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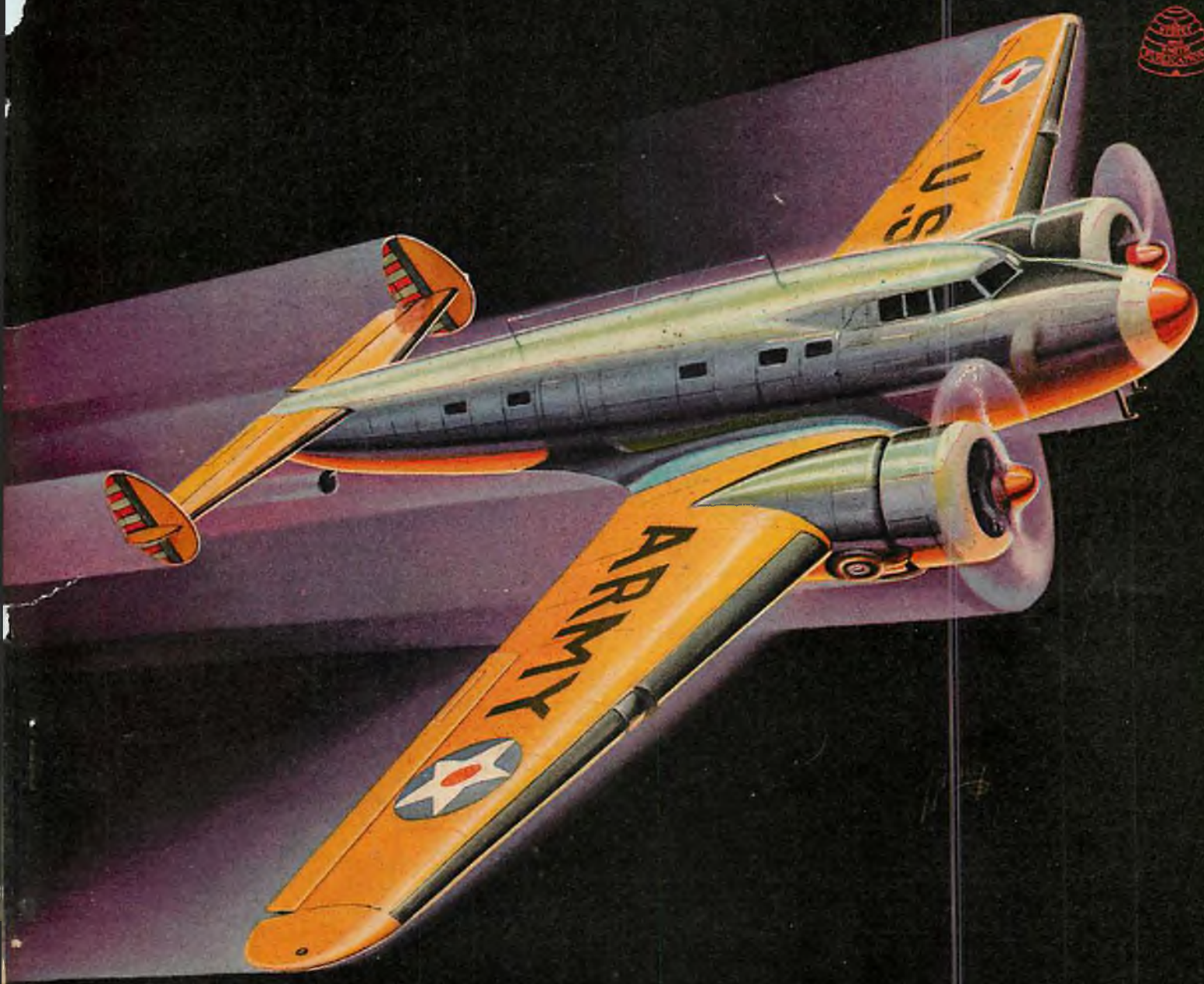
MAY, 1938



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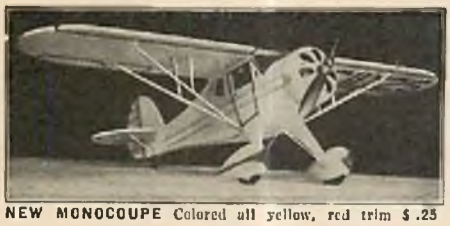

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CONTENTS

5 Articles:

Make Mine Light . . . . . *by Arch Whitehouse* 10
A well-known authority expresses his opinion on the sport of light plane flying.

The Army Never Sleeps . . . . *by Frank Lambert* 18
A fascinating description of the air corps' 24-hour service—as seen by a close observer.

Elementary Avigation . . . . . *by James Smithson* 28
The first of a series of complete, easy-to-understand lessons in air navigation by a recognized expert.

109 Miles Without a Motor . . . . *by Emil Lehecka* 30
Riding the winds on a record flight in a motorless ship as told by its crew of one.

Substratosphere Ship . . . . . *by Frank Tinsley* 36
In which the curtain is raised on a new chapter in aerial comfort, safety, and efficiency.

2 Stories:

The Hero . . . . . *by Charles Verral* 14
He snaked himself into a hero's role—and out again.

The Saver of Souls (Bill Barnes Air Novel)
by George L. Eaton 40
Trouble pays a call on Bill Barnes and gets a royal welcome.

8 Features:

Air Progress 4
In the front rank of the parade of aviation.

Pictorial History of Man in the Air 5
Another act in the drama of aerial conquest.

This Winged World 6
Aviation headlines in tabloid form.

Ryan Serves the Industry 16
A living testimonial to a famous name.

Ships in Black and White 21
An interesting presentation of an interesting ship.

The Air Trails Gallery 25
Full-page photographs of the latest planes.

What's Your Question? . *Conducted by Clyde Pangborn* 34
Answers to your aeronautical problems.

Split-second Action . . . . . *by Jon L. Blummer* 35
Tales of those who lived to tell.

3 Departments:

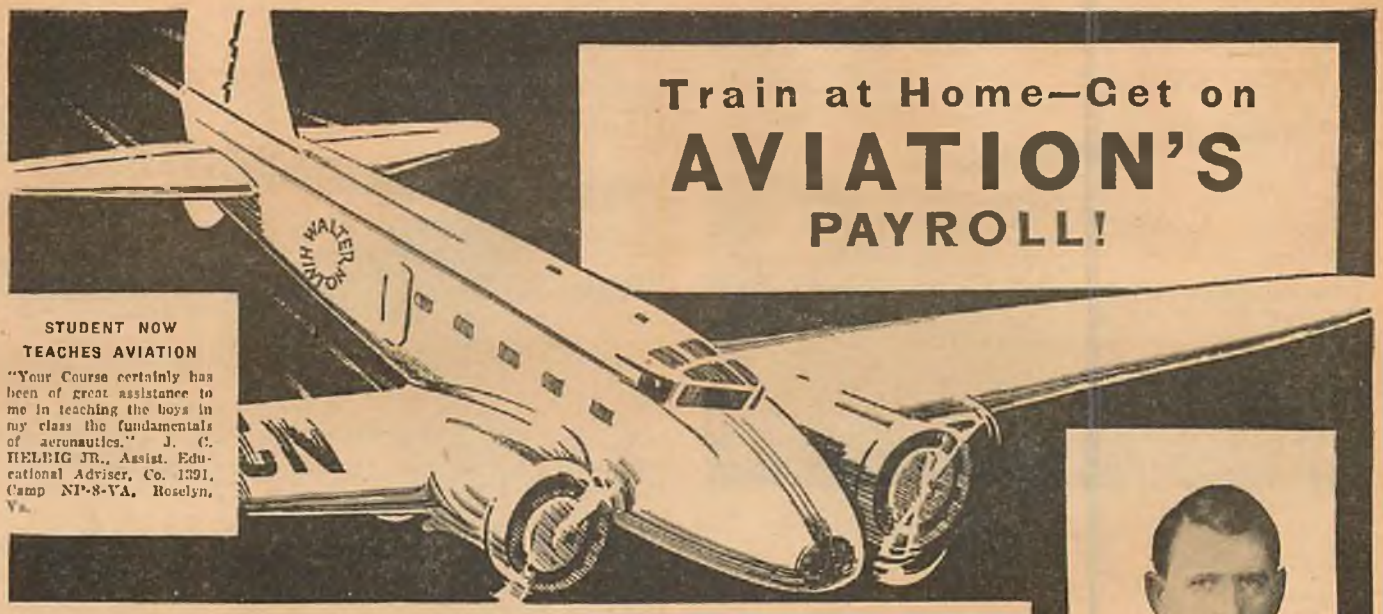
Light Plane Flying Clubs *Conducted by Arch Whitehouse* 22
Light plane enthusiasts talk shop with an authority.

