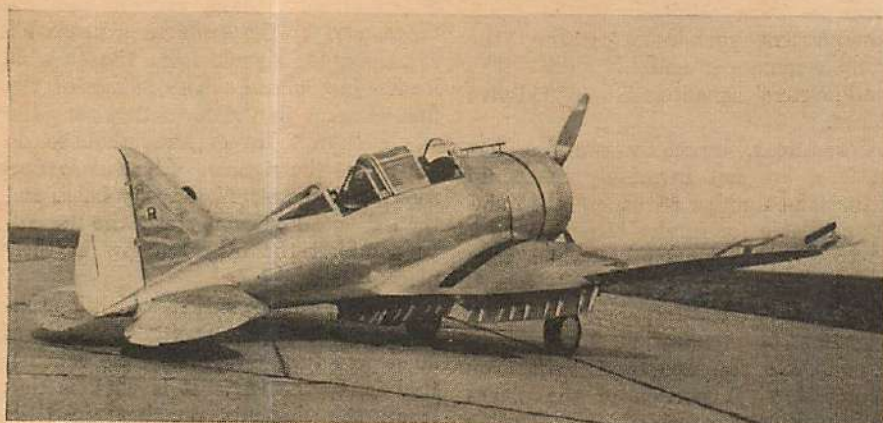
A pursuit pilot above another has a very great advantage, because he can attack the enemy below him when he pleases. If the enemy pilot should try to climb it would slow him down and decrease his maneuverability so that a plane diving from above would have all the advantage (as long as he didn't dive so fast as to be unable to turn or pull up quickly without blacking out). Hence, a group commander who found himself higher than the enemy pursuit would at first send down only enough planes to equal the enemy's, and retain the altitude advantage for the rest of his planes until it could be utilized to the best advantage. Thus the group would operate as detachments of squadrons.

In a major war, however, the enemy would also fly in large groups, and the result would be that in a big air battle all the planes would soon be drawn into the combat and a general mêlée would result, with still other groups coming in on both sides in answer to radio calls or as the result of previously arranged flight plans.

In such gigantic pursuit battles the side with the most maneuverable and fastest climbing planes would no doubt be victorious, since pilots would probably be of about equal skill. Pursuit pilots agree that climbing ability is supremely important in pursuit combat.

Though speed, rate of climb and maneuverability are all very important in every case, speed is considered of relatively higher importance for pursuit attacking bombers and other multiseat types. The development of faster bombardment planes has resulted in a running controversy among military airmen as to whether pursuit would be able to cope with bombers in another war.

It was found during the War that a 50 per cent speed margin was just enough to enable pursuit to keep the initiative in combat. Unable to break off and attack again at will, a pursuit plane, with all guns shooting forward, would be helpless. With only a small speed margin the various units of a pursuit formation would be unable to maneuver into position to attack repeatedly from different directions, thus dividing the fire of the defensive gunners. Instead, after the first diving at-



The two-place Seversky fighter for Russia.

Diving turns are normally away from the echelon, but 90 degree dives into the echelon are sometimes made. Here the elements ahead pick up speed so fast that following elements don't have time to cross on over into echelon on the far side of the leader's line of flight, but follow down in a line behind him, the echelon being resumed in the recovery.

In a 180 degree dive away from the echelon, the elements successively do the dive in place, which automatically puts the formation in a dive back under its former flight path and echeloned in the opposite direction.

The Lufberry circle is a maneuver performed by a flight or by an element alone. It was devised during the World War as a defensive maneuver in aerial combat. The flight leader starts a circle to the right or left, and the other planes fall in behind him—the wing men on the side of the turn going first. To recover regular formation, the leader flies straight for about five seconds and then turns back past the circle, the others falling into position behind him as he turns.

Various other maneuvers are per-

formed by pursuit formations in peacetime drill. One especially spectacular exhibition trick is the "huddle." It is performed by a "flying wedge," which is a Vee of three elements, with a fourth element close behind in the fork of the Vee. The huddle takes place over a certain point. Just before the wedge of ships gets over the point the rear element does a loop and dives straight ahead, crossing over the point of the huddle. In the meantime, the Vee of three elements has gone on past the point a short distance, where the lead element does a half roll and comes back in the opposite direction, crossing the point a good distance under the element which has just performed the loop. The two side elements have done 270 degree diving turns away from the formation, and now come diving back toward the point at exactly the same time that the other elements are also approaching the

point. When perfectly done, all four elements cross the point at the same time, going north, south, east, and west, one just above the other. From the ground it seems that they are going to meet in a tremendous collision. After they have passed the point, all turn to the right, forming a Lufberry circle of elements. The leader turns out and doubles back, giving the other elements a chance to form an echelon behind him. Lack of space forbids much description of tactical formations and mass fighting methods. Tactical formations in general are much looser than drill formations, and are purposely irregular. The echeloned squadron or group, such as we have been considering, though useful when searching for slower, non-attacking planes, is rather weak from a defensive standpoint. Hence pursuit ships flying in territory where enemy pursuit might be encountered would generally fly with squadrons divided into two flights of nine ships each, each flight in a Vee of elements. The squadron would fly as high as it could, in order to preserve the advantage of alti-



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Curtiss Falcons negotiating an inside crossover turn, a dangerous maneuver if improperly executed. The "corduroy" is a plowed field beneath.

tack, they would have to close in behind or just above the enemy formation and do little maneuvering or dodging about for fear of being left behind. When in shooting range they would be at the mercy of the tremendous firing power of dozens of machine guns bristling from the bombers.

Pursuit retained an adequate speed margin over bombers for 15 years. About 120 m.p.h. was as much as the older type bombers, such as the Keystone B-6, could do. Then in 1933 Glenn L. Martin threw consternation into the pursuit camp by producing a bomber which flew at close to 200 m.p.h.

Most of our pursuit planes at that time were Boeing P-12s and Curtiss P-6s. The highest speeds the later models of these biplanes could make at their best altitudes were 195 m.p.h. for the P-12F and 198 for P-6E. Then Boeing brought out the P-26 monoplane which made 234 m.p.h. at 7,500 feet. Substitution of a 600 h.p. for a 500 h.p. engine upped the speed somewhat, but Glenn Martin was also upping his bomber speeds by putting on more powerful engines. The Martin bomber with two 840 h.p. Wright Cyclones cruises at 210 and has a high speed of 235 m.p.h. Obviously the newest pursuit was far too slow. A 50 per cent margin would have required a speed of 352 m.p.h.

In Europe the pursuit specialists set about meeting the new situation with a new version of an old trick. The French ace, Guynemer, once tried a cannon of 37mm. bore on a Hisso Spad during the

War. It fired only one shot, and he didn't like it. The idea was dropped. But about three or four years ago the famous Hispano-Suiza company brought out the *Moteur-Canon*, an 800 h.p. Vee-type engine with a cannon of 20mm. (about  $\frac{7}{8}$  of an inch) bore mounted between the cylinder banks so that the mass of the engine would take the recoil. It fired 208 rounds a minute, through the propeller hub, at a tremendous muzzle velocity, producing a trajectory which was almost flat for 500 yards. Among the new planes using this formidable weapon are the Morane-Saulnier 405.C1 and the Dewoitine 513, both French low-wing pursuit single-seaters reported capable of 298 m.p.h. The Fairey company in England has also produced a cannon plane.

With the advent of such tremendous battleships of the air as the Boeing B-17 and B-15, and with even larger ones in the offing, it would seem that a heavy enough support could be provided to mount small cannon to fire to the rear. The Polish National Aircraft factory has produced a high-winged, strut-braced pursuit monoplane of tough metal throughout, which has two 20.01mm. cannon of Swiss make mounted rigidly at the juncture of struts and wings—one on each side. The structure is said to be able to stand the recoil without damage. However, a cannon on a flexible mount in a gunner's cockpit would be another matter. Anybody who wants to can guess that the Air Corps is working on it, though this writer hasn't heard even a rumor.

In America pursuit designers have for the most part been trying to meet the threat of the new fast bombers with much faster pursuit planes. They have built marvelous planes during the last year or so, but the 50 per cent speed margin over the bombers has not been restored.

Just how fast the big Boeing bombers will go is a military secret, but the B-17 averaged 230 m.p.h., figured from air-line distance and elapsed time on a cross-country flight. It probably flew at a fairly slow cruising speed, and perhaps made detours, since the elapsed time was given to the newspapers. If the high speed is only 250, a pursuit plane with a 50 per cent margin would have to clip it off at 375! That, according to the authorities, would be needed by a single-seater for effectiveness in actual combat, using forward machine guns. The hardest problem, of course, would be locating and intercepting fast enemy formations before they reached their targets. Many military men hold that bombardment cannot be kept from reaching a large proportion of its objectives.

The chances are there aren't any pursuers yet which will do 375. However, we now have some mighty fast ships. The most conspicuous pursuit planes in the Air Corps for the next two or three years are likely to be the Curtiss P-36s and the Seversky P-35s. The P-36 is a single-seater and the P-35 is a two-place pursuit plane which can be used as a single-seater, for it can outperform most single-seaters of to-day, and, it may be, all of them.

The P-36 was first tried out with a 1,000 h.p. Wright Cyclone and then a change was made to a new 14-cylinder Pratt & Whitney Twin Wasp, which develops about 1,100 h.p. for take-off. Six months ago the Air Corps ordered 210 of these planes, for reasons of economy combining two years' requirements in the biggest military airplane contract awarded in years.

Performance figures on the P-36 will be secret for some time yet. However, the plane is reported to have made an average air speed of 300 m.p.h. recently on a cross-country trip. On the basis of these figures one might reasonably guess at a high speed in the vicinity of 320 to 340. Howard Hughes' racing plane, which set the world land-plane record at 352 m.p.h. with the cockpit cover off, was supposedly capable of 360 or more. But it had no military load.

The P-36 probably has an excellent rate of climb, though not as great as could be given a slower plane of equal power. The Hawk 75, a Curtiss export pursuit plane very similar to the P-36 but with a nonretractable landing gear and an 840 h.p. engine, climbs at 2,400 feet per minute at sea level. The Boeing



P-26 in the 500 h.p. version can climb to 24,500 feet in 12 minutes. However, the Hawk 75 does 273 m.p.h. to the 234 of the P-26.

The new P-36 type was tried out at Wright Field with the recently developed Allison Vee-12 1,000 h.p. liquid-cooled engine. No plans or results are being announced, of course. But it wouldn't be a bad guess that the army is experimenting with a cannon to shoot through an offset geared propeller hub on this engine. Again, this writer hasn't heard even a rumor. The P-36 is armed with the conventional two forward machine guns, one .30 and one .50 caliber, and a load of light bombs. Cannon shooting through the propeller hub are not adaptable to radial air-cooled engines.

Recently both Pratt & Whitney and the Wright Aeronautical Corporation have perfected new 14-cylinder, twin-radial engines of 1,400 and 1,500 h.p. But there have been intimations that the torque of such engines would be so great that small pursuit planes could not be rigged to offset it. The tendency for the whole ship to roll over when the throttle was advanced would be too great for formation flying.

As a result the Materiel Division at Wright Field has been experimenting with an arrangement of two propellers, one behind the other, rotating in opposite directions, thus neutralizing the torque. The Fiat-powered Italian seaplane, which made the still standing 440 m.p.h. world speed record in 1934, had such a propeller assembly.

So also does the remarkable Dutch pursuiter, the Koolhoven F. K. 55. The 12-cylinder, liquid-cooled Lorraine Petrel engine in this high-wing monoplane is located inside the fuselage behind the pilot, and the two propellers are turned by shafts running to the nose of the plane. An Oerlikon (Swiss) cannon is mounted in front of the pilot and shoots through the geared offset propeller hubs. In addition, four machine guns are mounted in the wings! Enough fire power there to make the bombers quake. And the high speed, with only 840 h.p., is reported at 323 m.p.h.

American designers are giving more serious attention, apparently, to the development of in-line engines of a type suited to the mounting of small cannon. The Curtiss Conqueror has, of course, long been standard Air Corps equipment. It was used in the P-6s and only recently a 675 h.p. supercharged Conqueror was chosen for the new Consolidated PB-2A two-place pursuit planes. The Air Corps has taken a leading part in the development of the Allison 1,000 h.p. Vee-12 engine, which is being tried out in two or three kinds of planes. And recently Sherman M. Fairchild, president of the Ranger Engineering Corporation, announced that

the company is working on a new 1,000 h.p. engine composed of two 12-cylinder, air-cooled Vee-type engine units hooked together to turn two propellers in opposite directions, and adapted to mounting a cannon shooting through the propeller hubs.

It seems reasonable to suppose that practical tandem engines of this kind, which solve the pursuit torque problem, can be built much more powerful than 1,000 h.p. Inability to cool such powerful engines is the limiting factor here. The Fiat twin-tandem engine, which made the 440 m.p.h. record, produced more than 2,000 h.p., but could run only a short period of time. The surface of wings and fuselage was utilized as radiators, a practice which would obviously make a pursuit plane too vulnerable. However, great advances have been made recently in cooling technique.

The trend toward two-place pursuit planes has been gaining force lately, and great interest is being shown in an even more radical multiengineed pursuit type.

The Air Corps tried out a few Berliner-Joyce P-16, two-place pursuiter a few years ago and about a year ago acquired a number of Consolidated PB-2A, two-place pursuiter. This Conqueror-powered plane has three machine guns, a .30 caliber and a .50 caliber firing through the propeller and a .30 caliber flexibly mounted gun in the rear cockpit.

The most remarkable two-seater in the world, perhaps, is the Seversky P-35, with a 1,100 h.p. Twin Wasp. It is said to be capable of over 300 m.p.h. It came in for a lot of publicity during the fall as "similar" to the Seversky planes in which Frank Fuller won the Bendix trophy and in which Miss Jacqueline Cochran captured the world speed record for women at 293.05 m.p.h.

The Seversky 2P, a retractable landing gear pursuiter very similar to the P-35, but powered with a 745 h.p. single-row Cyclone, is said to have a high speed of 310 m.p.h. with a sea level climbing rate of 2,350 feet per minute. The service ceiling is 31,600 feet—which is 200 feet greater than that of the Hawk 75 single-seater of 840 h.p. The Seversky 2P climbs about as fast as the more powerful single-seater and with the advantage of a retractable landing gear is, of course, much faster.

The need for a great volume of firing power to meet the deadly defensive fire of bomber formations has resulted in development of the multisat, two-engine fighter. Several European models have appeared, but perhaps the most interesting of all is the new Bell XFM-1 fighter. It is a retractable landing gear monoplane. Its two Allison engines are mounted in nacelles on each wing, and drive three-bladed, electrically adjusted propellers behind the wings. The for-

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ward part of each nacelle is a completely inclosed gunner's cockpit.

Pilot and co-pilot sit in the nose of the fuselage, one behind the other. A radio operator, who is also a gunner, is carried, making a crew of five. In addition to the 37mm. cannon, which is braced against the weight of the engine in each nacelle, there is a .30 caliber forward-shooting machine gun. The two .50 caliber guns are in the fuselage, and sweep the sky to the rear. A load of time-fuse bombs is carried for breaking up close formations from above.

The Bell fighter has a wing spread of 70 feet, is 58 feet long, and loaded weighs about seven and a half tons. Heated, supplied with oxygen for the crew and high-powered superchargers for the engine at high altitudes, the "Airacuda" would be a nightmare to any formation of "Flying Fortresses."

Combat tactics have not yet been worked out for the new two-engined pursuit planes, and methods of employing even the less radical two-seaters are still highly theoretical. However, it is obvious that the tremendous speeds of

all the new planes would make diving approaches on enemy planes from the front and sides practically useless. Attacking pursuers would have to start their dives far ahead and the moment they would be in firing position would be so short that the human eye and hand could not function quickly enough to shoot effectively. Approaches underneath and from the rear would give a pursuer only an instant to shoot while the bomber gunner had much more time.

Attacks using forward guns would, therefore, undoubtedly be confined to the general area above and behind the enemy defensive formations. Two-place or multiplace planes with flexible guns could fly alongside and in front of enemy formations and shoot from those vantage points. Planes of this type could pour lead into a group of bombers from all sides at once, all the attacking planes flying either above or below the enemy so as not to be in the path of each other's fire. The position would doubtless be above, so forward guns could be used at the same time in diving

attacks from above and behind. The pursuit fire would be concentrated on a more or less compact formation, while the defensive fire would be scattered out around a wide circle.

Those who claim that formations of "Flying Fortresses" can't be stopped, at least in daylight, may be jumping to conclusions. Large formations of pursuit would no doubt brave the fire of the bombers, and expect to take heavier losses than in similar engagements in the World War. However, the pursuers could maneuver so that some of the bombers would be in each other's way. The field of fire and vision from a "blister" on a bomber is comparatively limited. Shooting at some angles would be extremely awkward and pursuers dodging in and out of sight would be hard to hit.

Regardless of how the new planes would be used in warfare, it is extremely interesting these days to watch developments. For, without a doubt, more things are happening in the world of military aviation to-day than at any time since the World War.

## GLIDING

(Continued from page 23)

At the 18th Rhoeon soaring contest held at Wasserkuppe, Germany, a total of 78 sailplanes participated, nine of them being two-place craft. These proved equal in performance to any of the single-seaters, and included Minimoa 2As, Kranichs (which are similar to the Rhonsperbers and designed by the same engineer), and MU-10s, which, contrary to general German construction, have a welded steel-tubing fuselage. The total number of miles flown at the meet was 28,500, and the most recorded for one pilot was 1080, this honor going to Beck, flying a MU-13 single-place sailplane. The winners of the whole contest were Krach and Zimmerman, using a two-place MU-10.

honor, whose requirements are a distance of over 31 miles in a single flight, an altitude to excess of 3,300 feet, and duration of at least 5 hours, is now shared by 9 other Americans. These



Jack O'Meara and Mayor LaGuardia of New York at start of glider mail flight from Brooklyn to Washington, D. C.

include (the figures stand for certificate numbers assigned by the International Federation of Aeronautics):

Richard C. duPont, 32, Wilmington, Del.; Lewin B. Barringer, 65, Philadelphia, Pa.; Stanley Smith, 236, Rochester, N. Y.; Emil A. Lehecka, 237, Long Island City, N. Y.; Henry Wightman, 238, Upper Montclair, N. J.; Emerson Melhose, 239, Wyandotte, Mich.; Chester J. Decker, 240, Glen Rock, N. J.; Harland Ross\*, Montebello, Cal.; Arthur Schultz\*, Detroit, Mich.

Jack O'Meara, however, showed the way to these pilots one bright day in 1933, when he flew a distance of 67 miles, went upstairs to 4,780 feet, and remained aloft 8 hours and 8 minutes. Since then he has become an important figure at all important air races, and has thrilled crowds all over the country with daring acrobatics in his brightly painted Franklin Glider.

(\* Certificate number not assigned at time of going to press.)

Jack got his soaring experience at Wasserkuppe, Germany, in 1930, and was the first to demonstrate cloud soaring in this country. In 1931 he acted as chief instructor for the Bowlus-Hirth gliding school at North Beach Airport, Queens, N. Y., being instrumental in training many of our present successful pilots. At that time he purchased a cracked-up German Darmstadt sailplane and reconstructed it from stem to stern.

With this ship he broke many American glider records and became National Soaring Champion, which title he held for over two years. In his Chanute, Jack explored the air currents over New York City, soaring for nearly an hour and broadcasting his experiences through a specially installed radio transmitter.

In 1935, together with R. E. Franklin and Stanley Smith, he organized the Lustig Sky Train, which consisted of three gliders towed by an airplane. In this they successfully flew official mail from Floyd Bennett Field, Brooklyn, N. Y., to Washington, D. C. Later the same year, with Paul duPont, Jack made the first international glider tow flight from Miami, Florida, to Havana, Cuba.

Jack O'Meara's glider time runs into hundreds of hours, more than that of any other pilot in this country. In addition to being a glider pilot, he is also known for his skill in handling power planes, including the autogiro.

Recently he has not been active in gliding having been kept busy in executive capacities. At present he is with the Wold-Chamberlin airport at Minneapolis, Minn.