Gliding and Soaring . *Conducted by Alexis Dawydoff* 32
New developments in a great sport.

The Air Adventurers Club *Conducted by Albert J. Carlson* 38
Over 20,000 reasons for America's future supremacy in the air.

10 Model Building Items:

Model Contents are listed on a separate page 59



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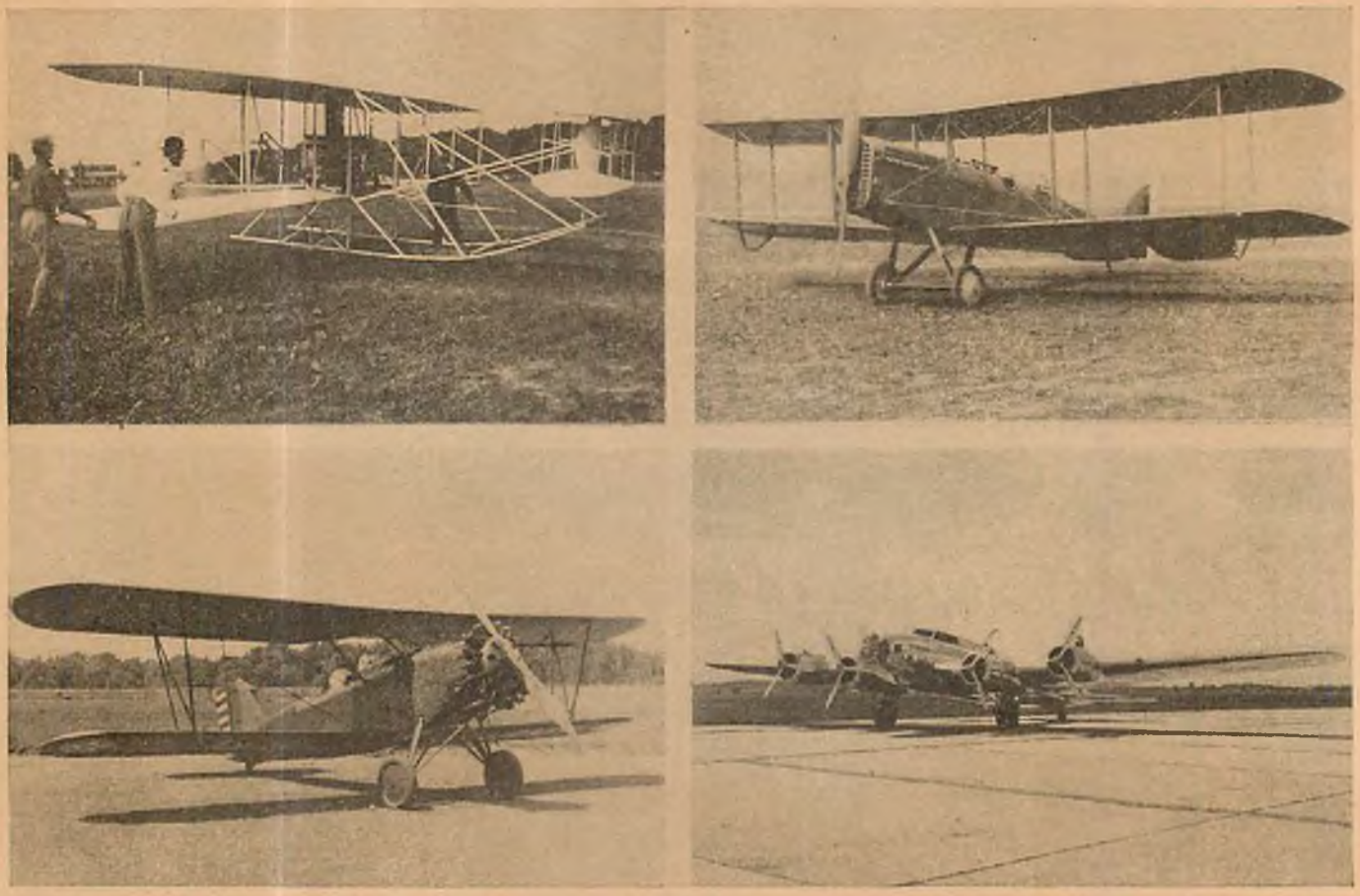


Thirty years of Army aviation: Top, left—the first Army plane, a Wright pusher; top, right—D.H.4; bottom, left and right—Thomas Morse observation and Boeing YB-17.

AIR PROGRESS

A Summary of Aviation News

TRANSPORT

DURING the so-called slack season usually experienced through the winter months, three major air lines attempted to boost their seating percentages by inviting the wives of men patrons to accompany their husbands on air trips, free of charge. TWA started the idea on their San Francisco to Los Angeles run mainly in an attempt to induce women who might be timid about air travel, to accompany their husbands and see what comfort and safety could be found in modern air transportation. It was discovered that most women who accepted the invitation had never flown before, or they had never been aloft in anything much better than a two-seater, open-cockpit ship flown from barnstorming fields.

United Airlines took up the challenge next and offered free trips to wives accompanying their husbands on the New York to Chicago trip. Later they allowed children under two years of age to accompany the parents gratis. American Airlines also went in on the plan, which later was broadened to take in flights all the way out to the West Coast.

In spite of adverse weather and general winter conditions, the American Airlines reports an all-time record in the ten-year life of the company, when 16,599 passengers were carried during January of this year. In the same month of 1937 only 12,919 were carried. The company now claims to handle 30 per cent of the air-line business in this country.

Australia has lifted the duty on large American transport planes of types unobtainable in Great Britain. In the past there was a 10 per cent duty plus a 10 per cent primage charge. The decision was retroactive and several large operators will receive thousands of pounds in rebates, which will enable them to operate routes which would otherwise be uneconomic. It is believed that instruments and engine parts which previously have been taxed up to 65 per cent will also be admitted subject only to a 4 per cent primage charge.

Information has been received that a passenger air service will be started this summer between Paris and South America. Air-France will conduct a weekly service over the 9,000-mile route between Paris and Buenos Aires which will take about four days each way. Germany, Italy and Great Britain will probably enter this field later in the season. The Air-France planes will be eight-passenger seaplanes capable of about 200 m.p.h.

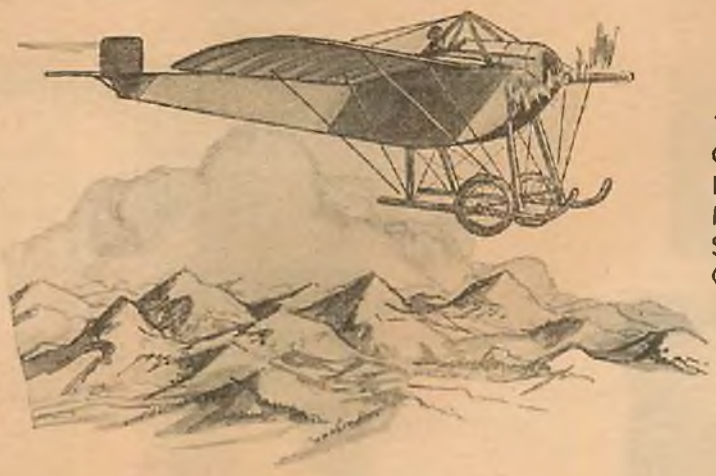
Exhibitors at the recent International Air Show held in Chicago, displayed many new light-weight and low-priced radio receivers suitable for use by private pilots on light planes. New precision tuners, simplified reel antennas and other important devices were inspected with interest by the growing guild of private pilots.

The first successful flight of the British Short-Mayo composite plane was staged early in February when, for the first time, the upper component was released from the lower after a regular take-off. The *(Turn to page 83)*

Pictorial History of Man in the Air

1910. UPON THE SEVENTH OF NOVEMBER OF THIS YEAR, HUBERT LATHAM, OF PARIS, MADE THE FIRST OVER-CITY FLIGHT IN HISTORY, CRUISING OVER THE CITY OF BALTIMORE, MD., IN HIS ANTOINETTE.