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Jack O'Meara was our first pilot to attain a Silver "C" certificate, the highest international soaring award. This



# FROM ACORN TO OAK IN AIR TRANSPORT

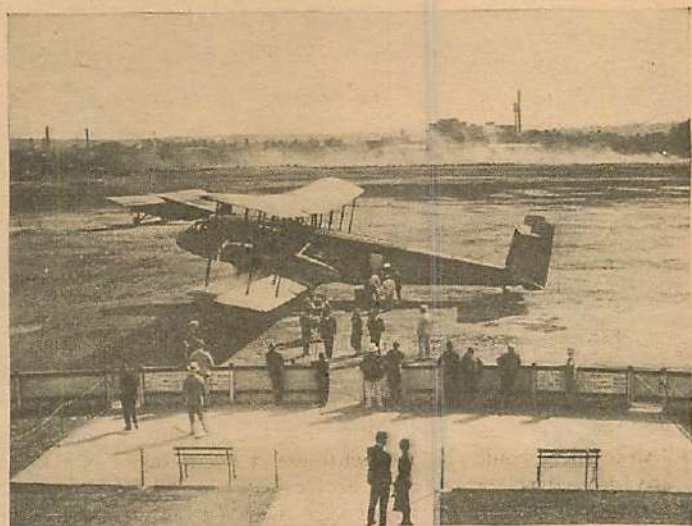
(Continued from page 21)

through coast-to-coast operation was inaugurated. Step by step in short relays—none over 200 miles in length—the system was “perfected.” New York, Bellefonte, Cleveland, Bryan, Chicago, Iowa City, Omaha, North Platte, Cheyenne, Rawlins, Rock Springs, Salt Lake City, Elko, Nevada; Reno, and San Francisco were refueling points. Cutting hay and the removal of hummocks transformed a cow pasture to a landing field. Corrugated tin hangars—which constantly were either burning down, from the careless cigarettes of mechanics, or blowing down in high winds—were the only shelter offered. When the pilots were not getting themselves lost or killed—seven died within the period of a few weeks experimenting with a foreign type of plane—so absent was discipline that it was not uncommon for a mail pilot to make an unauthorized landing on a convenient hay field to visit with the pretty daughter of a farmer. The “wild young pilot” tradition still remained from War days, for the mail pioneers all were recruited from those services. Actually when mail was flown experimentally between one or two relay points, invariably it was delayed rather than speeded in transit.

For the first two years the air mail was hit or miss, although a number of so-called emergency landing fields were laid out. It then became plain that there could be no through transcontinental service unless provision was made for night flying. The only precedent for lighting an airway was the light-house service serving water shipping. From Chicago west to Cheyenne blinker beacons and revolving lights of low illumination were spaced approximately every eight miles. But obviously they could be seen only in clear weather. None the less, by July 1, 1924, through transcontinental service was inaugurated.

A few weeks after that service began I flew the new air mail route. It was run in short relays as the pony express carried the mail. In place of Indian ambush to halt the riders there were the aerial enemies—fog and rain. I recall sitting down in Iowa City for twenty-four hours because of a normal rainstorm. The mail sat idle in the mail compartment for the period. Weather information was both inadequate and slow. Lacking communications between ground and plane, should dispatchers receive belated information of squalls in the path of a mail plane, the system was to attempt to reach a farmer living near an emergency field by telephone. Then, if time permitted, the farmer chased the cows from the pasture and stood forth shooting red

A pioneer in large-scale transportation of air travelers was the old Conqueror-powered Condors.



rockets into the air to signal the pilot to come down. Equipment used was War surplus army DH's powered with Liberty engines. Despite double pay, no pilot liked night flying.

Experimental air transport operations begun about that time were little better. It was the thrilling flight of “Slim” Lindbergh from New York to Paris which gave air transport its start. Above the emotional hero worship attending that historic hop, so far as results were concerned toward modern flying, the important reaction was that it opened the public purse for aviation development. All aviation, starving for years, still flying on War wings, suddenly found itself glutted with capital.

Dreamers and doers stepped into the picture. First executives ranged from incompetents to men of vision and imagination. Behind them grew an army of trained grease monkeys, salesmen in traffic departments who wouldn't take “no” for an answer from a cautious or uninterested public, plane designers, engine builders, radio experts, weather scientists, lighting engineers, a thousand inventors and patient research men toiling in humble shops and modern laboratories to improve metals, magnetos, spark plugs, fuels, tires, landing gears—the list is all but endless.

Still air transport operations had to have their heads knocked in the hard but enduring school of experience.

It's the popular thing to give all praise to the heroic pioneer pilots, many of whom gave their lives on the altar of aerial progress. But basically that isn't a true picture. “The wild young pilot” tradition still persisted. A pretty girl passenger often inspired vertical take-offs or spectacular side-slip landings on the part of the pilot, scaring the devil out of all on board. Too often weather judgment was poor. When decision whether or not to fly was left to the

pilot, he too often would take off in bad weather because of a poker game or a date with a girl in the city of his destination. Sometimes, because of jealousies existing in the temperamental moods of early pilots, a flight would be undertaken because the pilot of a preceding schedule had gotten through and the later pilot felt that if such a dub could make it, so could he. Too often such decisions resulted in tragedy—not only tragedy for the pilot, but for his passengers as well.

Cramped and uncomfortable in tiny, unheated, and unventilated cabins, frequently half-buried under mail sacks, invariably deafened by the roar of motors, they rode with pilots unskilled in instrument flying and still possessed of the dare-devil complex. Transportation to and from airports was poor, passenger comforts were almost entirely lacking. Emergency landings and motor failures were altogether too common. Yes, equal heroes with the pilots were those pioneer passengers!

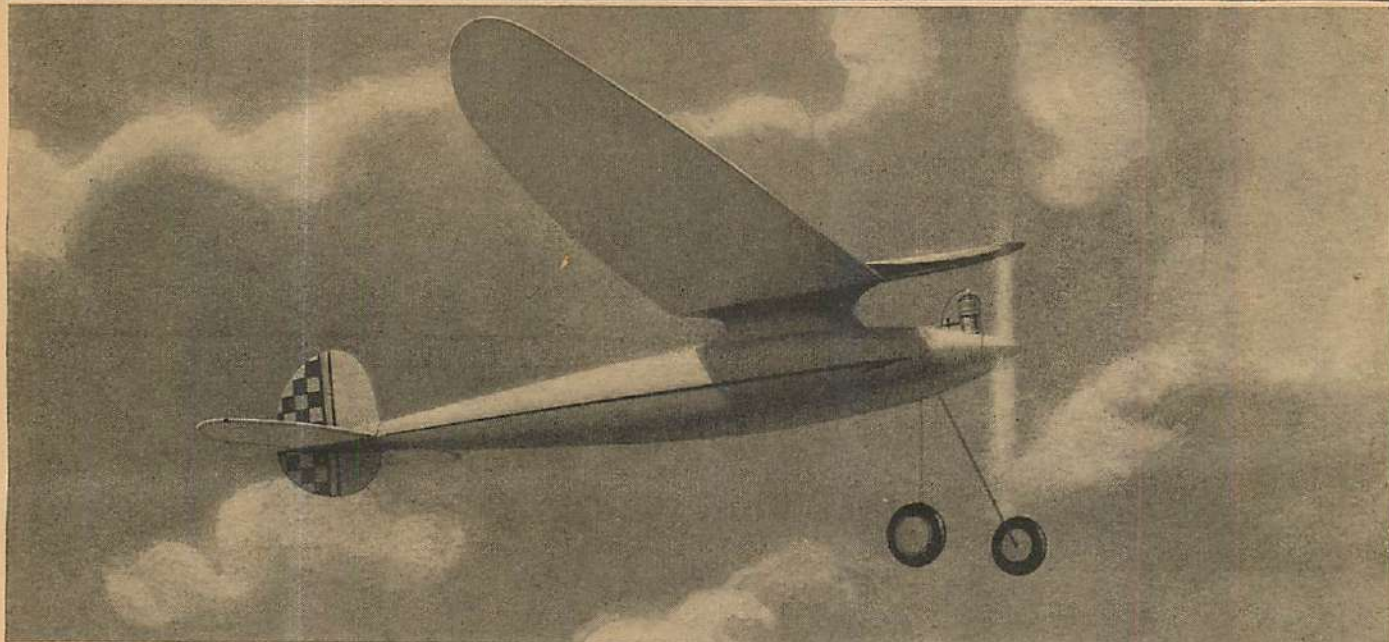
Then came the tri-motored transport, best and most serviceable of which were the Fords—the famous “Tin Goose.” From 85 they were to step up speed to 120 miles an hour, yet even the most modern were drafty and noisy. Cotton wadding could not save one from an aftermath of ringing ears. Too often coughs and colds attended a flight.

Yet the old Tin Goose served a noble purpose. It was de luxe equipment for its day. It pioneered through transcontinental passenger flying by the end of 1930. It only vanished from the skyways some three years ago—and vanished is hardly the word. For the same brave Tin Goose still serves air transport on a score of foreign-operated routes in South and Central America, and in Asia.

It was only eight years ago that the first transcontinental flying service was



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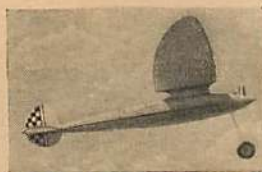
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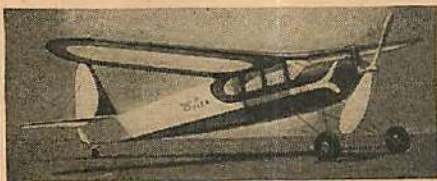
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WINGSPAN 36 in. LENGTH 28 in.

This is the original gas type rubber powered model airplane which has been built and successfully flown by thousands of model builders since its introduction last summer. The "Flea" has Movable Controlled Surfaces on Rudder and Elevator; Shock Proof Gas Model Type Landing Gear with Pneumatic M & M Rubber Wheels, new type Ball Bearing Propeller Washer and Adjustable Wing with new type improved wing clips.

Kit to build this remarkable model is complete with everything necessary including all materials to construct the "Ratchet" motor-hum effect and dummy engine with spark plug, 10 in. machine cut propeller, and a set of the most complete and easily understood plans ever devised, including all information on the construction of the entire model, dummy motor and the "Ratchet".

**COMPLETE KIT INCLUDING M & M PNEUMATIC RUBBER WHEELS**

AT YOUR DEALER OR SENT POSTPAID

**\$1.95**



two different models of forty-passenger transports are now nearing completion. Both are four-engined ships. Each may cross the continent with full load with a single intermediate stop. I can't imagine what new luxuries engineers may devise for passengers in those new planes, but I am sure new luxury will be built in them.

This matter of new, larger, faster, safer equipment for transport operations has become an eternal game of leapfrog among the builders and operators. Such fierce competition in equipment explains why air lines do not make money.

Two pilots, the second one originally called a "safety pilot," had been used on major air lines practically from the advent of the Ford tri-motor. As new instruments were added, each possessing some indispensable quality under certain conditions, flying a modern plane became a two-man job. And sometimes too much for two men! Literally the instrument panel overflowed the dashboard. An additional panel had to be installed over the pilots' heads in some transports. Two pairs of eyes were required to scan them all. That, in addition to flying, concerns such as radio communication and operation of controls. We began to hear the medical phrase, "pilot fatigue." Some crashes were assigned to that cause. "Pilot fatigue" was not mere physical weariness, since eighty-five hours' flying a month is a standard schedule for transport pilots. It was the nervous strain of having so many things to do.

Again the engineer stepped into the picture. The automatic or robot pilot had been in a laboratory for a score of years—ever since Lawrence Sperry first demonstrated gyroscopic control of an airplane before the World War. Wiley Post further demonstrated the dependability of the automatic pilot when he flew solo around the world in one short week. The robot pilot was ready for practical use by the time "pilot fatigue" became a serious problem. Actually operating the controls in flight better than the average pilot, the robot is now practically standard equipment. Ninety per cent of all Pan American's flying operations are accomplished by the automatic pilot. On domestic lines the automatic pilot is flying more than a million miles a month.

Pilots are still required to take off and land by manual control. In soupy weather landings are the hardest. Experiments in blind landings have been going forward for several years, ever since Jimmy Doolittle proved the possibility for the Guggenheim Foundation. And now we have the automatic landing, as distinguished from blind landings. The Army Air Corps, as the result of two years of intensive research, only a few weeks ago demonstrated a completely automatic landing device.

The obvious weakness of such automatic landings is that factory chimneys, trees, or other obstacles may get in the way. A machine cannot have vision or judgment. That problem, too, is being met. The giant transports now being built will need longer runways for take-offs and in planning new airports to accommodate them, the engineers are forced to go far into the country.

All this progress, immediate and prospective, has been made in the face of dogmatic assertions that "such and such never could be done." Ten years ago one was told that transport flying speed never could exceed 100 miles an hour, "because high flying speed means high landing speed, and high landing speeds with passengers would prove disastrous." Landing flaps and wheel brakes together solved that problem. The 200-mile-an-hour plane could be landed at forty miles. American air

transport is where it is because American ingenuity refuses to accept any "can't's."



### THE CHIEFTAIN

7 ft., 4 1/2 lbs.

One of the sturdiest fliers, over 700 successful flights, complete in all respects; full-size wood, plans, wire, cement, dope, bamboo paper, blocks, wheels, etc., etc., etc.

STANDARD SET, ONLY.....\$4.00  
DE-LUXE SET, ONLY.....\$7.00

### THE BUHL PUP

7 ft., Wt. 5 lbs.

This kit contains full-size wood; plans, cement, paper, etc., same as Chieftain.

STANDARD SET, ONLY.....\$4.50  
DE-LUXE SET, ONLY.....\$7.50

### Special Prices

#### THE STARLET

6 1/2 ft., Wt. 4 lbs.

The best ship of them all complete and guaranteed in all respects full size strips; plans, cement, dope, etc. Same as our Chieftain set.

STANDARD SET, ONLY.....\$3.00  
DE-LUXE SET, ONLY.....\$5.75

### ALL OUR DE-LUXE MODELS

contain in addition to the regular materials supplied in each kit: 1 finished carved propeller, 1 pair air-wheels, 1 set cut out ribs; 2 1/2-pint cans of any colored dope. Buy the De-Luxe models and save money.

## GAS MODEL SUPPLIES AT PRICES THAT DEFY COMPETITION

### LUMBER GAS MODELS—ALL FIVE FOOT LENGTHS

The following wood can be had in Spruce, Bass, or Balsa at the Same Prices as those listed below.

1/16 sq. ....\$ .03  
1/8 sq. ....\$ .03  
3/16 sq. ....\$ .04  
1/2 sq. ....\$ .05  
3/4 sq. ....\$ .07  
1 sq. ....\$ .08  
1 1/4 sq. ....\$ .10  
1 1/2 sq. ....\$ .10  
1 3/4 sq. ....\$ .10  
2 sq. ....\$ .12  
2 1/2 sq. ....\$ .15  
3 sq. ....\$ .18  
3 1/2 sq. ....\$ .20  
4 sq. ....\$ .22

### REED

3/16, 3 ft. for .05

3/16, 3 ft. for .07

3/16, 3 ft. for .10

### SHEET BALSA (Special for Gas Models)

36" Lengths

1/16 sq. ....\$ .04  
1/8 sq. ....\$ .06  
3/16 sq. ....\$ .08  
1/2 sq. ....\$ .10  
3/4 sq. ....\$ .12  
1 sq. ....\$ .14  
1 1/4 sq. ....\$ .16  
1 1/2 sq. ....\$ .18  
1 3/4 sq. ....\$ .20  
2 sq. ....\$ .22  
2 1/2 sq. ....\$ .24  
3 sq. ....\$ .26  
3 1/2 sq. ....\$ .28  
4 sq. ....\$ .30

### BIRCHWOOD

36" Lengths

1/16 sq. ....\$ .04

1/8 sq. ....\$ .05

### BAMBOO PAPER

24"x36" sheet .05

### SPUN ALUMINUM WHEELS

5" dia. per pair only \$1.50  
GAS MODEL WHEELS  
Special pneumatic wheels good for gas model from 3" to 8" Size 3 1/2". Price pair \$1.50  
Carved Props for any Motor, each only \$1.00

### SHAPED PROPELLER BLANKS

Specify size of prop. and motor, each only .25c

### TOGGLE (ON-OFF) SWITCHES

45c

### CEMENT & DOPES

These liquids are specially made

### for gas powered models and should not be confused with those used for rubber powered models.

4 oz. ....\$ .18  
1 qt. ....\$ .60  
1 qt. ....\$ 1.00  
Gas Model dope and paper adhesive same price as cement.

### MINIATURE KNIFE

2 pieces .25c each

### SWITCHES

3 poles .35c each

### DURAL ANGLE

1/16"x1/8" foot .20

### BEAM

1/16"x1/8" foot .20

### A. C. PLUGS

Each .05

### MAKERS KNIFE

each .10

### SPRING STEEL WIRE (In five, 5-foot lengths)

1/16 dia. 5' .05  
3/32 dia. 5' .15  
1/8 dia. 5' .25  
1/4 dia. 5' .40  
3/8 dia. 5' .60  
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## Convoy-Fighter

(Continued from page 25)

the rear deck. Others use a sort of perambulator-top arrangement hinged to the bottom of the rear-hatch frame. Seversky has hit upon the simple device of rotating the rear deck into the fuselage like the cover of a roll-top desk. This serves several purposes. When turned up into position, it forms a stream-lined continuation of the cockpit inclosure that carries the air flow smoothly down to the tail surfaces. Needless to say, this adds a mile or two to the Fighter's maximum speed. In this position, the deck also serves as a compartment in which the flexible machine gun is snugly nested when not in use. A turn of the deck rotates it into a position completely out of the gunner's way in a section of the fuselage not generally used. The same movement automatically uncovers the gun for action, at the same time eliminating the deck as an obstruction to the field of fire. The gunner sits comfortably in the rear opening of the center section which protects him from the blast of the slip stream, thus permitting greater accuracy and freedom of action. Neat, eh?

The armament of the Convoy-Fighter is also something to talk about. For a long while, students of pursuit design have been watching the evolution of multigun fighters abroad and wondering when American designers and tacticians would snap out of the old World War, twin-gun complex. The Bell "Airacuda" appeared with a double answer to the European *moteur-canon* and now Seversky pulls out of the hat a multigun fighter to end all multigun fighters. Back in the old navy days of wooden ships and iron men, wind-propelled battle wagons were rated according to the size and number of their guns. If this increase in aerial armament keeps up, we may yet hear one of our air-borne ships of war described as the U. S. A. *Valiant*, a 44-gun ship of the line!

The Convoy-Fighter mounts *only* seven guns in all, which, I suppose, will be considered piker stuff some day. Right now though, it seems like a whole lot of shooting irons when we take a look at the two-gun fighters in service at the present time. The Seversky's battery of forward firing .50-caliber machine guns delivers a truly terrific concentration of fire at fairly long ranges. Four of these guns are mounted in a half circle inside the top of the motor cowl and are synchronized to fire through the propeller disk. Two additional .50-caliber guns are mounted in the leading edge of the wings. All are controlled electrically either singly or in battery. A flexibly mounted .30-

caliber gun protects the tail. In addition to this offensive equipment, the fighter is fitted with racks beneath the wings which have a capacity of six hundred pounds of demolition bombs. This is in line with the new technique of dropping small bombs on big bombers, a practical application of poetic justice if ever there was one.

Little is known regarding the performance of the new Seversky model save that one of them piloted by Frank Fuller won the 1937 Bendix Transcontinental race from Los Angeles to New York, averaging 258 m.p.h.—including refueling stops. Another sped Jacqueline Cochran to fame by establishing a new feminine international speed record at 304.5 m.p.h. The manufacturers claim a top speed with full military load of 310 m.p.h. for the Convoy-Fighter, and an operating range of 3,000 miles. These figures sound very close to those of the Bell, but don't expect me to stick out my neck by making any odious comparisons.

If you saved your November copy of *Air Trails*, you have the dope on the Bell. Here you have a description of the Seversky. It ought to be a cinch to figure out for yourself which of the two you prefer—only, when you pick your winnab, you'll probably find that half of your friends are on the other side of the fence. Airplanes are like horses. No two people can seem to agree on their respective merits. The "Bell boys" will point to the range and flexibility of their cannons, while the "Seversky set" talks long and loud about their deadly concentration of .50-caliber bullets. The "Bell boys" then speak loftily of "Battle Cruisers of the Air" and mention their pilot, co-pilot-navigator and three gunners. Seversky's adherents will undoubtedly laugh nastily at this and say that the little Convoy-Fighter can do the same job with just two men.

After all, the old saying that "a good big man is always better than a good little man" does not necessarily hold good in military aeronautics. There's the little matter of initial and operating costs to consider, not to speak of the requirement of highly trained airmen whose education is long and expensive. The logical military preference is always to do a specific job with as few men and as little equipment as possible.

So you see, each ship has its points. Speed, range, flexibility, armament, crew and comfort must be compared and evaluated. Directly or indirectly, you'll all have to pay your money for 'em so you can feel free about "tyking yer own chice." As far as I'm concerned, both ships are tops in their field and together they constitute the finest possible contribution to American national defense.

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# ONE SHALL DIE

(Continued from page 35)

anonymous letters such as Sandy had just showed had developed into something deadly and menacing. A panorama of his past enemies marched through his mind as he stared at the closed door. Some of them were dead—others in prison. A few were at large, but they weren't writing anonymous letters. They were keeping their heads down to avoid arrest.

"We have nothing on the fire at the present time," he said to himself. It suddenly occurred to him that he hadn't undertaken a job in which there had been the slightest element of danger in a long time. Everything had been routine—a survey here, a few tests there, and a constant application of his talents to his own inventions.

"If something doesn't happen around here before long," he said aloud, "the whole gang will be going to Spain or China."

"Cy checked in just before he landed at Winchester, Virginia," Sandy said as he came back. "He's going to drop his sister there and then come straight through."

"O. K.," Bill said. "Put these—e-e-r—mash notes away in the files, kid."

"Aren't you going to do anything about 'em, Bill?" Sandy asked, his eyes wide and troubled.

"What do you want me to do with 'em," Bill asked, "wear 'em over my heart?"

## III—TROUBLE AHEAD?

BILL BARNES was sitting in the living-room of his bungalow smoking a pipe and reading a new translation of a book on aeronautics by a French expert when Cy Hawkins knocked on the door a couple of hours later.

"Come in," he called. Then he got to his feet as the door opened and Cy's face appeared. "Hello, fellah!" he added. He shook Cy's outstretched hand and studied his lean, tanned face. "Everything—everything work out all right?"

"Yes and no, Bill," Cy said. "I've had a hell of a time. I had no idea my father owned so much property or had so many interests."

"What about your sister?" Bill asked. "Is she all right?"

"She worries me, too," Cy said. "She's in love, or she thinks she is. I think she was really hit harder by dad's death than I was because she's been closer to him."

"I guess she'll be all right, Cy," Bill said. "Your father took care of her in his will?"

"Yes," Cy said. "That part is all right. She'll have plenty of money.

Too much. We share alike—probably a million and a half each."

"Everything is solvent and so forth?" Bill asked.

"Yeah," Cy said. "But I'm afraid I'll have to ask for a little time—if you can spare me—to get things straightened out. I'm a little worried about a couple of things. Some things have happened that have me puzzled. I want to take Shorty or Red down to Texas with me to make an aerial survey of our land first—hundreds of thousands of acres of it."

"Any time," Bill said. "When do you want to go?"

"Right away," Cy said. "As I said, there are a couple of things that worry



Ted Richards.

me. If it's all right with you I'll shove off in the morning."

"It's all right with me," Bill said. "If there is anything I can do to help, speak up."

Again that harassed expression flashed across Cy's usually imperturbable face.

"No," he said. "There is nothing you can do, Bill. If you can spare Shorty I'll take him along."

"It's as quiet as a millpond in June around here," Bill said. "Nothing has happened."

The three anonymous letters Bill had received within the past two weeks flashed through his mind and he started to tell Cy about them. But he caught himself before he had spoken. He decided that Cy had enough things worrying him—things he didn't seem to wish to speak about.

"I'll get Shorty and see if it interferes with anything he is expecting to do," Bill said, reaching for a telephone. "You'll want Scotty to check over your ships?"

"Yes," Cy said. He sat pulling nervously at his lower lip while Bill talked to "Shorty" Hassfurther, his chief of staff, and made arrangements with him for a take-off at dawn. Then Bill asked the operator for "Scotty" MacCloskey,

chief technician and major-domo on Barnes Field.

"Hello, Scotty," he said. "Will you check fuel, equipment and ammunition in Shorty's and Cy's ships for a dawn take-off? Install that new Fairchild aerial camera in Cy's ship. O. K.?"

"Right, Bill," old Scotty said and cut off.

"Listen, Cy!" Bill snapped suddenly. "What's on your mind? You're all tied up in knots. Is there something wrong? Anything I can help untangle?"

Cy gazed at him through startled eyes. Then he shook his head and got to his feet. "I've been under a strain for a couple of weeks, Bill," he said.

"There is nothing wrong."

"I'll be shoving along, Bill," he said. He held out his hand and Bill could not help noticing the desperate strength of his grip.

"Good night, fellah," Bill said and watched him go out the door without looking back. He sat down and studied the back of his hand for two or three minutes.

"What," Bill asked himself finally, "is on his mind?"

## IV—MISSING

THE wall chronometer in Cy Hawkins' bedroom registered five o'clock when he pulled a heavy leather overall over his whipcord breeches, flannel shirt and boots. He pushed a heavy white helmet over his brown hair and picked up a roll of maps he had been working on the night before.

The goggled, white-helmeted head of Shorty Hassfurther stuck above the rim of his idling Snorter as Cy joined Scotty MacCloskey on the apron.

Cy talked to Shorty for a moment and gave him the course he had laid out the night before.

"We'll cut west to Cleveland and Chicago and then go southwest to St. Louis, Wichita, and Amarillo, if it's the same to you," Cy said.

"O. K.," Shorty yawned. "You better tell Scotty to have Tony let us know if he picks up any soupy weather down that way."

"Yeah," Cy said. "When we sit down at Amarillo I want to have a talk with you, Shorty. I got a couple of things on my mind. I want to tell you about 'em."

"Right, fellah," Shorty said.

"Ten thousand feet, speed three hundred?" Cy asked.

Shorty nodded, bent forward, and his Diesels bellowed forth a full-throated roar.

"Clear ahead, Shorty," Tony Lamport said in his earphones. "Fifteen-mile northwest wind. Nothing north or east of you."

"O. K., baby," Shorty said. His sleek Snorter sped down the runway.



A few seconds later Cy Hawkins' Snorter thundered.

The morning sun came out of the ocean behind them as the last blurred lights flickered out below them. They settled back in their bucket seats and listened to the monotonous drone of the 3,000 h.p. twin-Diesel motors in the nose of their ships as their eyes roved over their instrument panels.

Amarillo, Texas, was just a place it took a few hours to get to from Shorty's viewpoint. From Cy's it was a different matter.

As the outskirts of Chicago flashed under their wings they cut southwest and followed a course over St. Louis, Tulsa, and Oklahoma City.

After they left Oklahoma City they both checked their instruments and took their bearings. It was while they were doing that and reporting back to Barnes Field over the radio that they first noticed that half-grown twister ahead.

"Signing off, Tony," Shorty said, and then he spoke to Cy. "You know more about this country than I do," he said. "Is that a small cyclone ahead?"

While they watched, another and another and another of the swirling clouds leaped out of the horizon ahead and came plunging toward them like a great black wall.

"It must be a dust storm," Cy said. "I've never seen one before. They didn't have 'em when I was a kid down here."

"Will it reach this high?" Shorty asked.

"I don't know," Cy said. "We can climb out of it if it does."

They had been gazing down at the ghost villages below them that were caused by the dust storms without realizing why they were deserted.

Now as that solid wall of black horror marched toward them they knew what manner of thing it was that had caused such desolation. They rode straight on into it without realizing that it swallowed everything it encountered.

Before they were aware of it, the thing was upon them and they were strangling for breath. They closed and sealed their overhead hatches as sand and grit engulfed them. They turned on their two-million-candle-power landing lights, but they only turned the storm that was all about them from black horror to muddy gray.

Then something that sounded like distant artillery boomed against their ears as one storm moved into the area of another one and they both moved straight up.

Both Cy and Shorty yanked the control columns of their ships back into their stomachs as the storm began to buffet them about like leaves in a gale. The fury of the wind increased and

they had to use absolute concentration to keep their ships under control.

And, suddenly, these two were afraid—these two who had faced death a thousand times without flinching. They could not breathe and they could not see. Their bodies were cold and clammy while the temperature was over a hundred around them.

They eased their sticks back and opened their throttles wide while they coaxed and cursed their ships. They nursed their ships back to normal flight only to have them picked up and slammed down another five hundred feet.

Shorty threw the key on his radio panel and began to chant Cy's name into his microphone. No answer came back to him and he readjusted his master tuning control and tried again. His throat was so raw that his voice was hardly recognizable. Then a rasp that was Cy's voice sounded in his ear-



Nan Hawkins.

phones. But neither of them could understand what the other was saying.

Suddenly, as though they had moved from a darkened room into a lighted one, the thing was gone—swirling out behind them like a great impenetrable wall of black.

They slammed back their hatches and took air into their lungs.

"So," Shorty rasped into his microphone after he had chanted Cy's name and got a reply. "So! This is what you call your native State! Well, kid, you can have it! We're way the hell off our course. Shall we go on through to Amarillo or do you have other ideas?"

"I'll check and let you know in a minute," Cy said. "But we've got to get to Amarillo as fast as we can, Shorty."

"Anything you want to tell me now?" Shorty asked.

"It'll keep until we get on the ground," Cy said. "Check your bearings and we'll see where we are."

They were over mountainous country now and when they had finished figuring their positions they found that they must take a southeast course to strike

Amarillo. They laid their noses on it and settled down for a half hour's run.

Perhaps it was because they had been exhausted by the dust storm they had encountered. Perhaps it was something else. But they didn't hear those five sturdy little biplanes come out of a wisp of cloud far overhead.

They didn't hear them until their bullets began to drive into their tail assemblies. They wouldn't have ever heard them even then if the pilots of the five ships had eased off their speed enough for accurate shooting. Their inaccuracy gave Cy and Shorty that instant that is the difference between life and death. They hung their ships on their props and came up and around in a steep climbing turn while the five gray ships roared beneath them.

Shorty and Cy had no time to talk to one another as they prepared to defend themselves. They went about the job with the instinctive coordination of veterans.

Cy Hawkins gunned his Snorter as three of the gray biplanes came speeding back to the attack. For an instant he pulled away from them. Then they were on him and he knew that their speed equalled his own. He took his Snorter up and back in a flashing chandelle and went into them head-on. His finger was fastened down hard on the trip of his two powerful .50-caliber machine guns. He raked the foremost gray ship with a withering fire. One instant the pilot's face appeared above the cowl and the next it was gone.

"That," Cy said to himself, "would be Number 1." He took time to throw his radio key now and chant Shorty's name into the microphone.

"O. K.!" Shorty gasped in his ear a moment later. "Have you any idea who they are?"

"No," Cy said, "not the faintest. They seem to know who they are after. We can't run away from them. They're too fast."

"Who the hell wants to run away?" Shorty growled. Then he was silent.

The two gray biplanes that came at Cy now seemed to be a dozen ships. Besides the two fixed guns operated by the pilots there were gunners with flexible guns in the after cockpits. For a moment it seemed to Cy that the world was populated only by men with stuttering machine guns.

He knew that if he could hold them off until they had finished with their first desperate attack the superior maneuverability of his Snorter would begin to tell.

He saw Shorty flashing through the air far overhead, battling to the death with two more of the gray planes. He pounced on the tail of one of the biplanes with his guns chattering. He saw the gunner's tracers creeping along his right wing and saw that he was



overshooting. He eased his stick forward and clamped down on his trips again. The gunner's body shot straight up and over the side of the cockpit as Cy's .50-caliber bullets drove into him.

A thousand thoughts flashed through Cy's mind as he tried to shake off the other two-seater.

Through his mind, almost unconsciously, flashed all the things he had learned and Bill had taught him about fighting a single-seater against a two-seater.

He knew that he must keep above the two gray ships as much as possible and keep away from them. In-fighting would mean his destruction. He knew he must get the second gunner by the same direct-dive method he had got the first one—or he must maneuver to come up under a wing tip or under the tail.

He brought his Snorter up and over in a flashing Immelmann as the two ships tried to converge on him. As they reversed their directions he came around in another Immelmann and dived under the tail of one of them at terrific speed. Then he turned his nose up for one brief instant and poured lead up into the ship.

As the ship yawed wildly he eased the nose of the Snorter down and banked off to the left, underneath the wing tip and out of sight of the gunner. His hand was sure and steady on the stick as he executed the maneuver with the precision of a master.

But the pilot of the gray ship had anticipated his attack and had thrown his ship out of Cy's line of fire so that he would be ready for his method of retreat. As Cy came around the gray ship pounced on him from above like a hungry cat on a mouse. Machine-gun bullets drove through his Snorter with the fury of exploding shells before he could throw it out of range. The whole world seemed to explode around him as his Snorter began to reel drunkenly. His face smashed into his rubber crash pad with a force that dazed him. He pushed himself back into his bucket seat and dimly realized that when he was thrown forward he had jammed the control column hard to the right. Only his safety belt held him in his ship as it rolled over and stuck its nose down.

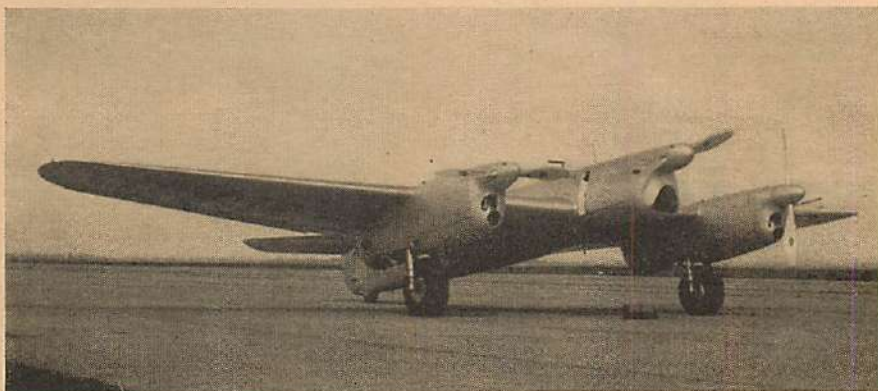
His dazed eyes saw his turn-and-bank indicator going mad as he tugged back on the stick and tried to neutralize his controls. His altimeter showed only a couple of thousand feet as he felt machine-gun bullets thudding into his Snorter again.

The sound of explosive bullets cleared his stunned brain and infuriated him. He glanced over the side of his plunging Snorter and realized that in a few more seconds the twin-Diesels in the nose would be driven back into his lap. He unsnapped his safety clasp and tried to push himself up and out of his

seat. But the ship was whirling too fast now. He was held in the cockpit by centrifugal force. His heart climbed up into his mouth and he tried to curse as the ship sped closer and closer to the earth.

He lashed out with his feet as he tried to drag himself out of the gyrating plane. His foot caught against the control column and he used it as a step-ladder to push himself up on the cowl-ing. The ground was racing at him as he lashed against the stick with his boots. One of his kicks did something to the controls that brought the nose of his Snorter up. With a wild cry he threw himself back into the bucket seat and eased the stick back as he opened his throttles wide.

But flaming death was hovering just over his head at that instant. As the nose of the Snorter began to lift, the fury of two machine guns was turned on him from only a few feet overhead.



Captain Papana's Bellanca, one Ranger, two Menascos.

The nose of his Snorter dropped again and the two great props knifed into the top of a cluster of trees. Again Cy was thrown violently against his crash pad. He slumped forward over the stick as the big ship nosed down and plunged out of sight.

SHORTY threw one frightened glance up over his shoulder as he stopped talking to Cy and opened the throttles of his Snorter wide. At the same time he kicked his rudder until it slapped against the stop, and dipped his right wing.

The bullets that vomited from the two guns in the nose of the diving ship came almost up to the forward cockpit of his Snorter before they danced off to the left and drummed into his left wing as he came around. His instantaneous coördination was all that kept him from being annihilated.

Perspiration cascaded down his face as he yanked the stick back into his stomach and took his Snorter upstairs. The other gray biplane was a thousand feet above Shorty when it started its shallow dive. Its screaming bullets chewed through the trailing edge of his

left wing as the second ship came back at him at terrific speed.

Shorty coolly yanked the control column back into his stomach and hung his Snorter on its two props. As he came to the top of his loop he half-rolled it upright and opened his throttles wide.

The ship that had been on his tail stuck its nose up and chandelled back to get on Shorty's tail again. Shorty stuck his nose up in a climbing turn, came over on one wing and opened his throttles. The planes roared toward each other like two runaway locomotives. Shorty's finger clamped down on his electric gun trip. His guns yammered out their stream of death. He saw his bullets wipe out a section of the windshield of the gray ship and knew the pilot had sideslipped it out of range.

He knew now that the pilots at the controls of those two gray two-seaters

were no novices. They knew how to get everything out of their ships. He was fighting a different kind of a fight than Cy Hawkins was fighting because he had more confidence in his own superiority.

Now the three planes raced and tumbled through a mad sky while the tops of the trees on the mountainside licked their lips and waited to engulf them in their bosoms. They fought like madmen, asking for no quarter and giving none. They fought viciously, with no one offering an opening for a kill. They were waiting for the other to make a mistake. Then the air would be filled with flaming lead for a brief instant.

Shorty matched his uncanny skill against the two pilots and the two gunners. He was fighting with the same cool, desperate skill that had saved his life a thousand times. The thought of peeling off and running had never occurred to him. They had been waiting for them and had laid a trap to murder them. That alone gave extra skill to his touch as he whipped his Snorter through the air.

He glanced far down to the left and saw Cy Hawkins fighting as desperately



as he had been fighting. He watched him for a moment and suddenly there was fear in his heart for him. He knew he must dispose of one of his enemies and go to Cy's aid.

His teeth were tightly clenched now and his breath was coming in short, sharp gasps. He maneuvered one of the gray ships into an error while he ignored the other one.

And that brief instant, while he had him under his hair sights, was enough. His finger clamped down and he saw his bullets drawing a line from the tail to the nose of the gray ship. He saw the pilot half rise from his seat and sink back. He saw the nose of the enemy ship drop and knew it was plunging to its death unless there were dual controls in the gunner's cockpit. His eyes were glittering as he probed the air all about him for some sign of the other ship. He located it in a minute. It was a mile away and beside it were two more of the gray ships.

He scanned the air all about him for some sign of Cy Hawkins' Snorter. He hung his ship on its two props as he saw the gray ship he had shot down straighten out and speed off to the east. His heart climbed up into his mouth as he widened his circle in his search for Cy. There was no sign of his Snorter in the air or on the ground. Back and forth above that desolate stretch he sped like a man gone mad.

As his motor began to sputter, he switched to an emergency tank and threw his radio key. He chanted Tony Lamport's call letters into his microphone. His face was haggard and gray as he waited for Tony to answer.

#### V—PLANS MADE

THAT same morning, at a little after nine o'clock, Bill Barnes hitched the stool on which he was sitting a little closer to his drafting board and ran a hand through his unruly mop of blond hair as he bent over the board again.

He was trying to concentrate on the work before him, but he couldn't keep his mind off Cy Hawkins.

He threw his pencil down and took the telephone from its cradle on his desk as the bell broke the silence of the bombproof secret study in which he was working.

"Yeah?" he said into the mouthpiece.

"Hello, Bill," Tony Lamport said. "Sorry to disturb you, but there is a bird named Richards calling you on long distance from Winchester, Virginia. I tried to find out what he wants but he won't tell me. He says you'll talk to him if I tell you he is engaged to Cy's sister. What about it?"