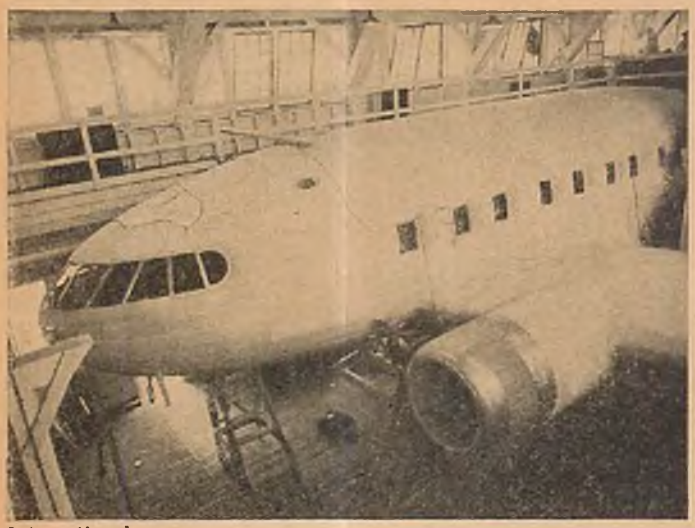
1911. THE FIRST FLYER TO LAND UPON THE DECK OF A SHIP AND THEN TAKE OFF AGAIN WAS EUGENE ELY. ON JANUARY 19, 1911 HE MADE THIS LANDING UPON A SPECIALLY BUILT PLATFORM ON THE U. S. CRUISER "PENNSYLVANIA."



1911. ON JANUARY 25, 1911, JEAN BIELOVUCIC, PERUVIAN AIRMAN, COMPLETED THE FIRST SUCCESSFUL FLIGHT ACROSS THE ALPS FROM BRIGUE, SWITZERLAND, TO DOMODOSSOLA, ITALY. THIS FAMOUS FLIGHT LASTED ONLY TWENTY-SIX MINUTES BUT WAS EXTREMELY DANGEROUS.

1911. THE FOLLOWING DAY THE FIRST HYDRO-AIRPLANE RISES FROM THE WATERS OF SAN DIEGO PILOTED BY ITS BUILDER, GLENN H. CURTISS. THIS WAS THE FIRST SUCCESSFUL FLYING-BOAT BOTH TO TAKE OFF AND LAND UPON THE SURFACE OF WATER AT THE WILL OF THE PILOT.

Wide World



International

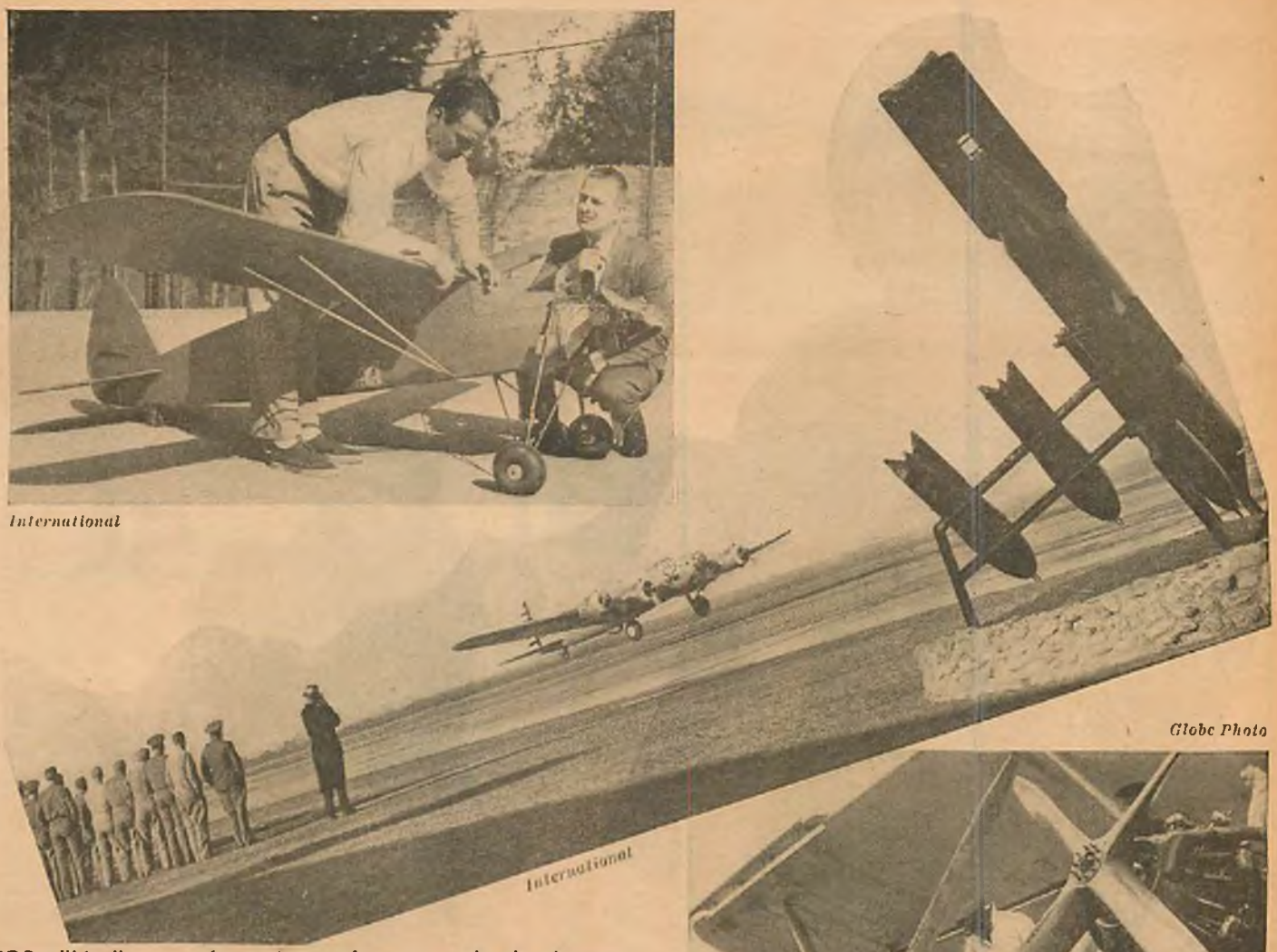
ABOVE—Seven league bombers aptly describes these Boeing B-17s as they roar through their paces high above the haze-shrouded Rockies. Left—A $1,000,000 Kiwi! The mockup of the new four-engined Boeing recently approved by T. W. A. This full-sized model is built, complete in detail, to eliminate "bugs" in the actual ship.

International

Wide World

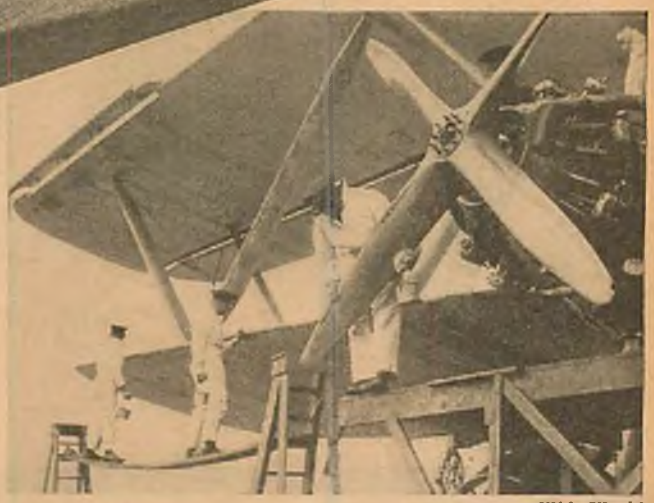
ABOVE—What is it? Just a range finder at Valley Forge Military Academy. Left—Lewin B. Barringer, center, demonstrates motorless flight to government officials at First National Gliding and Soaring Conference at Washington, D. C.