"Put him on," Bill said, and for some reason he could feel goose flesh rising across the muscles of his stomach. "And be sure there is no one on the wire."

"O. K.," Tony said.

"Hello. Mr. Barnes?" a voice said in his ear.

"Barnes speaking," Bill said.

"My name is Richards, Mr. Barnes. Ted Richards," the voice said. "Your chief operator said Mr. Hawkins left for Texas early this morning. That's why I bothered you. I am Nan Hawkins' fiancé. Did you see Mr. Hawkins last night?"

"Yes," Bill said. "For a few minutes."

"What time did you first see him, Mr. Barnes?" Richards asked, and his voice was tense.

"He arrived here at about nine o'clock last night. Is something wrong?"

"Something is definitely wrong," Ted Richards said. "Last night after Miss Hawkins arrived at her sorority house some one, who said he was her brother, telephoned and asked her to come back to the airport and get him. He said something had gone wrong with his plane that could not be fixed until this morning."

"Miss Hawkins went out to the airport to get him but she never arrived there. Two men stopped her on a steep road, forced her to move from the driver's seat of her car at the point of guns and then ran her car into a ravine—ninety feet deep—with Miss Hawkins in it. The men leaped out before it went over the edge."

The exclamation that came from Bill's lips seemed to key young Richards to a new pitch.

"They—they didn't find her until this morning!" he went on. "A passing car saw where her car had gone over and investigated. They only got her out a couple of hours ago."

"Is she—badly injured?" Bill asked.

"I don't think so," Richards said. "She has a slight concussion and a great many bruises. She had enough sense to crouch down inside her car on the floor as it fell. The nervous shock seems to be the worst thing."

"Do you want me to try to get in touch with Mr. Hawkins by radio-telephone?" Bill asked. "I think I can reach him and he'll come back there."

"No!" Richards said. "I want to talk to you, Mr. Barnes." His voice was both frightened and pleading now.

"Could you fly down here, sir? There is a reason—a horrible reason why I want to talk to you. I don't think I had better tell you over the telephone because I'm not sure. I know it's asking a lot of you. But Nan's frightfully upset. I'm afraid—I'm afraid the whole thing may affect her mind. She's under a terrific strain with this thing coming so closely on top of the death of her father."

"I'll be there in a couple of hours," Bill said shortly. "Can you meet me at the airport?"

"I'll be there, sir," Richards said. "I knew somehow I could depend on you."

"Good-by," Bill said and hung up.

"You might think I had a gray beard!" he said to himself. "These twenty-one-year-old kids who call me 'sir'!"

Twenty minutes later Bill, dressed in a tweed suit, snap-brim hat and tan brogues, stood on the apron beside the Silver Lancer, while Martin, the chief mechanic on Barnes Field, warmed it up. He was giving instructions to dour old Scotty MacCloskey.

"You better spread the word for every one to stand by," Bill said to Scotty. "And tell Tony to contact Shorty and Cy, if he can, and tell them to keep in contact with him. You'll hear from me within a couple of hours. Tell Red and Bev Bates and Sandy to stick around."

"Right, boy," Scotty said.

Bill climbed into the forward cockpit of the all-metal silver bullet, dropped into the bucket seat and adjusted the seat parachute.

He lifted a hand in farewell to Scotty, blasted his motor and kicked the tail around. Two minutes later he was a dim speck in the clear, cool air to the south.

Bill immediately liked the tall, dark-haired kid with the serious face who greeted him as he locked the wheel brakes on the Lancer and killed the motor.

But he couldn't believe the things young Richards told him as they drove in Richards' car toward a hospital in the town. They were too fantastic, too incredible.

"You say these men just held her up, forced her over in her car and then deliberately drove it into the ravine?" Bill asked.

"That's right," Richards said.

"Has she any idea why any one might do such a thing?" Bill asked. "Or who might have done it?"

"That's why I wanted you to come down here, Mr. Barnes," Richards said. "I know you've been Cy Hawkins' best friend for years. That's why I asked you to come."

"What has Cy to do with this?"

"She hasn't told me so, sir," Richards said, "but I'm sure she thinks her brother was the man who drove the car into the ravine!"

"She's crazy!"

"No," young Richards said. "But she may be if we don't get this thing straightened out. She says she is sure it was Cy who called her on the telephone. She says she would know his voice from any other because of his slow, low-pitched drawl. Then she started to tell me that the handkerchief slipped off the face of one of the men—the one driving her car—before he jumped. She got just that far—told me she had seen his face—then she couldn't



go on. But she kept saying her brother's name over and over until it dawned on me what she meant."

"That's ridiculous!" Bill snapped. "Utterly fantastic. I've heard Cy speak of his kid sister—half sister isn't she?—a thousand times. He is mad about the kid. There is quite a difference in their ages and I know he feels, now more than ever, like a father toward her."

"No," he went on sharply. "I couldn't even entertain such a preposterous idea. If she thinks that, she supposes it is because Cy is after her share of their father's money, of course. I never knew a man who was so little interested in money. I think he's overwhelmed at the idea he'll have so much. He doesn't want his own share."

"I hope you can make her understand that as clearly as you do me," Richards said. "She hasn't told me she thought it was Cy. But she told me she would be in constant terror of her life. Perhaps she'll tell you what she is afraid of."

"Perhaps," Bill said.

He was amazed at two things when he entered the private room Nan Hawkins occupied in the hospital. First, at her remarkable resemblance to her brother. Second, at the stark terror in her eyes.

She clung to Bill's hand after Richards had introduced them and a nurse had warned him that he could not stay long.

"It was good of you to come down here, Mr. Barnes," she said, and she tried to smile.

"Bill to you," he said.

"Bill," she said. "It sounds more natural. I've heard Cy talk about you so much."

"We haven't been able to make contact with Cy since Mr. Richards telephoned me a couple of hours ago," Bill said to her, and he watched her eyes carefully when he said Cy's name. If the mention of his name added to her

fear she didn't show it. "Tony Lamport talked to him earlier in the day on the radiophone but hasn't been able to pick him up again. He'll be very worried about you when he knows."

"Yes," she said. "He'll be worried."

"You've no idea who did this to you?" Bill asked.

"No," she said. "I have no idea. I can think of no reason for it. But I'm frightened, Bill. I'm terrified. I—I think—"

"Have the police questioned you yet?" Bill asked.

"Just a little," Richards answered for her. "I did most of the talking for her. They're investigating, doing what they can. But they have nothing to go on except Nan's description of their car and her hazy description of two men with their faces covered."

"I noticed a policeman in the hallway," Bill said. "Is he here because of Miss Hawkins?"

"Yes," Richards said. "He—"

"Well, get them to put two more men in here," Bill snapped. "Tell 'em to let no one in here except the doctor or nurses and yourself. Be sure there is a policeman on duty outside all the time. You can take care of that?"

"I'll be responsible," Richards said.

"Remember," Bill said. "I don't want any one to come in this room except doctors and nurses until I get back here." He went to the window and gazed out to see that there was a sheer drop of thirty feet from the window to the ground.

"Nan," he said gently, "I want you to rack your brain for the name of your father's best friend in Texas. Not an acquaintance or just a friend, but his oldest and best friend."

"Judge Shelton in Amarillo," Nan said without any hesitancy. "Are you going down there?"

"I don't know yet," Bill said. "I'm not sure. I want to make contact with Cy first."

Stark terror flashed for a moment in Nan Hawkins' eyes and was gone. "If Cy comes back here will you please come with him?" she said.

"I will," Bill said. "You rest and don't worry. We'll find out about this thing. There's an answer and we'll find it. No one is going to bother you here. I'm going to leave one of my men here if I go to Texas. He'll be here before I leave. Does that help?"

"That helps a lot." She smiled. "Is there anything more you want to know?"

"No," Bill said. "Mr. Richards can tell me anything you know, I think."

Bill saw her eyes dart to Richards' face and he knew that she knew what Richards had told him.

"Just get well," Bill said and took her hand again. "You'll run me back to the airport?" he asked Richards.

"Certainly," young Richards said.

Bill put in a long distance telephone call to Barnes Field from a booth in the lobby of the hospital. He got Tony Lamport on the telephone and gave him orders to send "Red" Gleason to Winchester immediately. He told Tony that Ted Richards would meet Red at the airport and explain the situation to him when he arrived. Then he asked about Shorty and Cy.

"I haven't been able to pick them up again," Tony said. "They ought to be in Amarillo by now."

"Keep on trying," Bill said. "If you get them don't tell them about the accident to Cy's sister. Just tell them I'm on the way down there."

"O. K.," Tony said. "Is that all?"

"That's all," Bill said and hung up.

On the way back to the airport he talked to Richards again and gave him instructions.

"Don't leave her unguarded for a second," Bill told him. "And be sure she knows there is some one guarding her constantly. She'll get well quicker."

"I'll take care of that if I have to sleep outside her door," young Richards said grimly. "What do you make of all this?"

"I don't know," Bill said. "I don't know any more than you do. But I'm certain of one thing and that is that her life is in real danger. We'll find out the answer. Then she'll be safe."

"Do you think Cy—" Richards began.

"I don't think anything!" Bill snapped. "I don't know. Maybe I'll know more after I talk to this Judge Shelton."

## VI—RESCUED

BILL'S head was whirling as he swung the Lancer lightly around and rolled across the Winchester airport. After he had kicked the ship into the



The two-place Grumman XSBF-1.



wind, the engines blasted as the three thousand horses in the nose snorted to be unleashed. The tail lifted, and a moment later the retractable landing gear slid up, making a monoplane of what had been a sesquiplane on the ground.

At five thousand feet he leveled off and laid a course toward Louisville and the southwest. He cut his throttles to cruising speed and made contact with Tony Lamport again to learn that Tony had heard nothing. He told Tony where he was going and signed off.

An hour later, after Bill's mind was reeling from trying to solve the puzzle that confronted him, the scarlet signal light on his radio panel suddenly flashed. He threw his key and spoke into the microphone.

"Shorty speaking, Bill," came to his earphones. "Shorty speaking— Can you hear me?"

"Go ahead—go ahead, Shorty," Bill said. "Where are you?"

"Amarillo, Texas," Shorty said. "Where are you?"

"On the way to Amarillo. What happened to you? Where is Cy?"

"He's down, some place," Shorty said. "Now, wait a minute! Let me talk! We ran into a dust storm on the way down here and got way off our course. We found ourselves northwest of Amarillo and just after we had plotted our course and laid our nose on it five two-seater biplanes armed with two fixed guns and a flexible gun manned by a gunner attacked us."

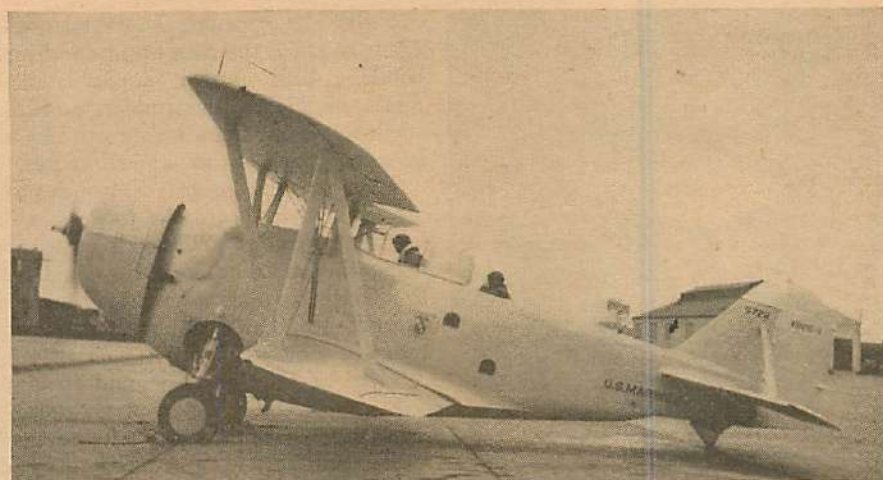
Bill cursed into the microphone and rubbed his hand impatiently across his face. His eyes had become two pin points of fire.

"Two of 'em kept me busy and three of them went after Cy," Shorty went on. "I knocked off one of the pilots of the ships after me and started to go to Cy's aid. But I couldn't find him. He wasn't in the air and he wasn't on the ground. The ships we were fighting had peeled off. I looked for him for a half hour. It was rocky, mountainous country with a few forests on the slopes. He might have plunged into a bunch of trees and went down through them. They plugged one of my fuel tanks. When I began to run out of juice I switched to my emergency tank and just made Amarillo. I couldn't find any trace of him, Bill. He had completely disappeared. I'm going back there as soon as my tanks are repaired and I get some fuel."

"Wait a minute," Bill said and his mind was working like chain lightning. "Did you take the approximate position of the place where the fight occurred?"

"Certainly," Shorty said. "Here it is."

Bill wrote it down on the edge of the chart on his shelf. "Have you told the



The Great Lakes Dive-Bomber.

police anything about the attack?" he asked.

"No," Shorty said.

"All right," Bill snapped. "Don't. And don't go back to the place you just gave me. I want you to do something there in Amarillo. I'll go to the position you gave me and make a search. I want you to go see a Judge Shelton there in Amarillo. Tell him who you are. By the way did you notice anything peculiar about Cy's actions before you left here?"

"Yes," Shorty said. "He acted worried about something. He was going to tell me about it when we reached Amarillo."

"He didn't tell you anything?"

"Nothing," Shorty said.

"All right," Bill answered. "After you tell Shelton who you are tell him the way Cy acted, why you were going down there and everything you know. Then tell him that some one tried to kill Cy's sister last night and she has an idea it was Cy. Do you get that?"

"What the hell are you talking about?" Shorty exploded.

"Did you understand what I said?" Bill barked at him.

"Yes, but—"

"Never mind that," Bill said. "Tell him all those things and then find out what he knows. I'll contact you again or I'll find you in Amarillo. Stay there until you hear from me. I'm signing off because Tony may be trying to get me. Good-by."

Bill threw his switch, spun the dials on his radio-control group for a moment and chanted Tony's call letters into the microphone.

"Tony speaking, Bill," came to his ears a moment later. "I've been trying to get you. Shorty got through to me and—"

"I just talked to him," Bill interrupted. "What about Cy?"

"I just talked to him," Tony said. "He got me after I had talked to Shorty. He's down in the mountains,

Bill, northeast of Amarillo. Here's his position."

Bill listened and checked it with the one Shorty had just given him. They were almost identical.

"Is he standing by his radio?" he asked Tony.

"He said he would until he had word some one was coming for him," Tony said. "Then he's going to climb up to a plateau where you can get in to take him out."

"Right, Tony," Bill said. "I'm going after him now. I'll contact him first. You stick close to your station and tell every one else to do the same thing if they contact you."

"What's on the fire, Bill?" Tony asked.

"I don't know," Bill said wearily. "Signing off."

Bill opened the throttles of the Lancer wide and saw his air-speed indicator climb to four hundred and fifty miles an hour while he laid its nose on the position Shorty had given him.

Then he went back to his radio and tried to get Cy Hawkins. He tuned and re-tuned and fussed for half an hour before his efforts were rewarded. Cy's voice came through to him faintly.

"Are you all right, Cy?" he shouted into his microphone.

"I'll do, Bill," Cy said. But his voice sounded weak and tired. "I'm all bruised to hell, but no wounds. They shot my controls away and I was knocked unconscious when I crashed. Do you have my position?"

"Yes," Bill said. "What about this plateau? Can I get in there? How will I spot it?"

"I'll take my Very pistol and a white flag up on the plateau with me," Cy said. "You can spot me with glasses if you get plenty of altitude. I'll be out in the open waving the flag. You have plenty of room to get in and get out again."

"Keep your chin up, fella," Bill said. "I'll find you as soon as I can."

He threw his radio key and checked





his present position with his destination and found that it would take him another half hour to make the run.

Bill checked his instruments and took his bearings as he saw the *Sangre de Cristo* range of mountains looming far ahead. As the foothills began to spread out below him he found that he was nearing the position Shorty had given him. He took a pair of binoculars from a pocket and began to scan the occasional flat plateaus that dotted the landscape below. He checked his bearings again and began to fly in ever-widening circles. He could see a dozen places that might be the one he wanted and was almost ready to get in touch with Shorty to ask for help when he sighted a lone figure through his glass, eight thousand feet below. He began to nose down—keeping his eyes on the spot. Suddenly, he heard the far-away roar of airplane motors. He looked up and back and probed the air all around him, but could see no planes. He didn't want to lose the figure that he believed was Cy and gazed down again to find it.

It was while he was searching the interminable stretch of forest and mountains with his eyes glued to his glasses that it happened!

A Vee formation of five rugged, gray biplanes dived out of a wisp of fleecy clouds a few thousand feet overhead, their engines screaming. Bill dropped the glasses on the deck of the cockpit and jammed the control column of the Lancer forward. He held the nose of the big ship down as white streams of tracers danced through the air toward him.

His mouth twisted into a snarl as it came to him that the formation of two-seaters had attacked him at the exact spot both Shorty and Cy had given him. How did they know he was going to be there? And who were they?

He eased the stick even farther forward and the Lancer came over on its back in an inverted loop. He centered the controls and then rolled right side up as the five gray biplanes came over him. Their speed was too great to pull

out with him. Opening the throttles wide again he stuck the nose up in an abrupt climbing turn until it almost stalled. Again he kicked the rudder, and the earth rolled out from underneath him as he swung back on his original course.

Then one of the gray ships was on his tail and he heard the *tat-tat-tat* of its machine guns, followed by the fire of another and another. He could feel the Lancer tremble as bullets drummed through its skin. He hung it on its props in a desperate zoom.

"They're fast jobs," he said to himself. "No wonder they shot Cy down."

Suddenly, his whole body seethed with rage. This gang of murderers had tried to kill two of his men and had shot down one of his ships. He saw red as he looked over his shoulder and saw that they were climbing behind him, still in formation. He gunned the Lancer for a few seconds to pull away from them. Then he whipped up and over in a flashing chandelle.

The Lancer, with its terrific speed and maneuverability, was up and back and diving at them head-on before they knew what had happened. They dived and zoomed and rolled to get out of his mad path. His fingers fastened down hard on the control column and his gun trips. He raked a gray ship that came under his sights with a withering fire and saw the pilot come up in his seat with his arms flailing the air. The ship yawed wildly, slipped off to the right and began to flutter toward the mountains below before the gunner in the rear cockpit could get it under control.

Bill gunned his engine again and came over on the tail of the last gray biplane. His line of tracer smoke curled above the head of the pilot. He corrected his aim but the pilot skidded out of range.

As he zoomed upward he heard the chatter of a swivel gun. Again he could feel bullets tearing through the Lancer as a gray biplane raced away from him with its rear gun belching fire and death.

Bill eased the throttles of the Lancer open another notch and took it through the air with the speed and fury of a flaming meteor. He saw his bullets tracing designs on the sides of the gray ships and biting into their engine blocks. But his speed was too great for accurate shooting.

He saw that all five ships were back in the fight again and he knew that the gunner of the ship he had started on a last plunge had managed to pull out and come back into the fight.

The next time he got one of them under his sights he switched from his machine guns to his 37mm. cannon because of its longer range. He fired a burst of five shots as he threw the throttle of the Lancer wide and moved

away at terrific speed. He saw the gray biplane become one great ball of black smoke and orange flame. As he yanked the stick back to zoom above the other four ships he saw the ball of black smoke disintegrate. The explosive shells he had poured into the biplane had taken it apart with a finality that was like death itself.

His breath was coming in quick, agonized gasps now. His hand was wrapped around the control column like a band of steel. He was using all his natural genius as a flier, plus the speed and maneuverability of the Lancer, to keep those four ships from sending him to eternity.

Then the pilots of those gray ships thought the heavens had turned loose their fury upon them as Bill threw discretion to the winds and attacked with a last burst of fury.

He tore one of them into a hundred pieces as he turned both of his powerful .50-caliber guns and his cannon on it. He poured lead and death into its very bowels before it knew what manner of thing had struck it. It flew apart like feathers from a duck's back taking a charge of buckshot at close range, then plunged straight down to its death—a whirling ball of fire.

That was enough!

Bill yanked the control column of the Lancer back into his stomach and watched them go. Then they were gone and forgotten as quickly as they had come. He scanned the terrain below him while he sucked air into his tortured lungs. He had no idea how far he had drifted away from the spot where he had located Cy before the fight.

He picked up the binoculars from the deck and swept the half dozen plateaus within his range. He picked out Cy on the third one and stuck his nose down again.

The sun was sinking closer and closer to the horizon as he circled low above the plateau and saw Cy frantically waving the white flag he carried. He could see that his face and one arm were bandaged and knew that he hadn't escaped injury entirely. But he was not worried about that. He was worried about getting in the place and getting away again.

Then he kicked the Lancer around and stuck the nose down as he unfolded his retractable landing gear. He set his flaps well down and cut his motor. But he was still doing close to a hundred miles an hour as he skimmed the surface of the plateau with his landing wheels.

At the far end, when it seemed that nothing in the world could keep him from plunging over the side, he kicked his rudder and swung the big ship around. It teetered dangerously on one







sat down in the chair behind his desk. He sat there, nearly motionless, for the better part of half an hour, thinking. His eyes were two pieces of blue ice when he got up and went back to the radio-control room. He asked Tony to see if he could pick up Red Gleason some place in Winchester, Virginia. Tony found him occupying a room in the hospital and plugged Bill in.

"Nan is all right?" Bill asked Red.

"She's all right," Red said, "except for the jitters. She's frightened to death, Bill."

"She has a right to be," Bill said grimly. "Have you had any sleep, fellah?"

"A few hours."

"Fine! Is young Richards there?"

"He's sleeping out in the reception room," Red said. "He won't go home."

Bill chuckled. "That's one ray of light, anyway," he said. "Now listen. Go out and tell him he must stay awake and keep a cop or a detective with him outside Nan's door until I get there. Tell him not to let any one get by him. No one. Do you get that?"

"I get it," Red said. "And what do I do?"

"You hop out to the airport and climb into your Snorter and get down to Amarillo, Texas, by dawn," Bill said. "Shorty will meet you there at the airport and tell you what you have to do. Is that clear?"

"Can I make it by dawn?" Red asked.

"Turn on the heat," Bill snapped. "You ought to be able to make it in five hours. You'll be running away from the sun you know."

"Right," Red said. "I don't suppose you can spare a minute to tell a guy what this is all about?"

"Shorty will tell you," Bill said. "Then you'll be sorry you know. Good-by. Wait a minute! Impress on young Richards that no one must go into that room but the nurse and doctor."

"I'll impress him," Red said grimly. "Good-by."

Bill hung up the receiver and went back over to the little infirmary on the field. Doc Humphries had completed his examination of Cy and had given him a sedative to make him sleep.

"Let me have a pen or pencil and some paper," Bill said to the doctor. He took the pencil and paper and went into Cy's room.

"How're you coming now, fellah?" he asked, grinning.

"O. K.," Cy said. "The Doc gave me some pills to stop my bruises from paining. He says I'm all right. Don't you think I'd better hop down to Winchester now, Bill? Nan must be worried to death."

"No," Bill said firmly. "You get a good rest. Then you won't scare her so much when she sees you. Your face

is covered with bruises. I don't think she'll recognize you. I got a piece of paper and a pencil from Doc. You just write a little note to Nan and tell her you're O. K. Just say you're all right and will see her in the morning. I'll send it down by Sandy right away and she'll have it the first thing in the morning with her coffee."

Cy pushed himself up in bed, saying, "I don't know whether or not I can write."

Bill took the folded piece of paper from him and said, "You get some rest and you'll feel better. I've got to get to bed or I'll die on my feet. Good night, guy."

"Good night, Bill," Cy said, and Bill could feel his eyes following him to the door.

Bill stuck the note Cy had written in his pocket and went back to his office in the administration building. He spent fifteen minutes there and saw that it was half past four in the morning by the clock on the traffic tower as he made his way wearily toward his own bungalow.

But he didn't go to bed. Instead he got Scotty MacCloskey on the telephone and gave him instructions to get two Snorters warmed up.

Then he sat down in a chair that commanded a view of the administration building, the traffic tower, the infirmary and the apron. He fought desperately with himself for a half hour to keep his eyes open. He got up a half dozen times and walked back and forth across the room to keep from falling asleep.

Gray streaks of light were heralding the coming dawn when he finally succumbed. His head dropped forward on his chest and his eyes closed.

He slept the sleep of a man that is thoroughly exhausted.

## VIII—DUEL

HOW long Bill slept he did not know. He awakened with a start, sat bolt upright and swept the field with his eyes. But he knew it had not been too long when he saw the front door of the infirmary open and a lanky form hasten down the steps.

A little smile played at the corners of Bill's mouth as he nodded his head back and forth with satisfaction. He watched the form of Cy Hawkins cross to the apron and nod to a night guard. He saw him go inside Number 6 hangar and saw the doors opening a few moments later.

The smile disappeared from Bill's lips then and they became a hard, tight slash across his face. He saw the two three-bladed propellers on the nose of the Snorter that was pushed out on the apron come to life as its twin-Diesels roared. He saw Cy Hawkins climb into the forward cockpit. Bill

reached for the white helmet that was lying on a table.

"I'm almost positive now," Bill said to himself as he opened the door of his bungalow and started on a run for the apron. He ran behind the administration building so he was out of sight of the Snorter that was rolling out on a runway. Then he heard the Snorter's engines blast as it sped down the concrete.

He didn't say anything to the men who were pushing that second Snorter out on the apron. He flashed by them, got into the front cockpit and worked the starter.

Sixty seconds later he whipped the red-and-black Snorter into the air.

"All right, Cy," Bill said softly. "We'll do the best we can for you."

He nosed his Snorter up until he had ten thousand feet under him while he tried to make contact with Shorty Hassfurther on his radio. He gave up after a few moments and probed the sky ahead for the other Snorter. His eyes spread wide with alarm when he failed to find it.

The next instant his Snorter bucked and quivered under the impact of lead that drove into it from underneath. For a split fraction of a second Bill sat immobile, frozen to the stick. The other Snorter had come back and come up underneath him while he had been trying to get Shorty!

He yanked back on the control column and zoomed his Snorter up and over on its back as the other Snorter sped beneath him and leveled off.

At the top of his loop, Bill half-rolled the Snorter to a level position and gazed over the side. The other Snorter had reversed its direction of flight and was coming back to the attack.

It came zooming up from beneath him with its twin guns spewing burst after burst of fire. Lead chewed through the leading edge of his left wing until he skidded his Snorter from its line of fire.

It roared upward again in a climbing turn and dived back on Bill's tail as Bill began a sweeping turn to the left. The pilot of the Snorter did not trip his guns until he was underneath Bill's ship again. He knew that he could not shoot accurately as he dove and waited until after he had pulled out and zoomed upward to trip his guns.

Bill was half choked with rage as he half-rolled out of that deadly line of bullets. The next instant the two ships were roaring head-on at each other at terrific speed. Bill's fingers tightened on his gun trips this time and he could see his tracers driving in the other Snorter's fuselage before the pilot skidded it out of range.

Bill was calm now and he knew that he was fighting a man who knew every



trick of the trade. He had accepted things as they were and grimly settled down to the task of completing the job before him. He wasn't sure that he wouldn't be held without blame for doing the thing he was doing but he was willing to risk censure.

"I'm almost positive I'm right," he said to himself. "I can't see any other way out."

The two ships streaked and tumbled all over the sky, filling the air with red-hot lead.

Bill's fingers clamped down on his trips time and again, only to have the other pilot slip out of danger. His lips became a hard, set line of determination as he studied the other pilot's tactics and strategy.

"You've got something on the ball," he gritted between his teeth. "But I don't think you can take it. You've shown you have a yellow streak and I don't think you can take it when I turn on the pressure." He sideslipped the Snorter out of range, as the ship came at him head-on with its guns yammering.

He came up in a lightninglike chandelle and dived on the other ship. But when he clamped down on his trips Cy again crabbed out from under his sights as though some unseen hand had flicked him out of danger.

Bill shook his head with a gesture of disgust as he realized that he was bearing down too hard.

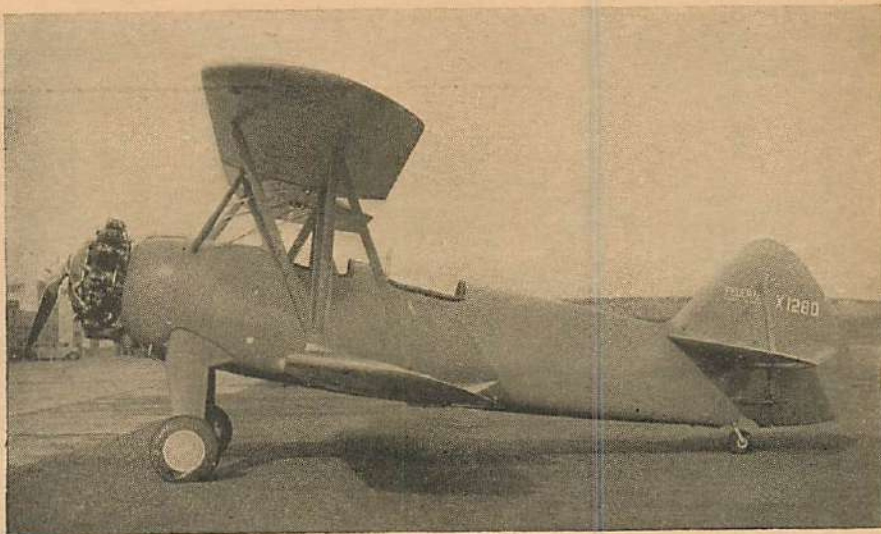
The next time the other Snorter flashed across his sights he held his fire until the other pilot had made his correction to escape Bill's probable aim. Then he kicked his rudder and his bullets wove a pattern from the engine housing to the tail assembly of the other plane. It skidded off dangerously on one wing and yawed wildly. Bill whipped back to the attack with all the speed his Snorter would give him.

"Cagy," Bill panted. "He knows what I'm going to do." He fought to get control of himself again, knowing that he was bearing down too hard. "I can't let him get away from me now," he said aloud. "I've got to stop him before he goes any farther. He—"

He broke off suddenly and slapped the stick of the Snorter forward, as the red-and-black streak nosed down in a vertical dive. Then the other ship came up and over in a flashing Immelman turn and Bill came up and turned with him. But Cy had gained altitude and was diving once more with his guns spewing flame and lead.

Bill slammed his stick all the way forward again and went into an outside loop at a speed that left him sick and giddy as he hung head downward at the bottom. He gulped and shouted to relieve the terrible pressure.

His stomach felt as though it had jumped up into his throat as he probed



The new Federal Experimental Trainer.

the air. Bullets came tearing up through the belly of his Snorter again and he barrel-rolled to get out of range. Then he was under the other Snorter with his guns raging. He could see his tracers driving into it before it was thrown out of range.

Together they raced upward, each trying to get the advantage of altitude. At four thousand feet Bill whipped around to return to the attack.

He poured juice into his Snorter and chandelled back to the attack with his exhaust pipes glowing and spitting fire in the dim morning light. The other Snorter began a wide swing to the left, as Bill's finger tightened on his trips. He saw his tracer smoke curling harmlessly above the other's head. He tried to correct his aim and saw that his bullets were tearing into his tail surfaces. Bill's teeth were tightly clenched and his breath was coming in short, sharp gasps.

He knew that now, was the time to put on the pressure. If he didn't get him now he could never get him. He mustered all his reserve strength as he called on his muscles and mind to coordinate.

As Bill zoomed over on his back, neutralized his controls and sought the other Snorter in his sights while he hung with his head the nearest thing to the ground, the pilot of the other Snorter made his fatal mistake. He waited for Bill to roll level. Before he realized that Bill was not going to roll level the bullets that were to drive the life from his body were speeding through the air. They crashed into his tail surfaces and crept forward to smash into his instrument panel.

He tried with a desperation born of panic and fear to throw his Snorter out of the line of fire. But this time he was too late. He had waited that infinitesimal length of time that is the difference between life and death.

His lifeless hand slipped off the con-

trol column. The nose of his Snorter lifted as though it would fight on by itself. Then the force of the pilot's body falling forward on the stick drove the nose down and it began a dizzy plunge toward the waters of the Atlantic Ocean far below. Bill had not realized until now that they had worked their way out over the ocean while they fought.

He watched the spinning ship plummeting down and down until it dove beneath the waters like a diving gannet. But unlike a diving gannet it did not rise again.

Bill's expression did not change while he watched the ship plunge to its death but his lips moved slowly. He knew that now he had a harder task to perform as he took his bearings and laid the nose of the Snorter on Winchester, Virginia.

## IX—TRAGEDY

BILL gazed into Nan Hawkins' tortured eyes while he greeted her, and suddenly he was glad that he had done what he had done. He glanced at the tight, white face of young Richards and then he spoke to the nurse.

"Will you leave us alone for a little while?" he asked.

She nodded her head and said, "Not too long. Her nerves—"

"I know," Bill said.

The nurse went out the door and Bill pulled a chair up beside Nan's bed and motioned to Ted Richards to sit in it. Young Richards obeyed and Nan reached for his hand. Bill could see the muscles in her hand stand out like whipcord as she gripped it. He knew that she was fighting desperately to keep herself under control. He sucked air into his lungs and sat down on the edge of the bed and said, "I'm going to tell you the worst part first. But it won't seem so bad when you know everything. And remember, you two have each other."



He saw their clasp tighten as their eyes met for an instant and he was no longer afraid for them.

"Cy," he said, looking into Nan's eyes, "is dead."

He had spoken softly but the words seemed to boom out in the still room and reverberate against the walls. Nan's breath sucked through her teeth like the sound of escaping steam and her free hand flew to her throat. For an instant she clung to young Richards' hand with a fierce intensity. Then her grip relaxed and her eyes were wet with tears.

"Tell me," she said softly.

"It's an amazing story," Bill said.

"Please tell me," she said desperately.

Bill reached in an inside pocket and took out three folded sheets of white paper. He unfolded them and laid them on the bed.

"About the time of your father's death," he said, "I received two of these letters at my field on Long Island. They didn't make any sense and I thought they were from some crank who was a little crazy and was trying to tell me he had a grievance against me. Later, young Sandy found out that they were Biblical quotations. The day Cy returned from Texas we received the third one. It said, 'One of you shall die.'"

"We put them away and didn't think any more about them until later on when they began to fit into the picture.

"When Cy came back that night I could see that he was terribly worried about something. He seemed on the verge of telling me about it a couple of times. But he didn't and I didn't ask him. He said he had to go back to Texas to straighten out some things that were bothering him and, of course, I gave him my permission."

"I remember that Cy was worried, too," Nan said quietly. "I didn't think anything about it then because I supposed that it was because he felt the same way I did about dad's death. Now, I remember that it wasn't only worry. It was also a kind of fear."

"That's right," Bill said. "He seemed harassed and afraid of something that might happen."

"Was it Cy—" Nan began.

Bill held up a forefinger and smiled at her. "In a moment," he said. "Let me tell you.

"Cy and Shorty started for Texas and then I heard from you. After I had talked to you yesterday morning I was as much puzzled as you were. But I could not believe that Cy had tried to kill you. Yet I remembered the way he had acted the previous night. I was sure he hadn't done it. Yet there was a doubt. That is why I started for Texas. I was as much concerned about Cy as I was about you.

"On the way to Texas I made contact with Shorty and he told me that he

and Cy had been caught in a dust storm and were driven off their course to get out of it. They were driven way off to the northwest of Amarillo above the mountains. On their way back to Amarillo they were attacked by five two-seater fighters. Two of them went after Shorty and three after Cy. When Shorty had disposed of one of the pilots and peeled off to go to Cy's aid he couldn't find Cy. He wasn't in the air and he couldn't find any trace of him on the ground. Shorty's fuel tanks had been punctured in the fight and he had to go to Amarillo to have them repaired.

"He said he was going back to look for Cy and I ordered him to go and tell Judge Shelton everything he knew and find out what the judge knew about things. Shorty told me that he had noticed something wrong with Cy and said Cy had told him he had some things he wanted to talk over with him when they reached Amarillo.

"But they never reached Amarillo together, so he didn't know any more than I did. A little later Tony Lamport made contact with me and told me he had just talked to Cy. He said Cy told him his approximate position and was standing by his radio.

"I talked to Cy a few minutes later and told him I would pick him up on the plateau that was just above the place where he had been shot down. He said he was not wounded, only bruised and battered from his crash. I sighted him with binoculars a bit later and was just about to go down to pick him up when I, too, was attacked by five ships.

"Remember," he went on, "I was as much at sea then as you are now. I didn't know who had tried to murder you, or Shorty and Cy. I didn't know why those five ships were attacking me. I knew, of course, that it all had something to do with Cy and with you. But I didn't know what or why. I didn't dare pull out of the fight and run away for fear they knew Cy was down there alive and would land and kill him. I had to fight."

"You weren't wounded?" Nan asked quietly.

"No," Bill said. "I was lucky. I shot two of them down and the rest peeled off and ran for it. Then I went down to get Cy. He was all battered and bruised and bound up with bandages. He could hardly talk. I got him into my Lancer and told him we were coming north to Barnes Field. He wanted to go to Amarillo. I told him about the attempt on your life. He seemed astounded."

Bill stopped talking for a moment and a grim smile flitted across his face.

"Then," Bill said, "he gave me my first clue. He said, 'She didn't die, Bill?' I knew then, by the way he said it, that either this was not Cy or if it

was he had tried to kill you. Do you see?"

"I'm afraid I don't," Nan said.

"I thought about that remark all the way back to Barnes Field," Bill went on. "When we arrived there I told Doc Humphries to order Cy to stay in bed and asked him to check up on Cy's body while he examined him. Doc Humphries had treated Cy many times in the infirmary and I thought he might know of a birthmark or something of the sort that would definitely establish whether or not it was Cy.

"Then, I made contact with Shorty in Amarillo. The things that Judge Shelton had told him almost gave me the answer." He studied Nan's face for a moment. "Did you know that your father had a brother who left Texas in disgrace?" he asked her.

"I recall it dimly," Nan said. "I never saw him. Father never talked about him. I understood that he had done something dad would not forgive and that dad sent him money all his life to stay away. You know that was all a long time before I was old enough to know about such things. Cy was my half brother. There was almost twenty years' difference in our ages. Dad married my mother ten years after the death of Cy's mother."

"Yes, I know," Bill said. "Well, your father's brother was a crook. Did you know that he had a son just Cy's age who looked almost exactly like Cy?"

"No!" Nan gasped. "Now I see!"

"Judge Shelton told Shorty about all those things and said that he had seen Cy's cousin within the past few weeks and had mistaken him for Cy. He had investigated because he knew that Cy couldn't be in two places at one time. Cy evidently knew his cousin was around, also. That was why he was worried when he came back from Texas. Perhaps he talked to the cousin and the cousin threatened him or something of the sort. Judge Shelton said, also, that your father's brother had been a great student of the Bible. When I heard that, those three threatening notes we had received at the field began to fit into the picture. Two of them were quotations from the Bible. I thought that perhaps this cousin of Cy's had inherited his father's taste for the Bible—particularly when I studied them again and read the one from the Book of Job that read, 'He hath fenced up my way that I cannot pass—' That sounded like something that would appeal to a Texan under the circumstances.

"So, I told Shorty to go back to the place where the fight occurred and make a landing and investigate Cy's Snorter. I also got in touch with Red and told him to join Shorty just in case some of those gray ships appeared again. The



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doctor hadn't found anything about Cy to make him suspicious but he gave him a sedative to make him sleep for a while. But not too long. I wanted to see what he would do next. I had him write a note to you saying he was all right. I told him I would send it over to you by Sandy so you would have it early this morning. But I didn't. Instead, I compared it with the handwriting on those threatening letters. From what I could tell the writing was the same. I wasn't sure. But I was almost sure that it was not Cy's handwriting. Remember, this man who was in the infirmary looked like Cy and if he wasn't Cy he was so badly bruised that no one could tell the difference until he was well.