International



Globe Photo

International



Wide World

TOP—"Live" targets for anti-aircraft guns are the development of Paul Whittier and Reginald Denny, of movie fame. These targets, large gas models controlled by radio, will test the marksmanship of anti-aircraft gunners. Above—The bird and her eggs. A B-17 takes off beyond a monument consisting of four 100-pound bombs and one 2,000-pound bomb. Right—Greased lightning might be the title of this shot of the Imperial Airways' liner "Horatius." Workmen are applying a grease compound to prevent ice formation.

FIRST of the Ensign Class, giant four-engined Armstrong Whitworth airliners, 14 of which are being built for Imperial Airways, reaches the flight test stage. Spanning 123 feet and weighing 20 tons, the Ensigns will do 200 m.p.h.

Acme

MEXICAN WINGS alight at the nation's capital enroute to Mexico City from East Hartford, Connecticut, where these Vought Corsairs were manufactured.

Wide World

NEVER TOO OLD to learn was the philosophy of Mr. and Mrs. Siewert Bus as they celebrated their 60th wedding anniversary by a trip to New York in a 200 m.p.h. United Mainliner.

Acme

THE "SEEING EYE" goes aloft as Miss Roselle Brewer of Chicago, flying via Chicago and Southern, makes the first aerial trip by a blind person, accompanied by an especially trained dog.

Wide World

THE CURTAIN RISES at the International Air Show at Chicago. This general view of the main floor on the day before the gala opening shows a T. W. A. Skysleeper in the foreground, a revolving beacon in the background, and, ranged around the sides, the seaplane exhibits set in their artificial lagoons.

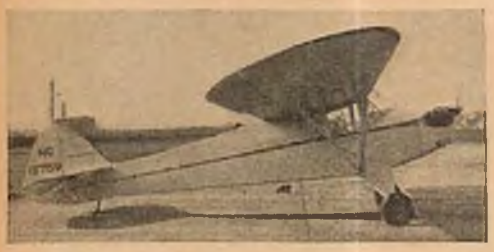
BEHIND the scenes at Chicago the ground force readies this American Airlines Flagship. Air conditioning trucks, gasoline trucks and attendants swarm about the giant ship, checking and rechecking to assure the safety and comfort of the passengers.

AIR TRAILS GOES TO THE SHOW

ABOVE—Capt. M. Sterling on the Mainliner, or "Pop" as he is known to the industry, brought Air Trails back from Chicago right on schedule. Right—The mecca of thousands, the Air Trails booth at the Chicago Air Show.

LOOKING OUT! What the window of a Mainliner looks like at 14,000 feet. The frost panel in the center is formed by a celluloid panel attached to the glass by a gum substance around the edges and in the center. The vacuum space prevents high altitude frost formation.

A FEW MINUTES by air makes a tremendous difference. At Chicago we left clear skies and bare ground only to drop down at Cleveland to snow and wintry weather.



MAKE MINE LIGHT

THE importance of the light plane in the field of modern aviation is a factor few can, or will, acknowledge. It is easy to pooh-pooh the small plane with its puttering 40 h.p. motor when we stand on the concrete gangway of an air-line hangar and admire the gleaming passenger transports. It is quite simple to say: "Of course, they're all right in their place, but not for me. Let the scatterbrained youth of the land fly them. My money is with the Douglas, Boeing and Lockheed lads."

So the light plane is unimportant, eh? It's for the wild, unrestrained youngsters who a few years ago would have been making life miserable for their generation astride roaring motorcycles? Aviation is only for the big air lines and million-dollar transports, eh?

If you will look up the facts and figures—— Well, let's take the month of October, 1937. Let's look up and find out how many commercial planes were actually delivered during that thirty-one days. Exactly ninety ships went out of the shops and were placed in the hands of the purchasers.

How many of that number, do you think, came in the airliner category? How many were planes with seating arrangements for more than five? You may not believe me, but the figures are on file with the Department of Commerce, and you can look them up yourself.

Not one airliner was delivered in the month of October, 1937, which we selected at random from a sheaf of reports. There were six Stinsons of the SR-8B class, six Wacos of the three-seater group, six five-seater Beechcraft and three Howard DGAs. The rest were Cubs, Taylorcraft, Fairchild 24s, and 90A Monocoupes.

So the light plane business does not mean anything, eh? But more than eighty per cent of the commercial planes delivered in that month were light planes. The rest were types equally suitable for light plane and amateur use.

Just for fun, we'll flip the sheaf again and look up another month.

Here's the list for August, 1937. Exactly 196 planes were delivered in that month. Of this number, exactly two were what you might call airliners—two Lockheed Electras—and they were both exported abroad. The

The light plane dominates the industry—deliveries of carload lots—preparatory training for national emergency—evolution of clubs—building up the business.

By ARCH WHITEHOUSE

rest were Cubs, Taylorcraft, Stinsons, Beechcraft, Wacos, Fairchild 24s, and Monocoupes. In two months, picked at random, we find that out of 286 planes delivered, only two were airliners. The rest were light or private-type ships that perhaps you or I could buy.

It should require very little imagination for one to realize, then, that this so-called light plane sport is a very important part of the mysterious business we call aviation.

Now, let's take another set of figures and try to piece all this business together. We are informed through official channels that on October 31, 1937, there were 17,379 pilots in the United States and 8,430 planes—or something like two pilots for every plane. If we were only considering airliners which require two pilots, it would be simple to understand. But such is not the case. Of the 17,379 persons holding government pilot tickets, 8,234 were in the private category and 693 were amateurs. As far as the light plane world is concerned, the two last groups can be classified together.

There are 380 transport planes in the country, which leaves us with 8,050 ships in the lighter categories—approximately as many as there are pilots in the combined amateur and private ranks. There are a few ships, of course, connected with air lines and a few with the recognized schools. But it should be quite evident that the output of light planes or ships in the lighter categories depends greatly on the number of licensed pilots who can or want to fly them.

This may bring up the old question: "Which came first, the chicken or the egg?"

We might rephrase it into: "What comes first, the pilot or the plane?"

If we look back on the history of aviation we discover that first there were men who wanted to fly. To attain this unbelievable ambition, they had to build or devise something to fly with. The Wright brothers first taught themselves the theoretical art of flight by watching birds, building gliders, and studying the papers written by the men who had gone through this elementary science before.

Richard Hoit from Globe

The man then, the pilot, must come first!

A careful analysis of the light plane situation indicates that if we are to progress, if we are to fly—as we now motor—if we are to keep the light plane in its rightful position in the world of aviation, we must produce and sell a certain number of ships every year. Progress in the light plane industry during the past few years indicates that the planes in the $1,500 to $5,000 class will soon dictate the general principles of the business. I personally believe that it will be the purchaser of the light plane who will be the most impressive figure in aviation within ten years.

To bring up the old subject of the automobile industry and the influence of the "flivver" would only be wasting time and valuable space. The monster passenger busses and the long-distance haulage trucks are only puny outshoots of the business created by the $500 to $1,000 car. Even the military side of the industry will be affected by the trend and progress of the light plane, because the gadgets, features and developments incorporated into the light plane will soon be snatched up and utilized by the military plane makers. We have only to look at the part the modern automobile plays in the present-day army setup—and the motor boat in the high-speed branches of the navy—to realize to what extent the development of the light plane can revolutionize the standard of fighting planes.

"But what about our giant airliners?" you may argue. "You certainly can't write them off and say that they owe anything to the light plane."

On the contrary, the transport industry probably owes more to the light plane pilot and designer than to any other feature of the business. After all, call them what you may, dress them up in the gaudiest insignia, give them the most luxurious cabins and plaster them up with engines, but you still can't deny that they are only light planes enlarged a trifle. They use the same motive power, the same system of control, the same theories of design and have to accept the same indisputable laws of artificial flight. Every gadget, every feature, every "improvement" they have was first developed on a light plane—in one form or another.

The giant transport companies spending money for the latest in airliner equipment could not stay in business a day were it not for the influence of the light plane. It was on a light plane the transport pilot first learned to fly. It was a light plane that first took slotted wings, flaps, adjustable tails, Frise ailerons, Townend rings, retractable landing gears and controllable propellers into the air and proved their worth. It was the light plane that first made the public air-travel conscious, for most of our regular air-line patrons made their initial flights in light planes—years ago. It was their loyalty to aviation and their money that enabled our air-line operators to put up hangars, lay out air routes and maintain schedules with million-dollar airliners.