"I was almost positive that it was Cy's cousin. But, as I said before, I wasn't sure. I sat down and tried to think out what he would do if he wasn't Cy. That's why I told Red to be sure young Richards let no one in your room but a doctor or nurse.

"Then, I sat up, or tried to, waiting to see what he would do. I fell asleep for a bit but I awoke in time to see the man I had brought back from Texas steal out of the infirmary early this morning and climb into a Snorter. I followed him in another Snorter. While

I was trying to get Shorty on the radio to find out what he had learned about Cy's Snorter I was attacked by one of my own ships."

"And still you weren't sure," Nan said.

"No," Bill said. "I wasn't sure. But I knew that if it was Cy in that ship he had gone crazy and might better be dead than as he was. When he brought the fight to me—I shot him down."

"Oh!" Nan gasped. "Oh! He's dead?"

"He is dead," Bill said. "But it wasn't Cy. I found that out a few minutes later when I made contact with Shorty. He and Red had got in where Cy's Snorter crashed yesterday morning. Cy was still in it. He died as he would have liked to die—fighting."

"Then," Nan said, and she was weeping softly, "the man you shot down murdered Cy—his cousin."

"That is right," Bill said. "He first intended to kill Cy and claim part of your father's estate. He sent those first letters to me to make us think that it was some one who had a grudge against me who would even the grudge by killing one of us. That one would be Cy.

"Then he decided that he would kill both of you and hide Cy's death and step into Cy's place. According to Judge Shelton they looked enough alike to have made the deception. The whole thing would have fitted perfectly. I would have picked him up at the place Cy had been shot down. Later he would have gone back there to hide Cy's body.

"You were the one who upset the apple cart for him," Bill went on. "When he failed to kill you night before last he knew he had to go back and finish the job. That was where he was going this morning. Then he would have resigned his job with me to impersonate Cy and get your father's money to pay the men he had working for him."

"Why did his men attack you yesterday?" Ted Richards asked.

"To make the whole thing look as though it was an attack on me rather than on Cy. Nan's death at the same time would just have been a coincidence because, seemingly, Cy would still be alive. He didn't realize that I had already become suspicious of him until I followed him this morning. By then he was desperate and he thought with me out of the way he could go on and finish his hellish task."



"I'm glad you killed him!" Nan said vehemently.

"So am I," Bill said. "Now you won't have to be afraid."

"Poor Cy," Nan said and the tears welled from her eyes.

"Yes," Bill said grimly. "Poor Cy."

He is the second of my men to have died gloriously. I'm going down there now to join Shorty and Red. I'll let you know about things. You'll want Cy buried beside his father?"

"Yes," Nan said and she laid young Richards' hand against her wet cheek.

"You let us know and we'll be there together."

"Together," young Richards said.

And Bill knew as he went out the door that Nan would not grieve for her brother as he would grieve, because of her love for young Richards.

## Air Adventurers

(Continued from page 29)

columns and he has already ordered several articles through this medium. We have been wondering whether you other birds have noticed how our advertising columns have increased. That's always a real clue to a good magazine, you know. Of course, Doyle is a Bill Barnes fan, too. "There's nothing I like better than to sit down to a Bill Barnes story," he says. "They bring forth the action and experiments of today, and I feel the characters are the real heroes of modern aviation."

Now there's a swell way of putting it!

Hello, here's another of these fuel ideas. Lyle Lindbloom of Chicago, whose father is an automotive engineer and who holds several patents on the automobile engine, comes through with a letter in which he says that he believes that there is a chance somewhere for some one to devise a new and cheaper fuel for use in aircraft. Lyle's taking our Engineer's examination, too. Perhaps we'll get a hint of what he's seeking. There's no question but that he may have a real idea there.

Edward Byerly of New York City hands us a swell pat on the back for our interest in rocket ships and for publishing so many interesting articles on the subject. Every so often the idea seems to drop into the doldrums, and then all of a sudden it blazes up again, and we have a new angle. We

hope we can encourage some of our members to take up the idea. But we do want you to be careful, for it is a very touchy subject and we warn you not to play with it until you are perfectly familiar with all the angles and realize the danger of the chemicals you are working with. Edward got 92 on his paper.

Another 92 paper has been turned in by Harold Grathwohl of Southampton, New York. And if you think you read Air Trails, you should see Harold's condensation of the magazine. That lad reads it through and then backward just to make sure he hasn't missed anything. He found items in there even we were not acquainted with. But he sure goes for Air Trails Gallery and Air Progress. He even files copies of Air Progress in his high school library every month.

H. D. Brown of West Sunbury, Pennsylvania, brings up the old subject of articles with drawings to illustrate them. He particularly remembers our Modern Motors series and suggests that we continue it and show the workings of controllable-pitch props and vacuum flaps. Has any other member any more such suggestions? We want to give you fellows what you want, so speak up now.

William J. Karges, of Wheeling, West Virginia, has passed his Observer tests with a full report on an air show he attended at Scott Airport, Yorkville, Ohio. Clarence Chamberlin was there

with his small speed plane and, we presume, Clarence's Curtiss Condor which was taking up passengers. A parachute jumper went around with a hat and collected \$3.50 for his "death-defying" act, which should be a warning to all you birds who want to become parachute jumpers.

Robert H. Taylor—no, not the screen star—has clicked for a Photographer's award with a good picture of a U. S. Marine's Boeing F4B-4 taken at the Allegheny County Airport in Pittsburgh. He used a Kodak Six-20 with an f4.5. Compur shutter, 105mm. focal length at  $1/50$  of a second and got a pretty fair picture.

We must say, however, that most of the prints we are getting do not come up to former standards, and we look pretty carefully for those really suitable for reproduction. Most of you get your pictures badly out of focus, or stand too far off from the subject. Many get swell subjects, pictures we would be delighted to publish as interesting additions to our Air Trails Gallery. But they are usually out of focus or underexposed. Remember this, you photographers, next time you draw a bead on something hot, will you?

Bob Peifer, of Kansas City, has won his Craftsman award with a model which flew for 5 minutes 32 seconds. He has won contests staged by the Kansas City Y. M. C. A., the Metro Club, and several other junior organizations.

## The Nordmeer

(Continued from page 51)

Mark the outlines of the tail surfaces on sheet balsa, trim. Then sand the edges and surfaces until a streamline cross section is obtained. Pin and cement the rudders to the stabilizer ends. A small streamlined pylon block, visible on the plans, is prepared and cemented to the top of the fuselage at the indicated position. To it, when dry, is attached the entire tail unit.

Small, streamlined struts support the stabilizer.

### PAINTING THE MODEL

Give the entire model a coat of white shellac, clear dope or varnish to fill the pores. Sand lightly as possible with the finest paper available. If controls are to be indicated, score the outlines lightly before painting. The aluminum top coat is then applied. For those who are more meticulous, a number of coats may be applied, sanding between each. Trimming is done in black. Windows may be simulated by white paint outlined in black.

Propellers are made from scraps and mounted on pins, free to turn. Other details, such as the radio mast and aerial, are then added to complete the model.

### BILL OF MATERIALS

1 $1\frac{1}{4}$ sq.x12"	soft balsa block
2 $1\frac{1}{4}$ sq.x8"	" " blocks
4 $\frac{5}{8}$ x1x3"	" " "
2 $\frac{3}{4}$ sq.x2 $\frac{1}{4}$ "	" " "
1 $\frac{3}{4}$ x3x18"	" " "
1 $\frac{3}{16}$ x2x12"	" " sheet

Cement, dopes or varnishes, and paints as specified in the directions.

In The Next Issue Watch For A Feature By

CLYDE PANGBORN

**"EUROPE PREENS HER WINGS"**

EUROPEAN AVIATION REVIEWED



# 54 MINUTES!

(Continued from page 44)

The rudder is cemented on the top-center line of the elevator and is NOT set for any turn. The camber in the rib shape takes care of the turn to the right. In the sketch of the rudder, the wire tail skid is shown extending down between the junction of the fuselage and rudder to 2" below the bottom of the rudder.

## PROPELLER

The block size is  $1\frac{1}{2} \times 2 \times 16$ " medium balsa. The excess wood is cut away as shown in the drawing. The hub of the blank should be  $\frac{3}{8}$ ". Cut the propeller blades to taper in thickness from  $\frac{1}{4}$ " at the hub to  $\frac{1}{16}$ " at the tips. Each blade is given  $\frac{3}{16}$ " camber in the rear face. The propeller is sanded smooth and highly doped. Use a half dozen coats of dope with intermittent sandings. The propeller shaft is bent from  $\frac{1}{16}$ " wire.

## POWER

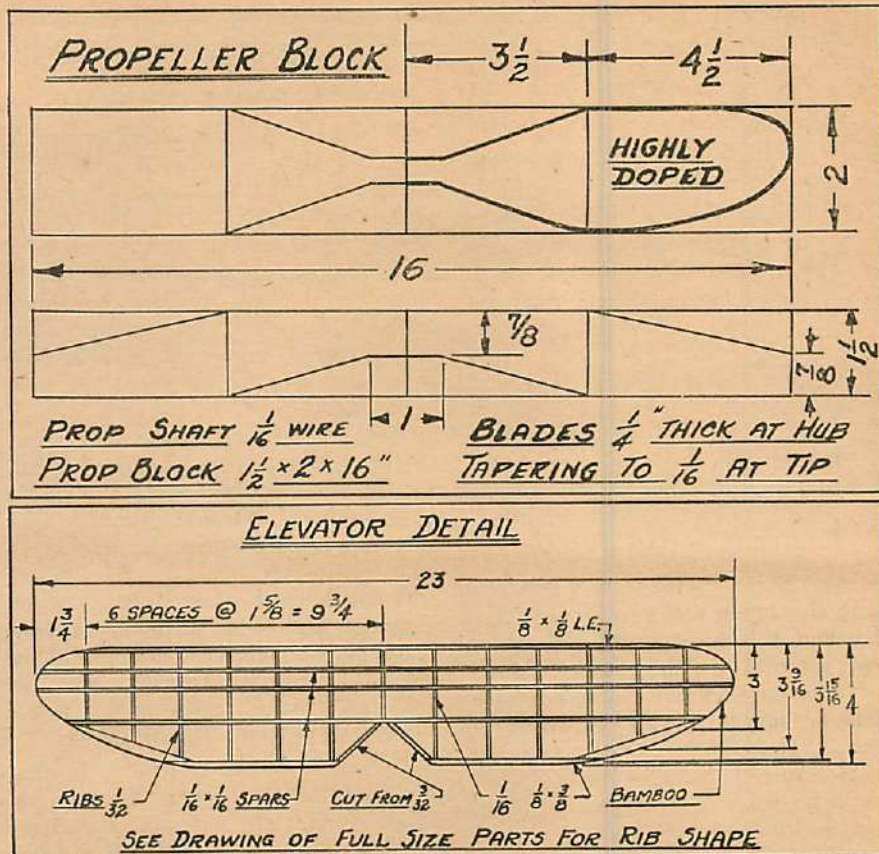
Use 24 strands of Banko's  $\frac{1}{8}$ " flat crown. The motor length is 40". This type of rubber is the result of experiments conducted by the Cleveland modelers. They claim its superiority on the following points—long life which enables the contestant to adjust his model with the same motor to be used in the contest; less affected by heat and sunlight; more power and strength with greater winding capacity.

## COVERING

Ordinary tissue is used. After covering it is first water-doped and then treated with four coats of thin dope on wing and tail—with several coats of heavier dope on the fuselage.

## FLYING

When adjusting a contest model under full turns, Korda usually flies after 6 o'clock in the evening when the air is cool and calm. Even at this time he is annoyed by out-of-sight flights and has lost four models during these evening sessions. One model was launched



at 7:15 and was lost out of sight after 14 minutes.

Korda treats his rubber motor carefully. And this is probably the most important item in a contest model. He recommends the following procedure—break in the rubber motor the night before the contest by first giving it a few hundred turns and gradually increasing the number of turns in subsequent windings until it is nearly fully wound. After it is well broken in, lubricate it slightly and put it away for the contest. (Any of the common rubber lubricants are satisfactory.) If you don't take these precautions to break in your motor, it will not be soft and pliable.

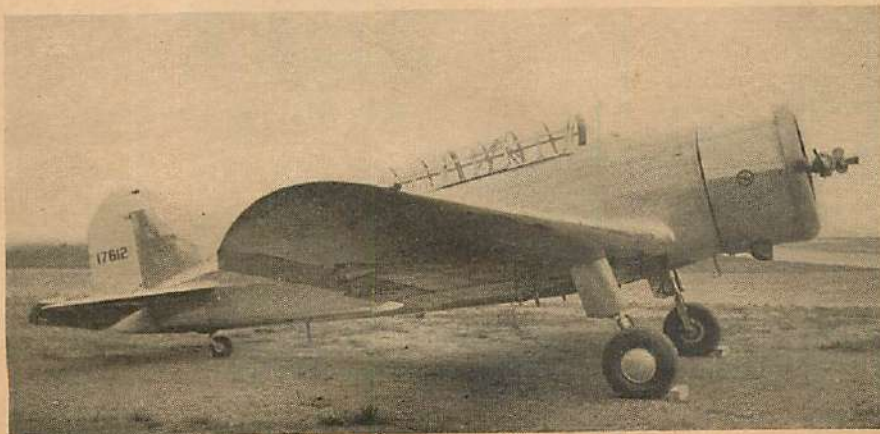
## WINDING

Before winding for an official flight, first give the rubber about half of its

capacity of turns and allow it to unwind. Repeat this operation several times to loosen up the rubber. Now the rubber is ready for capacity winding. Stretch it about three or four feet from the nose of the fuselage and give it about 200 or 250 turns. Keep winding and move back slowly to about seven or eight feet. Stay at this position until you've added about 450 turns. About this time the rubber will begin to tighten, then come in slowly reaching the model when you have about 900 or 950 turns. Just before launching the model, give it a few turns by hand to tighten up the rubber and give it a little extra power.

Before lubricating rubber be sure to shake off all the powder. Keep the lubricated rubber free of grit and store it in a cool place away from sunlight.

The model has a rather small propeller, which gives it a quick get-away on the take-off. The climb is slow and against the torque (to the right). Because of the lifting tail, the model assumes a tail-high attitude during the glide, which gives the impression of a steep glide angle. However, the actual sinking speed of the model is slow. This tail-high glide cuts down frontal resistance by putting the fuselage in line with the glide path. When adjusting the nose block for offset thrust, use book matches inserted between the nose plug and the fuselage. They can be conveniently split to any thickness. The model weighed  $7\frac{3}{4}$  ounces, a figure well above the necessary weight of  $6\frac{1}{4}$  ounces.



Spartan Zeus Export Attack Fighter.



## CURTISS SBC-3

(Continued from page 46)

with fine paper until glossy. Cut the wheel wells in, but leave the small flaps intact for the present.

Separate the blocks and hollow them out, paper thin at the rear, gradually increasing the thickness to  $\frac{1}{8}$ " at A. Leave a strengthening thickness around the inclosure rim and about  $\frac{3}{32}$ " on the portion of the wheel wells that remain. Cut out the small flaps that remain under the wheel wells and set them aside to attach to the landing gear later. Fit station C with half formers, install rear hook attachment, and cement the sides back together. Then fit a partial former at B.

### COWL

Carve the cowl from a  $1\frac{9}{16} \times 2\frac{1}{8} \times 2\frac{5}{16}$ " medium block and hollow a  $1\frac{1}{2}$ " diameter hole as shown. Carve 7 bas-relief cylinders on a  $\frac{1}{4}$ " sheet disk to fit the cowl. Cut the  $\frac{3}{8}$ " hole in the center to receive the nose plug (crankcase), and cement it in the cowl  $\frac{3}{8}$ " from the front. Impress the joint and louvre markings with a pencil. Sand and dope until a high gloss is obtained.

### WINGS

Assemble the wing parts on the drawings with waxed paper between. Line all the parts up with pins before cementing. Leave the ailerons until the top wing has set and then cut through the ribs and fit the spars while the wing is still fastened down. Leave extensions of the leading and trailing edges on the lower wing frames to be fitted to the fuselage.

### TAIL SURFACES

The vertical and horizontal tail frames are assembled of plain blank stock described on the drawing. The rear of each rib piece is notched to center the trailing edge and the leading edge is blocked up to center.

### PROPELLERS

Bevel three  $\frac{7}{8} \times 1\frac{1}{4} \times 3$ " as shown and prime the bevels with a coat of cement. When partly dry, cement them together to form the three-blade blank. From there, blank, carve, sand and polish, and balance in the conventional manner. Attach to nose plug with shaft

and washers. The scale prop may be made in a similar manner.

### LANDING GEAR

On the left side of the center line of the front view, a workable scale landing-gear assembly is shown. The parts shown are of aluminum (tubing and sheet). Though the working arrangement is shown, an operating mechanism must be devised by the individual builder. The shock absorber must compress to allow retraction, so it is suggested that a spring be inclosed to hold it down.

On the right side of the center line a rolled-paper, incased-wire landing gear is shown. The simple wire parts are bound and cemented together and then wrapped with paper to appear as scale.

Make the tail wheel fork of sheet aluminum and fasten it to the fuselage with a pin through the aluminum tubing and sheet balsa bracket.

### COMPLETING THE MODEL

The celluloid on the inclosure is supported at the front by a #8 m.w. or bamboo arch. The separations are narrow paper strips applied with thin dope.

To mount the top wing, cut a support template from  $\frac{1}{8}$ " sheet to fit the space between the fuselage and wing on the drawing. Pin this support to the fuselage and the top wing to the support. Fit the center-section struts and cement them to the fuselage only. When dry, remove the wing and start covering all surfaces. The tail surface must be trimmed and sanded to a streamline shape. Cover the vertical with red tissue and the remainder of the frames with aluminum or white tissue, except for the top of the top wing, which is yellow. Cut the tissue away from the wood where the struts attach and cement the top wing onto the C. S. struts. Cut the wing struts from  $\frac{3}{32}$ " sheet. When the top wing has set, attach the lower wings and struts with pins and when they are properly lined, add the cement. Cut a  $\frac{1}{16}$ " slot in the top of the fuselage at the rear for the horizontal tail spar to rest in, cement it in place, then the vertical tail. Fillet the tail assembly to the fuselage with narrow strips of tissue. Cement the cowl on and then spray the tissue covering with water. When dry, apply one coat of thinned dope.

The rigging wires are best simulated with fine bamboo strips. They are

more easily installed than thread and are not apt to tear out other parts of the model on impact. Add the tip lights, wing light, deck hook, and other details. Then dope the model with aluminum dope, except for the parts designated otherwise. A suggested formula for flying-model dope is to mix  $\frac{1}{4}$  part dope to  $\frac{1}{2}$  part clear lacquer to  $\frac{1}{4}$  part acetone and mix enough powder to make the proper consistency of liquid. Use red lacquer thinned with  $\frac{1}{4}$  thinned dope to coat the vertical tail, band on fuselage, and portion of cowl. Paint the tires and motor black and add natural bamboo pushrods.

Clasp the special "S" hook to two loops (4 strands) of  $\frac{1}{8}$ " flat rubber, with 1" of slack. Hold the model nose up and dangle the hook end of the motor down into the rear of the fuselage until the hook engages with the rear-hook attachment.

### FLYING

Make the initial glides and flights in tall grass until the proper adjustments have been made, or gradually increase the number of motor turns in successive r.o.g. flights. The original model weighs but  $1\frac{1}{4}$  oz. and flies several hundred feet consistently.

### MATERIAL LIST

#### Blocks

2  $1\frac{1}{8} \times 3 \times 11$ " 1  $1\frac{9}{16} \times 2\frac{1}{8} \times 2\frac{5}{16}$ "  
3  $\frac{7}{8} \times 1\frac{1}{4} \times 3$ "

#### Sheet

2  $\frac{1}{32} \times 2 \times 18$ " 1  $\frac{3}{32} \times 2 \times 4$ "  
1  $\frac{1}{16} \times 2 \times 18$ " 1  $\frac{1}{4} \times 2 \times 2$ "

#### Strips

1  $\frac{1}{16}$  sq. x 8" 1  $\frac{1}{16} \times \frac{3}{16} \times 18$ "  
1  $\frac{1}{16} \times \frac{1}{8} \times 18$ " 1  $\frac{1}{8}$  sq. x 10"  
2  $\frac{3}{32}$  sq. x 18"

#### Miscellaneous

1 oz. cement  
1 oz. clear dope  
 $\frac{1}{2}$  oz. thinner  
1 dram aluminum powder  
1 sheet aluminum tissue  
 $\frac{1}{2}$  sheet red tissue  
 $\frac{1}{2}$  sheet yellow tissue  
4 U. S. insignia ( $1\frac{3}{4}$ ")  
2 strips bamboo  
2 ft. #12 music wire  
2 drams red lacquer  
2x $\frac{1}{16}$ " aluminum tube  
3x4" sheet celluloid  
6  $\frac{1}{8}$ " washers

NEXT MONTH

# A PICTORIAL SCOOP!

WATCH FOR IT



## HOT STUFF

(Continued from page 16)

but came out almost immediately. He muttered something under his breath to the other pilots, whereupon all of them went to Hot Stuff's room.

"You kids've been down here a long time," he said, when all had made themselves comfortable. "You've saved yourselves some dough and going back home don't mean a damn thing to you other than looking for and probably finding another job. With me it's different. I was broke when I landed and now in less than a day I find I'm due for home on the next boat. Hired, tired and fired in less than twenty-four hours. And that's not the worst of it. I can't get another job for a year, and no one this side of heaven could convince my girl that I didn't start this revolution. Now I'm not going to lose my job without putting up some kind of a squawk. I've got an idea. Does any one know what ship I was going to fly?"

Scholer, number three pilot, spoke up. "I think it's the twin-engined, converted Bach."

"How much dust does she carry in her hoppers?"

Harrison, the technical man, explained that with only fifty gallons of gas in the tanks, the Bach would carry four thousand pounds.

"Swell! Now listen with all your ears, and for the luva Mike, don't let O'Rourke or Hart even suspect anything."

At the table next morning, O'Rourke delayed the service with the remark that they would have a guest for breakfast.

"Who?" asked Hartley.

"Captain Perez of th' Federals is honorin' us with his prinsine, an' also requestin' us to throw th' blasted insurrectos off th' finca. I wish we could without killin' some of them."

Captain Perez entered and remained standing stiffly by the door until O'Rourke brought him to the table and introduced him. He was very military and very condescending. O'Rourke bowed him grandly to a seat and clapped his hands for breakfast to be brought in. Before the *mozos* entered, Captain Perez inquired in halting and butchered English, "You 'ave tell these gentlemen wot ees eet I 'ave tell you, Señor O'Rourke?"

"Not yet, Captain, but I will now." O'Rourke looked at the faces raised to his in eager expectancy.

"The Captain informs me that if we don't have the insurrectos off the finca by noon, he is authorized to declare the property confiscated. He states we are harborin' an' feedin' inimy troops. I

tried to explain to the Captain that we have no authority to—"

"But, señor," interrupted Perez, "ees eet not that you 'ave be'ind you all those *Estados Unidos*?"

"That's what I told Cardenas, Captain. He said that when all those *Estados Unidos* came down here he'd get out an' not before." He added sarcastically, "Bein' that the *Estados Unidos* is busy on Thursdays, I'm afraid they can't get down here before noon."

Captain Perez shrugged. "Ees too bad."

After breakfast Perez departed, skirting the finca in order to avoid the insurrectos.

O'Rourke and Hartley went to the company office for a conference. O'Rourke had sent Fields down to look over the insurrectos situation and when Fields returned at ten o'clock he reported that Cardenas had his men deployed in a single skirmish line down a long row of banana trees. There was some desultory firing, but no damage had been done. The Federal troops apparently were afraid to venture in among the trees in view of Cardenas' superior position.

At ten-thirty, Hot Stuff and Parsons left the dining-room and wandered down to the hangars. Ten minutes later the irregular staccato popping of motors brought Hartley out of the office on the run.

"What's going on down at the hangars?" he demanded of a couple of nearby pilots.

Scholer thought vaguely that Hot Stuff was testing out the engines on the ship assigned to him.

"What for? He'll never use it. Go down there and tell him to—"

Before he could finish, the motors settled into a steady note. He looked toward the hangars and swore. The ship was lumbering off the apron toward the edge of the field. Hartley jumped into the office, grabbed the wall-phone and rang wildly. But before he could raise any one at the hangars the ship roared down the field, staggered off the ground and just cleared the first row of banana trees. It flew down the rows of trees and climbed gently, then made a wide circle at the end and started back.

By this time O'Rourke, Fields and the entire finca personnel were standing out in the open watching the plane swoop down and just barely skimming the tops of the trees. Suddenly from beneath the tail streamed a thick cloud of dust. It descended in layers. So closely was it laid on the tops of the trees that it barely spread over two rows. Before the end of the row was reached, the dust was valved and the ship continued on to the landing field. Instead of landing, however, it circled and started back. Again the heavy

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10" Balsa	Silver, ea. 5c	PROP. SHAFTS	2" .....for 1c
1/16x1/16 100, 5c	Superfine, wh. 5c	PAUL-O-WINA	5" 10c. Add 5c per
1/16x3/16 35 for 5c	WHEELS per pr.	in. up to 10 in.	
1/16x3/16 18, 5c	Brch Balsa Celu	Machine Props.	5 in. ....4c
1/16x3/16 15 for 5c	1/2" .01 .03	(Add 1c per in.	up to 16 in.)
1/16x3/16 5 for 5c	3/8x3/8 30, 5c		
3/8x3/8 30, 5c	1/2" .03 .05 .07		
3/8x3/8 30 for 5c	1/2" .04 .08 .10		
3/8x3/8 12 for 5c	1/2" .07 .10 .16		
3/8x3/8 10 for 5c	1/2" .15 .30		
3/16x3/16 8, 5c	18" Balsa Planks		
3/16x3/16 6 for 5c	1x1 .....for 4c		
3/16x3/16 3 for 5c	1x2 .....for 8c		
3/16x3/16 2 for 5c	2x2 .....for 15c		
3/16x3/16 1 for 5c	2x3 .....for 23c		
3/16x3/16 1 for 5c	2x6 .....for 35c		
1/32x2 5 for 5c	PROPELLER		
1/32x2 4 for 5c	BLOCKS		
1/32x2 4 for 5c	1/2" x 1/2" 5 8—5c		
1/32x2 2 for 5c	1/2" x 1/2" 6 5—5c		
1/32x2 2 for 5c	1/2" x 1/2" 8 5—5c		
1/32x2 1 for 5c	1/2" x 1/2" 8 3—5c		
3" sheets or 35"	1/2" x 1/2" 10 2—5c		
lengths, double	1/2" x 1/2" 12 3c ea.		
above prices; add	1 x 1 1/2 x 1 1/2 6c ea.		
10c packing	1 x 1 1/2 x 1 1/2 7c ea.		
charge for 35"	DOPE Clear		
lengths.	1 oz. 5c 1/2 pt. 25c		
NOSE BLOCKS	2 oz. 5c 1/2 pt. 10c		
1x2x1 .....1c	Colored		
2x2x1 .....2c	1 oz. 5c 1/2 pt. 30c		
2x2 1/2 x 1 .....3c	2 oz. ....10c		
3x3x1 .....3c	11 in. BAMBOO		
3x3x1 .....3c	1/16x3/16 6 for 5c		
3x3x1 .....3c	Shredded 40—50		
3x3x1 .....3c	Shredded 40—50		
Alum. Tubing	ALUM. LEAF		
1/16", 3/16",	2 Sheets for 1c		
3/8", .....10c ft.	WIRE		
Rubber Motors	6 ft. ....3c		
1/16 sq. 20 ft. 5c	THINNER		
3/4 flat 20 ft. 5c	Best, oz. ....5c		
Sheet Aluminum	1/32, 1/16		
.003, .001, 1 for 10c	3 ft. 1c		
TISSUE, AA	1 1/4 in. ....3 ft. 2c		
All col., doz. 10c	2 for .....11c		
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cloud of dust streamed out and down, over the same row of trees. Then the ship moved erratically over the plantation, emitting an occasional burst of dust. As the plane got lighter the movements were quick, more definite. Finally, with a last burst, it headed straight for the field.

On the ground under the banana trees was a scene difficult to depict. Certainly no military strategist could conceive of such surrender. Insurrectos were apparently going into convulsions, rolling about on the ground, tearing off their clothes, throwing aside their guns and ammunition bandoleers. Fifty yards away, the Federal forces stood in dumfounded amazement and awe at this screaming, scrambling, whirling-dervish effect on the insurrectos. Those who were not going into nose dives and flat spins, were streaking for the jungle.

At the hangar, an irate manager and chief pilot awaited Hot Stuff's plane when it taxied up. Hot Stuff stuck his head out of the cockpit, sneezed twice and started to speak. Before his mouth had opened both O'Rourke and Hartley

went into action. For two minutes Hot Stuff heard things about himself he knew couldn't possibly be true. When the tirade had died out through lack of breath and further cuss words, Hot Stuff waved both hands toward the plantation.

"Why don't you tell that over-stuffed captain to come in and pick up his insurrectos? They're helpless now. Swell time for him to grab himself another medal."

"What do ye mean?" O'Rourke roared.

"I mean I just dropped two tons of cayenne pepper on that gang, and I kinda think they've given up the idea of war for the time being."

O'Rourke roared again, but this time in spasms of laughter. Between gasps he sent Fields on the run to Captain Perez. Hot Stuff was helped out of the cockpit. O'Rourke gave him a mighty slap on the back.

"If yer name-niver was Hot Stuff, it is now! Wait till I cable this to New York! Lad, yer job on this *finca* is good as long as O'Rourke is manager!"

Fields returned with a beaming Perez.

"Señor O'Rourke," gasped the captain, between sneezes, "my glorious troops 'ave make a other gran' victory. They 'ave receive mooch 'elp from this pepper piloto. I am tell my presidente you 'ave 'elp make estop these insurrectos. I am salud to you!" Then he departed in sneezing grandeur.

President Oliver of Consolidated Fruit was much elated by the following cable:

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O'ROURKE.

Hot Stuff is still down there and doing a fine job. His year is almost up. He likes his work and is happy except for one thing. The natives refer to him as "Señor Ca-choo."

## DuPont Winner

(Continued from page 40)

center longerons. If you intend to do much flying with the cowl in position, it will be necessary to solder control extensions to the air, gas, and spark controls. These controls have been shown in the fuselage drawing. You can regulate the spark lever control by cementing a "saw-tooth" piece of aluminum to the top of the cowl to maintain any desired spark setting.

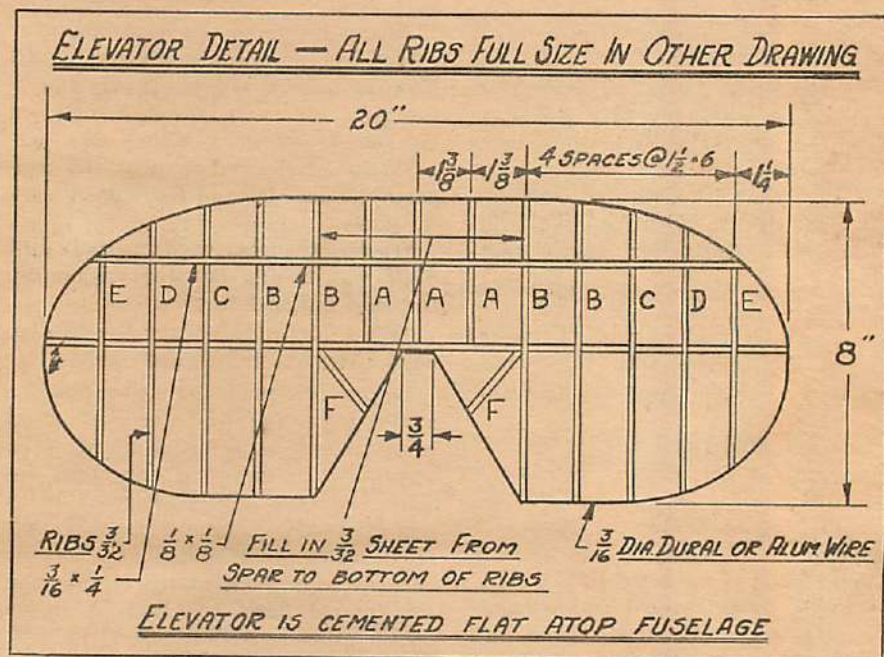
Flying can be done without the cowl. However, be sure the cowl is in position when you exhibit your model on the ground, as it improves the appearance of the model.

### LANDING GEAR

$\frac{1}{8}$ " diameter wire is used throughout. It is bent in two U-shaped pieces. The bottom of the U is cemented and bound to the bottom of the fuselage. The ends of the rear U-piece are looped to fit around the ends of the front U. All joints are soldered and wrapped with soft wire. A spreader bar is attached to the front U-piece to prevent the landing gear from spreading apart. The sides of the landing gear may be covered with silk for better appearance. However, the silk is likely to be split on a rough landing.

### WING

The wing is made in two pieces. Construction and covering can be completed before cementing the two halves together. When joining, cement the two



end ribs together and add a V-shaped piece of  $\frac{1}{8} \times \frac{1}{2}$ " balsa to reinforce the joint.  $\frac{3}{8}$ " balsa is cemented to the bottom of the wing to fit into the top of the fuselage.

Wing struts are cut to a streamlined shape from spruce  $\frac{1}{4} \times \frac{1}{2}$ ". The method of attaching the struts to the wing and to the fuselage has been clearly illustrated in the drawing.

### WING ATTACHMENT

The wing rests on top the fuselage on formers F4 and F5. Rubber bands are used to secure the wing. The rubber passes over top of the wing and

around short lengths of  $\frac{3}{16}$ " diameter tubing which have been cemented to the fuselage.

### ELEVATOR AND RUDDER

Rib shapes for both these surfaces are included in the drawing. Their positions in the elevator and rudder can be identified from the detail drawings. In the drawing of the rudder, notice how rib "A" has been cut away to fit over the center rib of the elevator. The elevator itself is cemented firmly to the top of the center fuselage longerons. Set it at zero incidence. Directly forward of the elevator is located the rudder ad-



justment device. A machine screw fits through rudder rib "A." This screw is set in a piece of aluminum. You can adjust the rudder by merely turning the screw which moves the rudder in either direction. Rib "A" is not cemented to the elevator or fuselage; the adjustment device is the only attachment. However, the bottom of the rudder at ribs I and J is secured to the rear of the fuselage with pieces of  $\frac{3}{32}$ " diameter dural tube. These tubes are cemented to the ribs I and J, pass through holes in the rudder post, and are inserted into the rear end of the fuselage and secured with cement. The rudder is braced to the elevator with fine wire. The elevator is, in turn, strengthened by two  $\frac{3}{16} \times \frac{3}{8}$ " spruce struts cut to a streamline shape.

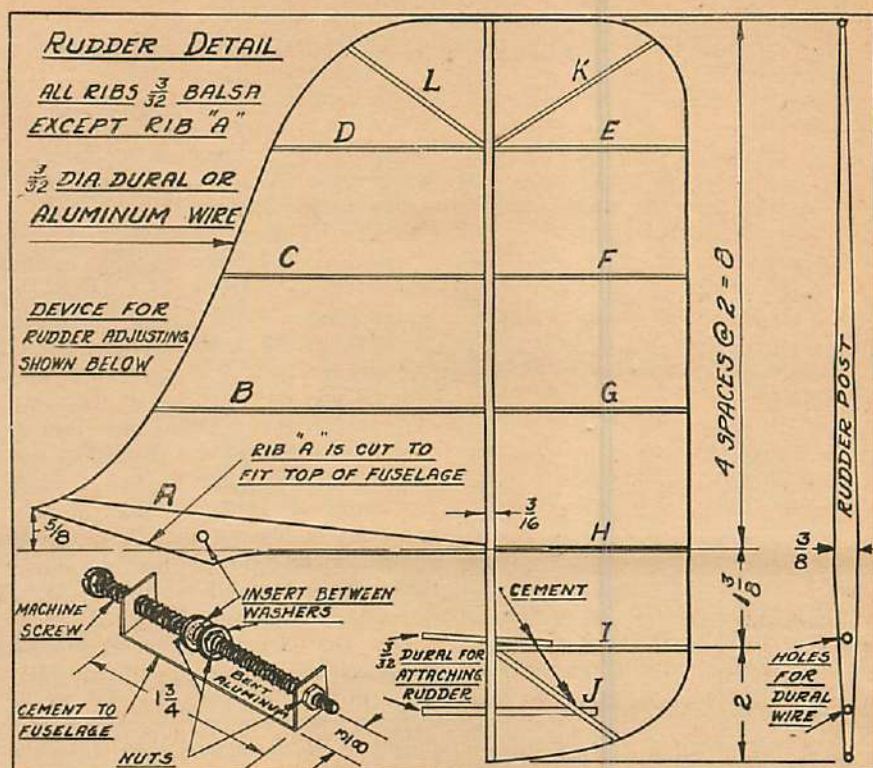
### COVERING

The model is covered with silk. Treat the silk with two coats of Berryloid dope. The color scheme of the model is yellow and black.

### BATTERIES AND IGNITION SYSTEM

The two batteries are carried in a fiber flashlight case. Take out the lens of the flashlight and insert a  $\frac{1}{8}$ " flat balsa disk of the same size. Punch a hole in the center for the positive wire. The positive battery terminal is made by removing the glass from an old flashlight bulb. Take care not to break the porcelain base. Drill a hole through the bulb and insert the wire, securing with solder. The negative wire is soldered to the switch, which is on the outside casing of the flashlight. The rear cap of the flashlight, with the spring for keeping the batteries in place, is left intact.

The battery case is mounted on a balsa "sled." Cut from  $\frac{1}{8}$ " flat. The sled rests atop two skids cemented to the floor of the fuselage. A balsa guide is cemented to the bottom of the sled to fit between the two guides. The sled



is secured to the guides with a hose clamp.

### FLYING

For ordinary flying, the Brown Junior should be set at about  $\frac{1}{3}$  full power. Full power or even half power will cause the model to stall, unless zero incidence is used in the wing. When carrying payload, increase the motor r.p.m. as the weight is added. Dillon has carried a maximum of  $2\frac{1}{4}$  pounds payload. On this flight he used  $\frac{1}{4}$ " incidence block under the leading edge of the wing. With a 25 percent payload or about 1 pound, he recommends using  $\frac{2}{3}$  power and a  $\frac{1}{8}$ " block under the leading edge of the wing.

Dillon has already developed a new type of model for the limited motor-run

events. He calls the model Mr. "X." The flights which it has turned in during the past six months indicate that it is a promising design, fully capable of winning the payload contest this year. To stimulate competition along these lines, Dillon has generously offered to put the duPont Trophy back into competition. He won permanent possession of it last July. Nevertheless, if contest officials accept his offer, payload fliers will have another chance to win the attractive duPont award. It will be difficult to beat Dillon in a payload or any other type of model contest. His methodical flying—day in and day out—brings out a model's weak points. He corrects these shortcomings and the final version is a dependable, good-flying model that never fails to deliver.

## AIR PROGRESS

(Continued from page 4)

They will be used in the new Douglas DC-3 Mainliners. They have a maximum output of 1,200 h.p.

The new French Marcel Bloch 220 has started scheduled flights between France and England. It is a low-winged cantilever monoplane powered with two Gnome-Rhone K-14 supercharged engines of 870 h.p. each. It has a top speed of 220 and carries 18 passengers.

The technical section of the Dutch K.L.M. is experimenting with a new zinc-spraying device which they claim will render the interiors of their Douglas D.C.2s fireproof.