You can't laugh off the light plane.

Assuming, then, that I have proven this one point, it is obvious that if aviation is to progress, if our air lines are to continue to function and if our aerial defenses are to maintain their high standards, we must keep prodding at the root of the industry and keep the light plane industry alive. It must be nurtured, encouraged and carefully directed. It is too important a branch to be neglected or commercialized for the benefit of the bank accounts of a few. The light plane industry, mishandled or placed in the control of the wrong group, can wreak havoc on the industry in general. It is not enough that our factories turn out hundreds of these ships a year and deliver them in carload lots all over the country. It is not sufficient that we export them abroad by the shipload. There must be a profound integrity in design, manufacture and a sincerity of purpose in distribution. If this

sounds like something they taught you as a Boy Scout, hang me. But no industry in this, or any other country, ever progressed without an industrial creed based on honesty of effort.

If we are to progress, then, we must continue to build more and better light planes. But before we can build and distribute more light planes, the records disclose that we must first find the men to fly them—just as, in years past, the automobile industry had to teach people to drive a car before they could hope to sell them one.

Unfortunately, as we all know, suitable instruction which results in acceptable knowledge and skill for a government license costs anywhere from $350 to $1,000, and it would be unfair to expect the manufacturers who are working on a close margin to accept this financial burden. On the other hand, only a comparative few under the present setup can afford to add the cost of tuition to the price of a plane, and get into the air. It is true that a few companies do, or used to, give flying instruction to those who purchased their ships. But that system demanded that the purchaser sign a contract to buy a plane. Whether it was—or is—a good system is open to question. It makes a prospective purchaser select a certain type ship, whereas, had he made his selection *after* he had taken his ticket, he might have selected another type. For instance, he might have signed to purchase an open cockpit job to train on, for no particular reason other than the fact he could get free tuition from the company making that type plane.

After he has taken his ticket, he no doubt sees light plane flying in a new light, and wishes he had bought a closed cockpit job or vice versa.

An accident, as we all know, does not do the industry any good. Aviation accidents, for some strange reason, are always "good headlines" for the newspapers. The seriousness of the crash is always magnified and the public gets another shock to its rising interest and confidence in flying.

What is the answer to this all-important problem?

As we see it, there must be some sane and reasonable system for teaching men to fly. We have good schools in this country and splendid instructors. But like any other institution of learning, they cannot operate efficiently without a reasonable amount of money. Too many men interested in aviation are seeking a quick, easy, cheap way to learn to fly. They think that most aviation companies should institute pay-as-you-learn systems in their factories, whereby, for a certain amount of work done, the applicant can get a certain amount of flying time. Others seem to think that if they agree to make parachute leaps at fairs and exhibitions, the pilot or exhibition companies should repay them with flying instruction. There are many other versions to the same general idea, but they are, of course, utterly impractical and plainly unreasonable. In the first place, the aviation companies can only afford to hire skilled labor—men they wish to become integral parts of their system and not fly-by-nights who are only there to feather their own nests.

There is no quick, cheap, and romantic way to a pilot's certificate. It takes a combination of hard work, money and a normal physical make-up. These three facts we cannot ignore and if most would-be-pilots would exert as much energy and thought into obtaining a ticket through the regular channels as they expend in thinking up new and easier ways of getting some one to teach them to fly for practically nothing, I am positive there would be more demands for private light planes than the manufacturers could take care of in five years.

But we must have pilots. *You* want to fly and it is upon your ability to obtain and absorb *(Turn to page 85)*

Richard Holt from Globe

The HERO

He wasn't afraid of anything —except snakes.

By Charles Verral

I DON'T like snakes myself. I get the cold shivers and go weak in the knees whenever I see them. But in comparison to Willie Stevens I'm a candidate for the Congressional Medal.

Willie Stevens worked for me when I had a flying business down near Miami, Florida. A big shy blond with pink cheeks and a slow grin. Everybody liked him. And the way he handled a crate was a dream. Nervy? Why, I've seen him bring a loaded Stinson in on one wheel right in the middle of a rainstorm. Everything he did was spectacular. I know he didn't mean it that way. But he began building up quite a reputation as a hero.

Maybe that was why the gang jumped him when they found his weakness. We were all loafing back in the office one afternoon. Things were slow. No instruction, no payloads. Suddenly we heard the *bang bang bang* of a gun going off. We all piled out on the apron.

There came Willie, racing across the field toward us. He kept twisting around and firing his gun behind him. His face was the color of that wind sock.

"Snake!" he yelled as he whistled past us.

He was trying to climb the side of the hangar when we finally grabbed him. It took a little while before I could find out what had happened. Willie had just been walking across the field when all of a sudden he'd seen a four-foot blacksnake. He'd revved up his feet and let loose with his artillery.

We didn't find any snake carcass, but every blasted window of a cabin job across the way had been shot out and the gas tank was a sieve.

Willie came in for a lot of kidding after that. I did my share, too. The guy took it pretty well. He tried to tell us how he felt about snakes, but everybody thought it was funny. We should have had our heads read.

At that time we had a brand new Waco. A honey. Plushed up inside and a nifty paint job. Two-way radio and all the gadgets. The gang took turns flying the crate to get their hand in. One Monday morning when things were slack, Willie took off in the job. He was no sooner in the air than Snooker Smith—good old Snooker, I could've gladly busted his neck—got the bright idea of pulling a gag on Willie.

He let us in on it. "Hey," Snooker said. "I'm going to radio up to Willie that there's a snake in the cabin. Hang around and watch the show."

We all thought that was the funniest idea we'd ever heard.

Willie was up about four thousand and circling lazily. The gang was outside on the concrete, watching. We could hear Snooker make radio contact.

"Hey, Willie," he said. "Snooker talking." He made his voice sound terribly anxious. "Hey, watch out! One of the grease monkeys says there's a rattler in the ship."

"Ha, ha," I chortled. "This is going to be rich."

I didn't hear Willie's answer. But I saw his reaction!

It must have been less than one second after he'd received Snooker's message that the Waco's cabin door flew open and out came Willie. He didn't open his 'chute until he was five hundred feet from the ground.

Yes, the Waco went ambling on and smashed itself to bits out in the 'Glades.

Of course, I couldn't do anything about it. I'd been a party to the whole scheme. I said a few choice words to Snooker and the others and started making red entries in the books.

Willie felt bad enough about it but when he heard it had only been a gag, why, I thought he'd bust out crying right there in my office.

"I'm sorry, Speed," he said to me. "I guess this is where I get fired. . . . I can't explain how I feel about snakes. I'm not a-scared of most things. But snakes——"

He shuddered and bit his lip.

I may be soft. But I liked Willie and he was tops as a pilot. So I said, "Forget it. We'll make up the loss somehow. You're still working for me."

But I told the boys in no uncertain terms to lay off any more practical jokes.

It took Willie a little while to get over his shock. Even then he wasn't himself. The old sparkle to his smile was gone. He began wearing knee-high boots. He carefully inspected the interior of every ship before he took off. And he begged me not to give him any flights over the Everglades. "I might have to make a forced landing," he said.

We had a heart-to-heart talk. "Snap out of it," I told him. "If you can't get over this snake idea you'd better move to Ireland."

"Ireland?" he asked. "Don't they have snakes there?"

"Not since St. Patrick chased them all out," I said. "But look here, Willie. You can beat this thing. Quit thinking about yourself. What you need is a dame."

Willie looked down at the floor and blushed. "Aw, dames don't go for me," he said. "I don't know how to treat 'em."

I laughed. "You'll meet the right gal one of these days. And boy, howdy, you're going to be sunk."

Old Prophet Speed, that's me. Right the next day what did I see with my own two eyes, but the thing happen. Willie was flying five fares up to Palm Beach and among them was a tall, slinky, dark-eyed sister. Exotic-looking, if you know what I mean.

I saw Willie give her a second look and then a third as he helped her into the cabin. And his face got the color of tomato soup.

I walked over when all the fares were tucked in and said to Willie, "There she is."

He shuffled those big shoulders of his. "Aw, cut the kiddin', Speed," he said. "But she is sorta beautiful, huh?"

He was off his beam and in a fog from then on.

The sister spent the week-end up at Palm Beach. And when Willie took another load up Monday, he brought her back down with him. After they landed, she stuck around and talked to Willie.