### RECORDS AND REWARDS

Miss Jean Batten, noted New Zealand

girl pilot, has again broken the Australia-to-England record by flying from Darwin to Lympne in 5 days, 18 hours with a British Percival Gull powered with a Gypsy engine. This is, of course, the solo record between the two points.

A. E. Clouston, a New Zealander, and Mrs. Betty Kirby-Green broke the London-to-Capetown mark on November 16th with a flight of 45 hours and 5 minutes. They clipped 33 hours and 24 minutes from the previous mark set by Amy Johnson in 1936. Clouston and Mrs. Kirby-Green used the same De Havilland Comet, flown by Scott and Black in the London-to-Australia race several years ago.

B. J. Bouchier of Toronto was awarded the Webster Trophy, the most important Canadian award, at the an-

nual light plane meeting at Hamilton, Ontario. Bouchier is a member of the 10th Squadron of the Canadian Air Force Reserve. Second prize went to Gordon R. McGregor of the Kingston Flying Club who had been awarded the Webster Trophy in the two previous years.

A number of meetings of tribute to the memory of Amelia Earhart were held in New York, Los Angeles, Miami, and Portland, Oregon, by fellow aviators on November 21st.

### AIR FORCES

The Secretary of War has announced that an order for 29 Model A-17A attack planes has been placed with the Douglas Co. These planes, of course, are better known as Northrops. Information indicates that they cruise at 220



m.p.h. and carry four .30-caliber machine guns. In addition, 95 basic-trainer planes have been ordered from the North American Aviation Co. of Inglewood, California.

Recent tests of the new Boeing B-17 bombers give some idea of their actual performance. Loaded with fourteen 300-lb. bombs, they maintained speeds of 200 miles per hour for 4 hours and all ships of the Second Bombardment Group remained in the air under tactical conditions for more than 12 hours. No other plane in the service can offer this time range.

The Danish army air service aircraft factory recently started work on a big batch of Fokker D.21s, single-seater fighters which are said to do 276 m.p.h. The Fokker concern in Holland is also building a large number of these planes for the Dutch government.

The Seversky Aircraft Corporation is now offering what is known as a Convoy-Fighter, which has been getting considerable publicity abroad. We pre-

sume the high-performance two-seater is something of a cross between an attack ship and a light bomber. It is to be powered with an engine in the 400-500 h.p. category and obviously is being built for impecunious nations who desire mounts that fit several categories. This ship appears to good advantage on this month's cover.

The French Morane factory is starting work on eleven MS-405 single-seater fighters employing the Hispano-Suiza "cannon" motor. These will be the first batch of a large number being ordered by the French Air Ministry.

A new German Arado, described as a semicantilever biplane, twin-float seaplane has been built for the German Air Force. It is stressed for catapulting, has folding wings, can carry bombs, a torpedo or special smoke-screen apparatus and will be capable of a top speed of 196 m.p.h.

The new German Dornier Do.17, medium bomber powered with two Mercedes inverted Vee-12s, is said to be

faster than the British Blenheim bomber which previously had been claiming the world's speed mark in that class.

The Bell twin-engined fighter has been put through its initial test flights and according to the company officials has maintained its estimated performance figures. Few know, however, that the "cannons" shown in the engine nacelles were dummies. We understand that the type gun to be installed has not been decided upon.

Colonel E. S. Gorrell, president of the Air Transport Association, has stated that should war come to the United States, the army and navy would find a powerful supplemental air force in the country's commercial air lines. A survey has disclosed that commercial air lines operate 380 transport ships and employ 1,233 pilots and 390 hostesses. A majority of the pilots hold military or naval reserve commissions and the hostesses, who are registered nurses, would furnish a Red Cross staff.

## THE SOLUTION

(Continued from page 59)

strip of  $\frac{1}{32}$ " sq. stock around the former used for the tail, and insert the ribs. Then the tail may be covered.

### PROPELLER

The propeller may be either carved from a solid block or else a semicarved propeller may be finished. If you prefer to finish the semicarved propeller, use one of 14" diameter and a pitch-diameter ratio of 1.4. If you carve a block, one of the following dimensions,  $14 \times \frac{7}{8} \times 1\frac{3}{4}$ ", will suffice. The diagonals should, of course, be drawn on the broad faces. Cut down to the diagonals,

smoothen the faces, and then carve the block. Complete the concave sides first and finish them with varying degrees of sandpaper from #00 to #10-0. Then carve the convex sides. Make a template of the blade shape and transfer it to the blades. Finish the edges and then cement the shaft in place.

### ASSEMBLY AND FLYING

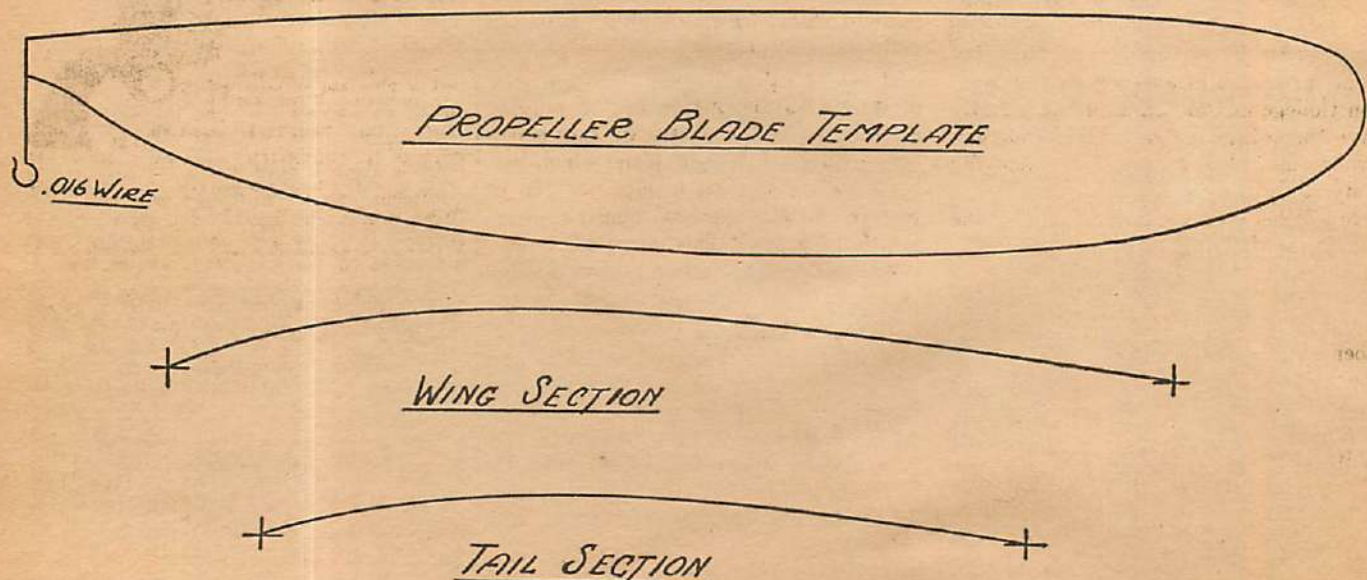
Cement the tail and rudder to the boom and insert the shaft of the propeller in the thrust bearing of the front plug. Put a loop of  $\frac{3}{32}$ " brown rubber, 17" long, on the shaft of the propeller and allow the other end to drop through the fuselage in order to attach it to the rear hook of the boom. Clip the wing on the fuselage and glide the model. If

the model stalls, then move the wing back. If it dives, the opposite treatment is in order. Repeat this treatment until the proper glide is obtained. The model may now be wound for its initial test flight. Four hundred turns on the rubber is sufficient. The model should turn in circles of about forty feet in diameter and maintain its altitude for at least two complete circles. On succeeding test flights the number of turns should be increased to capacity.

### WEIGHTS

Wing .....	.020
Tail, rudder, and boom.....	.010
Fuselage and landing gear.....	.031
Propeller and plug.....	.018

### PROPELLER BLADE TEMPLATE





# LIGHT PLANES

(Continued from page 9)

## INTERCOLLEGIATE FLYING CLUB

It was with considerable satisfaction that we have learned that light plane



The Arup Experimental.

flying is fast becoming a major sport in many of our colleges. So quietly and so efficiently has the National Intercollegiate Flying Club grown that few outside the inner circle realize that there are more than forty chapters—or flights—scattered through our colleges and universities.

From what we can learn there are flying clubs actually flying now at Har-



Funk Brothers, 60 h.p. Ford.

vard, Dartmouth, University of Pennsylvania, University of Minnesota, Detroit University, Leland Stanford, and the University of Virginia. Other schools have had clubs for some time, but have not as yet reached the flying status. Even college alumni have become interested in aviation and at Kenyon College in Ohio an alumnus recently gave the college a flying field, a hangar, two planes, and a fund for employing a flying instructor.

Meets between the various clubs take the form of flying skill, marksmanship in dropping flour-bombs and efficiency in navigation. One of the most prized trophies put up for competition is the Loening Trophy awarded annually to the college club showing special excellence in its air program.

A point noted so far in college flying is its safety. So far, in several years of activity and competition, not one college flying club member has been killed or seriously injured. They use representative types of modern light planes which are cheap to fly, service and fuel.

Believe it or not, but Harvard has

the distinction of having the oldest flying club in the country. They started back as far as 1910 and its members built Boston's first airport. They built everything and anything and a history of the Harvard Flying Club would be fairly representative of America's progress in aviation. To-day the club holds the Loening Trophy on the basis of its flying hours, experience and showing in meets, as well as several other important trophies. The president of the club is James Keith Davis, a Harvard senior, whose home is in Montclair, New Jersey. We understand that the club at present has thirty-five members and will engage in four meets during the coming year. They are the New England Intercollegiate Meet, the Middle Atlantic Meet, the National Intercollegiate Meet and a dual New England Meet for the Bushwick Trophy, another honor held at present by the Harvard Club.

## NEW SHIPS

The old Knight Twister has come to the front again. Remember a few years back when the first Knight Twister was shown? It was a small—very small—biplane built by Vernon W. Payne of Chicago.

A lot of readers all over the world wrote to us about that darned thing, and for months we cussed it up and down the well-known welkin. In the first place we knew nothing about it. It was originally built as an experiment. It was not for sale or ever put into production. It was just a freak ship that got a lot of publicity. Many were under the impression that it would be put on the market, painted yellow, and sold in "hands" like bunches of bananas.

Unfortunately, this never happened because the Knight Twister cost a lot of money. It cost more than three times the price of a Cub or an Aeronca, and so it had no real market value.

However, Payne got something out of it besides his picture in the papers. A wealthy South American sportsman ordered a small Knight plane which has been turned out as a biplane. It is powered with a special Douglas-conversion Ford motor. This power plant dispenses with the regular water cooling system and is naturally much lighter. In flight tests the new Twister did 160 top and cruised at 130. It lands at 45 and climbs 1,100 feet per minute. One of the interesting features is its ceiling which is 19,000 feet—a service ceiling necessary in any plane to be flown in South America where there are so many high passes to be negotiated.

## CRITICISM FROM ABROAD

It is interesting to get the reactions of foreigners who fly our light planes, particularly those in Europe where the

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light plane holds such a commanding position in aviation. I have just finished reading a particularly fair criticism of the Taylor Cub by a noted British test pilot who has had much experience on many types of light ships and various low-power engines.

"Generally speaking the machine flies more like a lightly loaded Mark I Moth than anything else, though the take-off is a great deal better, to the point in fact of being quite phenomenal when flown one-up"—and, of course, he means without a passenger—"and the stall is less pronounced. It is safely possible to bring the Cub in on a half-

stalled side slip, with the controls in opposite corners. The pilot still has plenty of control left to take off, bank and carry out the landing. We brought the Cub into Hanworth, slightly off wind, discovered the fact with only about 5 miles of air speed to spare and flat-turned into the wind without difficulty or delay by the use of the rudder alone.

"Stalling tests at a safe height showed that the Cub merely sank on a level keel with the stick right back, while the nose rose and fell gently against the horizon. The application of rudder caused a wing to drop momen-

tarily, but there was no tendency for the machine to flick into a spin. Apparently the Cub can only be made to spin on a wide throttle opening, a deficiency which from the instructional point of view, can be treated as good or bad, according to one's attitude to such things."

There was a lot more about speeds at various throttle settings and a description of the cockpit and controls, much of which has been written before. But, somehow, we liked this plain, unvarnished description of a flight. We wish we could get more of this sort of material.

## Model Matters

(Continued from page 56)

ogy and consulting engineer for both the Douglas Airplane Co. and the Northrop Corp.

The contest was different from the usual competition in that no flying was required, the purpose of the contest being to bring out of the competing model builders the best of engineering,

design, and workmanship. This was considered particularly fitting because of the fact that the sponsor, the Aero Industries Technical Institute, is preparing men for careers in the production end of the aircraft industry.

The contest was held coincident with the official opening of this new training institute, upon which occasion the school was formally accepted for the aircraft industry by Northrop, Robert E. Gross, president of the Lockheed

Aircraft Corp.; and C. A. van Dusen, vice president of the Consolidated Aircraft Corp. These aircraft executives compose an executive board set up to supervise the Institute's operation.

All model builders attending were permitted to go through the four buildings and extensive shops of the school and to observe the twenty-two phases of actual airplane manufacturing operations carried on in the Aero I. T. I. training program.

### CROSS WINDS

	1	A	2	R	3	O	4	D	5	N	6	A	7	M	8	I	9	C	
10	T	11	L	12	E	S		E			13	T	14	U	15	T	16	O	17
18	A	19	S	20	K		21	P	22	R	23	A	24	T		25	S	26	U
27	C	28	L		29	L	30	R	31	E		R	32	A	33	F		34	N
35	H	36	E	37	A	38	L	39	F	O		A	40	C	41	O	42	S	43
	44		45	S	46	K	47	Y	48	R	49	O	50	C	51	K	52	E	53
54	M	55	E	56	T				57	E	58	A	59	T			60	A	61
	62		63	I	64	S	65	O	66	S	67	T	68	A	69	T	70	I	71
72	73		74	T	75	H	76	R	77	I	78	P	79	S		80	B	81	A
82	83		84	E	85			86	87	P	88	I	89	E		90	L	91	I
92	93		94	R	95	A			96	A	97	S	98	H	99	E	100	N	
101	102		103	S	104	T	105	A	106	R	107	T		A		108	109	T	110
	111		112	H	113	A	114	B	115	E	116	R	117	P	118	A	119	S	120

#### ACROSS

- 1—Pertaining to forces interacting between air and moving bodies
- 10—Clay slabs for surfacing
- 11—Type of Avro training plane
- 13—Request
- 14—First name of makers of Wasp and Hornet aero engines

- 17—Seek legal recompense
- 18—Model plan abbreviation designating longitudinal axis
- 19—Anger
- 20—Abbreviation for Britain's air force
- 22—Letters marking a commercial-licensed American plane
- 23—Cured

- 25—Admiral Byrd's pilot in transatlantic flight
- 27—Type of Belanca plane
- 29—Contacted
- 30—To swallow
- 31—Toward the stern of vessel or airship
- 32—Subjected to equal pressure from every side
- 37—Order of insects that feed on plant juices

- 39—Part of balloon holding passengers
- 41—Electrical engineer, abbreviated
- 42—Kind of filled pastry
- 43—Ignited
- 44—3.1416
- 45—Went rapidly
- 47—Pale
- 49—Seventeenth Greek letter, corresponding to R
- 50—Commence
- 52—Red-berried evergreen shrub
- 54—Dealer in small articles of men's dress

#### DOWN

- 1—Passage between rows of seats
- 2—Kind of deer
- 3—Second musical syllable
- 4—Type of Curtiss military plane; also, a fish hawk
- 5—Affirmative vote
- 6—Kind of military plane designed for combat against ground troops
- 7—Twelfth Greek letter, corresponding to M
- 8—Neuter possessive pronoun

### Answers for January

S	L	O	T	S	S	O	L	O	S
Q	C	H	R	I	S	T	M	A	S
U	S	M	O	E	I	N	H	R	
A	I	R	A	D	V	E	N	T	U
D	R	A	G	O	R	O	G	O	R
R	E	V	E	A	L	I	R	O	N
U	N	E	N	U	R	S	E	D	V
P	I	S	T	O	N	I	N	T	O
L	A	I	N	T	E	N	T	S	T
A	N	N	E	A	G	E	P	R	O
N	O	O	R	S	O	E	B		
E	A	S	I	L	Y	S	P	R	A
S	T	E	E	D		T	E	P	E

- 9—Enumerate
- 10—Instruments showing engine speed
- 12—Withdrawal of wrong opinion
- 15—Restores plane to normal flying attitude
- 16—Easily led
- 19—Of the same name
- 21—Enemy
- 24—In motion
- 26—Exhaust pipe
- 28—Porridge, cereal grain
- 33—Drink in small quantities
- 34—Narcotic medicine
- 35—Infects
- 36—Noun suffix denoting occupation
- 38—Make of American light plane supplied in kits for home building
- 40—Spartan magistrate
- 46—American aeronautic and model-regulating organization, abbreviated
- 48—Past tense of the verb have
- 49—Bread cereal grain
- 51—Chemical symbol for rubidium
- 53—Exclamation of surprise



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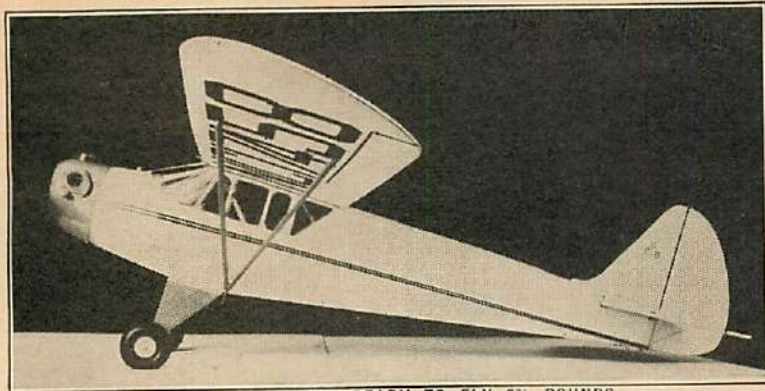






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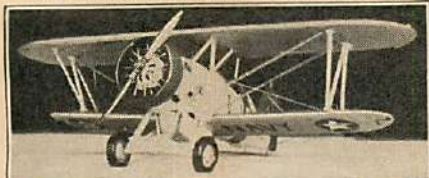
Boeing F4B3  
Boeing F4B4  
Boeing P26A  
Curtiss Goshawk  
Curtiss BF2C1  
Boeing P12E  
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Northrup XFT1  
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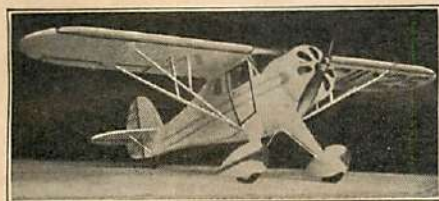
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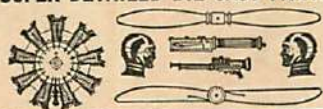
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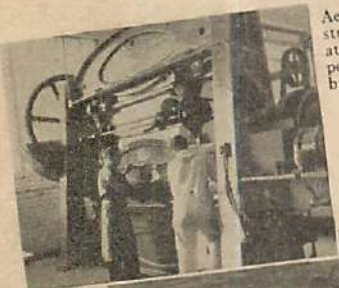
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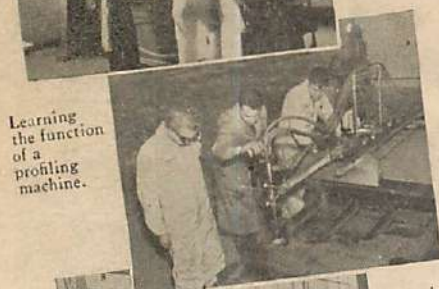
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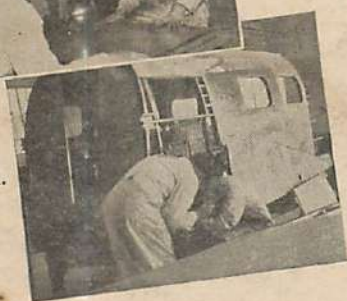
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