The poor guy was all hands and feet. When she left he came piling in to see me. "Gee, Speed," he said. "Isn't she a honey?"

"Who?" I asked, playing dumb.

"Veronica," he said. "You know the dame you kidded me about. With those big black eyes. And those pearly teeth. And Speed, guess what?"

"What?"

"She's crazy about flying. She's going to start taking instruction from me to-morrow morning."

"We can use the dough," I said.

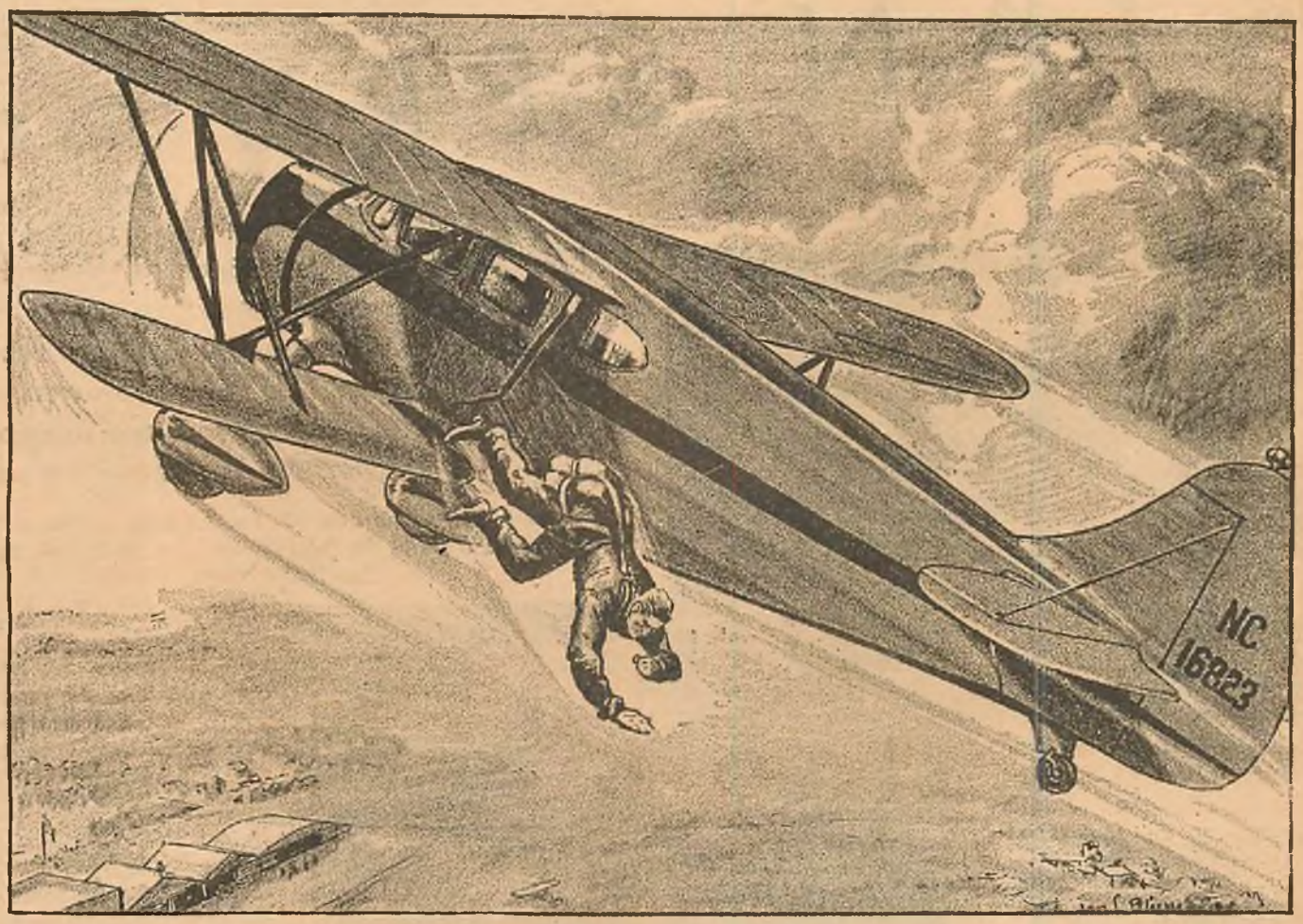
The next morning at nine o'clock, Veronica showed up all rigged out in what Lincoln Road says the aviatrix should wear. I'll say this for her. She had plenty. Her eyes, mostly.

Snooker Smith was standing behind us and I heard his muffled laugh. And I began to wonder what Veronica would say if she ever saw her hero run from a snake.

Right after that Willie came back and they started out toward the plane.

It so happened that one of the mechanics' wives had wheeled her infant over to our place and parked the carriage near the hangar. Right at that moment the baby took it upon itself to let go with its rattle.

I'll swear Willie jumped two feet in the air. He came around white-faced and all set to run. Then he saw what had caused the noise.



The cabin door flew open—out flew Willie——

When Willie introduced me, she let those big black landing lights focus on me for such a long time I began to feel uneasy. Then she said, "Ha-llo, Speed." Her voice was husky and sort of foreign-sounding like those spy sisters in the movies.

Every morning after that she came out for her flying lesson. But it didn't take me long to get wise that Veronica didn't care about piloting a ship herself. She was after Willie—and boy, she had him like a cat takes a mouse.

I wasn't very pleased about it. When these shy guys fall, they're liable to spin right in. And—well, somehow I didn't cotton to this Veronica dame.

Just after this Willie pulled a spectacular job of flying some trick serum to a sick guy and got his name in the papers again.

"Will-ie is so big and brave," Veronica said to me one morning while Willie was getting the trainer ready. "So, so brave."

Veronica looked at him in amazement. "Why, Will-ie, whatever is wrong with you?"

Willie pulled a fine act. He forced a grin. "I—I just thought some one had called me," he said feebly. "Come on."

By this time Veronica had Willie walking around in zero-zero. Of course, the gang ate it up and handed it back to Willie. But he didn't mind. All he seemed to exist for was the morning hop with Veronica. He didn't see her any other time. I know that. He didn't even know where she lived or what she did. And didn't care.

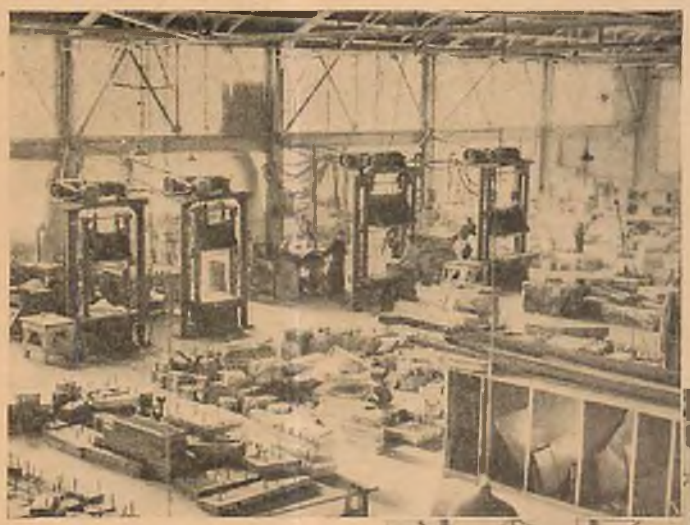
Business got so hot that I couldn't take much time off to worry about Willie's heart throbs. I was working every plane and every pilot overtime and the cash register was playing tunes.

I should have known things were going too good—that something was bound to happen. And, sure enough, one Saturday it did. *(Turn to page 86)*

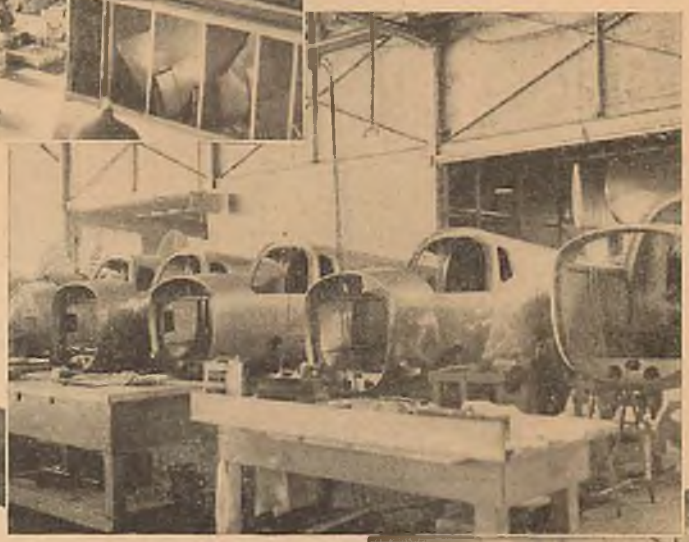
RYAN SERVES

For fifteen years the name of Ryan has
This organization, broad in scope and
and maintained a reputation for efficiency
whether in regard to their hundreds of
famous planes. The growth and integrity
tribute to its famous founder

Above—Ryan on parade. A fleet of Ryan planes on the line before some of the Ryan buildings at Lindbergh Field, San Diego, Calif.



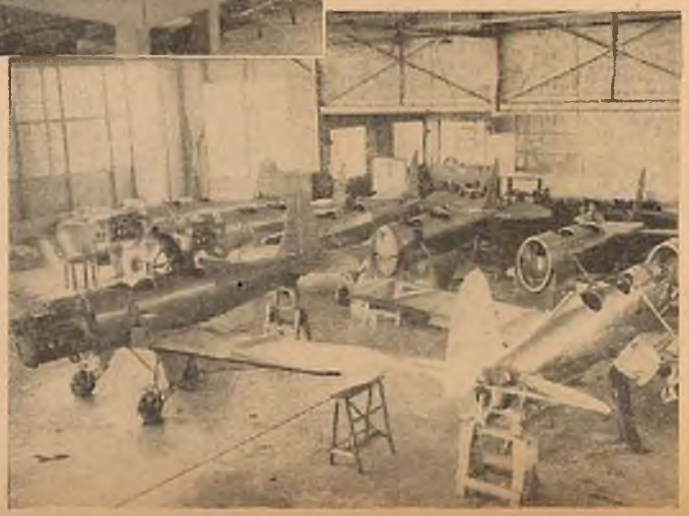
Above—Interior of the Ryan factory showing stamping machines and stock used in fabricating the famous all-metal planes.

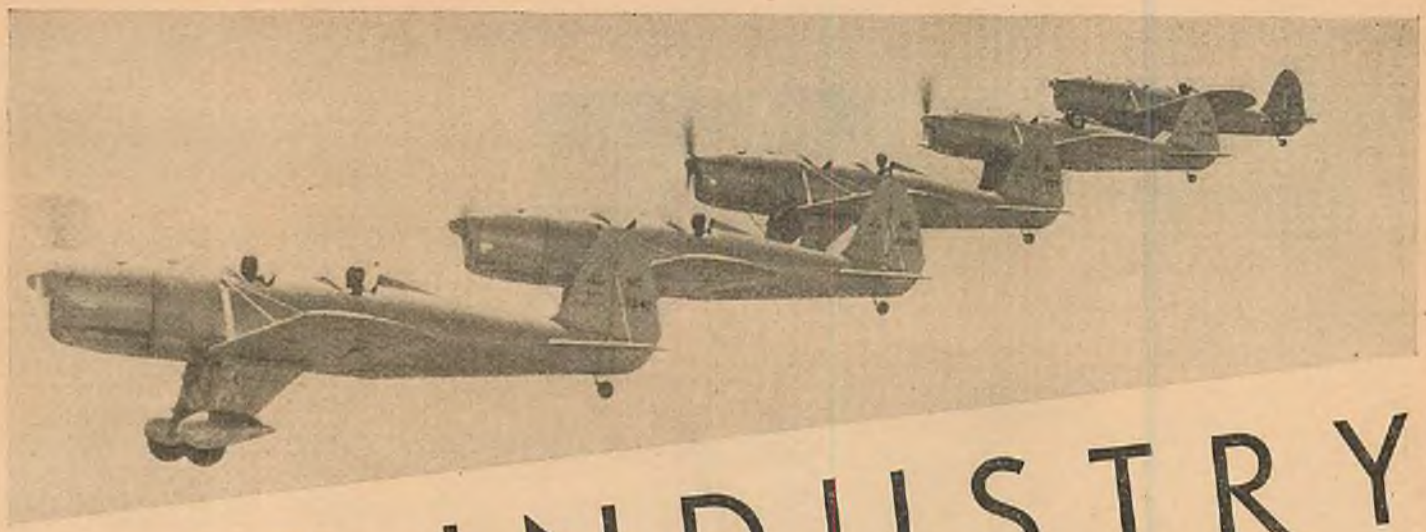


Left—A lineup of S-C metal cabin planes on the production line at the factory awaiting engine installation and wings.

Below—Ryan S-T-As for the Mexican Army Air Force under construction at the Ryan factory. These ships are being used for military training at Mexico City.

Left—Chester Rians, transport student at the Ryan school, gives his own S-T a 20-hour check as part of his technical school instruction.

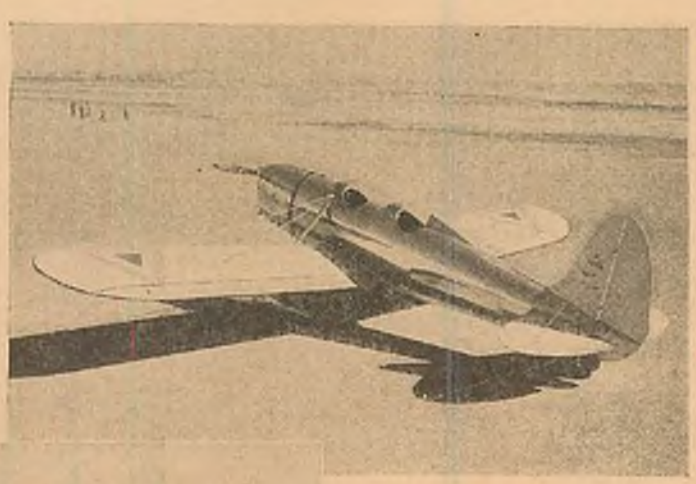




THE INDUSTRY

been synonymous with aviation progress. far-reaching in influence, has built up high ideals, and perfection of production, graduate flyers or their internationally of this vast enterprise stand as a living and mentor, T. Claude Ryan.

Above—Five reasons for Ryan superiority in student instruction. Formation flying in Ryan planes is a regular part of advanced flight training.



Right—The aviation bug is no respecter of sex. Women students at Ryan exemplify the high type of co-ed now entering the field of aviation.

Above—The sport trainer, or S-T, is representative of typical Ryan cleanness of design and high performance.

Below—Tex Rankin, who won the International Aerobatic Championship at St. Louis last year, flew an S-T against specially built American and foreign stunt planes.

Below—T. Claude Ryan, president-founder of this great organization, entering his new Ryan S-C metal cabin plane. Mr. Ryan's aeronautical career goes back to World War years, and from 1922 on it has been one of outstanding development.

Official Photograph, U. S. Army Air Corps.

Around the clock with the army—from dawn to dusk and even through the night the roar of army motors is never silenced.

Above—A formation of Northrop A-17 attack planes. The A-17s differ from the A-17As in that the undercarriage is not retractable. In service the A-17As are not painted, retaining their natural metallic finish. Right—A Douglas bomber and visiting navy Voughts, seen from the observation tower at Barksdale Field, Louisiana.

THE ARMY

HAVE you ever wondered what army pilots do after they have learned to fly? Of course they have to keep on flying regularly to avoid getting rusty, but that isn't all—not by any means. Just to prove it, let's take a look at the many kinds of flying you might see in one day at the greatest inland establishment of our air force: Barksdale Field, near Shreveport, Louisiana.

You'll have to get up early if you want to see the beginning, for the pursuiters start their gunnery practice soon after daybreak. The air is smoother at that time and there are fewer planes in the air to distract them. Far down at the south end of the huge landing area, which is more than two miles in length, five or six P-26s are following each other around in a great circle. They are evenly spaced, and at one point in the trip around each pilot dives and fires a few rounds at his own individual target on the ground. As soon as he has fired his burst, he pulls up and circles for another approach. When he has fired the required number of shots, he lands to reload while the scorers count the hits.

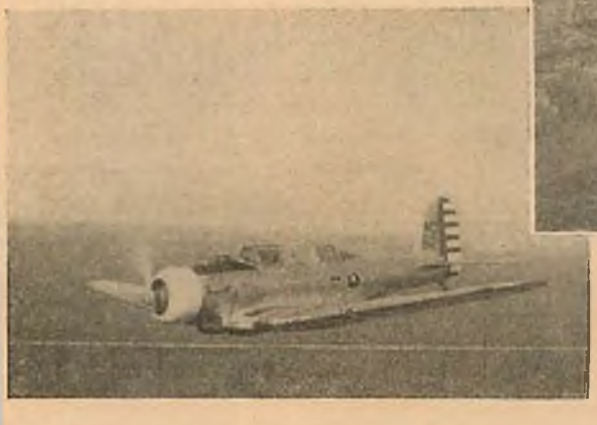
The Northrop A-17A Attack.

Of course it's highly important training, this aerial gunnery, but it's also great sport, far different from just aiming a gun at a target and pulling the trigger. For in this case you must aim an airplane at the target and fly it down the line of your gunsights. Since the gun is fixed to the plane, you must fly the plane, dive it and line up your sights all at the same time by using your stick and rudder. Hunters think it great sport to shoot birds on the wing, but only the pursuit pilot knows the thrill a bird would get if it could turn and dive and shoot *from* the wing.

Watch these pursuiters circle and dive and you'll discover that each pilot has developed his own individual style of approach. Some like to begin their dives from

By Frank Lambert

Official Photograph, U. S. Army Air Corps.



A formation of army P-26s. Although they are among the better-known ships in service, the P-26s and P-26As will soon be but a memory. The 85 Seversky P-35s and 210 Curtiss P-36s now on order will comprise the backbone of pursuit aviation. Left—A Northrop A-17A of the Thirteenth Attack Squadron.

NEVER SLEEPS

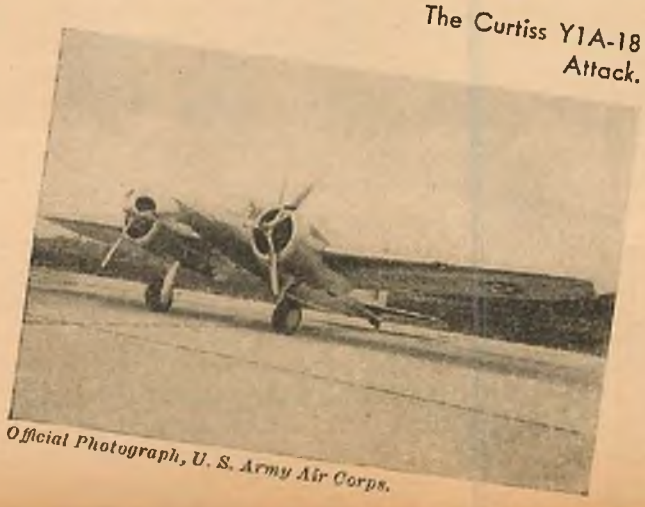
an altitude of several hundred feet, while others are content to start much lower. Also, there are the steep divers and the flat divers. And while some may pull away at a good distance from the target, others make you hold your breath and wonder if they aren't going to dive right on into the target.

One of my classmates did that once—just once. In spite of warnings he liked to come in fast and steep, and pull out low; three things he should never have done at the same time, for no man can come in at a hundred feet a second with his eyes glued to the sights and accurately judge his altitude down to the last few feet. The inevitable finally happened; his plane squashed more than he expected on a pull-out and the target fouled a wing. Unfortunately, the plane rose steeply, out of control, and fell back at the same angle. But most pilots listen to advice and allow a far greater margin than seems necessary, so that such accidents are rare.

It isn't easy to fire a whole burst straight into a ground target while you are diving at it, particularly if the air is rough. But the pursuiters take their gunnery scores very seriously, and they take great pains with everything that might improve them—from the bore-sighting and harmonizing of their guns to the rigging of their airplanes. The average scores of individual pilots vary considerably, depending upon whether or not they have both superior flying ability and superior shooting ability, and on how well they can learn to use both abilities at the same time.

Often one of the three pursuit squadrons at Barksdale keeps up this continuous circling and diving and firing from daylight until dark, somewhat to the annoyance of other pilots who must remember to keep out of their way. And there are plenty of other pilots in the air.

The Curtiss Y1A-18 Attack.



Official Photograph, U. S. Army Air Corps.

Official Photograph, U. S. Army Air Corps.

The Boeing P-26A.

While most people are still at breakfast the sound of motors being warmed up along the hangar line can be heard for miles. The pilots arrive at the hangars, go over briefly the instructions for the day's operations, and soon planes are taking off and flying away in all directions. Let's climb the three-story operations tower for a complete view.

And a complete view it is when we reach the top. We are near the center of the mile-long hangar line which runs north and south. Behind us are the many barracks, quarters and office buildings occupied by some fifteen hundred people, most of whom are connected in some way with the flying, servicing and maintenance of the more than one hundred planes stationed at Barksdale. Beneath us is a huge hangar marked "Visiting Ships," which is usually crowded to capacity. But in front of us is the stage for the most important activity of all—flying, which we can watch all day and far into the night.

We can scarcely see the boundary markers at the north and south ends of the field, for they are more than a mile away from us. The field is large enough to permit landing several formations at one time, but its width is less than a quarter of its length, so that we can easily see across it to the bombing and gunnery ranges of the great reservation to the east. And the first thing we notice is a nine-plane pursuit squadron taking off and heading for one of these ranges.

The entire squadron proceeds to dive steeply, pull up, circle and dive again, very much like the fellows at the south end of the field, but this squadron is practicing firing in formation. The target consists of several large squares of cloth spread on the ground in such a way as to resemble a formation of bombers. Of course this mass firing cannot be as accurate as that performed by the individual planes flying alone, since in this case each pilot is distracted by the necessity of keeping his proper position. But one plane alone would have a poor chance against the defensive guns of a bomber formation, or even against all the guns of such a bomber as the Flying Fortress. So accuracy in individual fire is not enough, and the pursuiters learn the delicate teamwork required by diving, firing and pulling away in close formation.

No, you won't see any pursuit planes up dog-fighting. To-day dog-fighting takes place mostly in the heads of fiction writers. Even by the end of the World War the individual "gladiator" was beginning to disappear from the air picture, and why so many people expect to see dog-fights going on around our army fields is a mystery. Sometimes a little of it is performed for exhibition purposes. But the important thing to-day is good formation flying, and it's no wonder that most military flying training is devoted to the development of this skill in the individual. The poor formation flyer is not only of doubtful value in combat, he is also something of a hazard to his friends under any circumstances. So don't say "Didn't they learn that simple stuff in flying school?" when you see nine more pursuit planes taking off for no other purpose than to practice formation flying. For that is one job that has to be performed almost automatically—you can't pause to try to remember something or figure it out. It requires regular practice and frequent repetition of every possible signal and movement. The formation you see leaving the ground now probably includes some new men and maybe some fellows whose office work has been keeping them grounded for a few days; but the leader will take them to a considerable altitude somewhere near the field and proceed to climb and dive and turn and shift them from one pattern to another for an hour or two. When he brings the squadron in for a landing you'll be able to notice a difference in the smoothness of its maneuvers.

When the pursuiters get the new P-36s they're expecting, they'll have to spend a lot of time just getting familiar with them, and a lot more time learning to use them in formation. There'll be retractable wheels, cowling flaps and other gadgets to worry with, in addition to the increased difficulty of formation flying in cleaner, faster planes. No military pilot is ever completely trained.

Instrument flying also requires regular practice. It's impossible to take along a safety observer in a P-26, and that's the reason for those Northrop A-17s you see warming up down at the pursuit end of the field. Each pilot is preparing to take off and fly some distance away from the field to an assigned area, where he will draw a hood over his cockpit and spend an uncomfortable hour practicing various maneuvers without peeping. If another plane approaches the man in the rear seat will kick the dual rudder pedal as a signal that the pilot had better remove the hood and take a look.

Even though it looks like a DC-2, the big plane circling the field and lowering its wheels in preparation for landing is really a C-33, which is the Army *(Turn to page 87)*

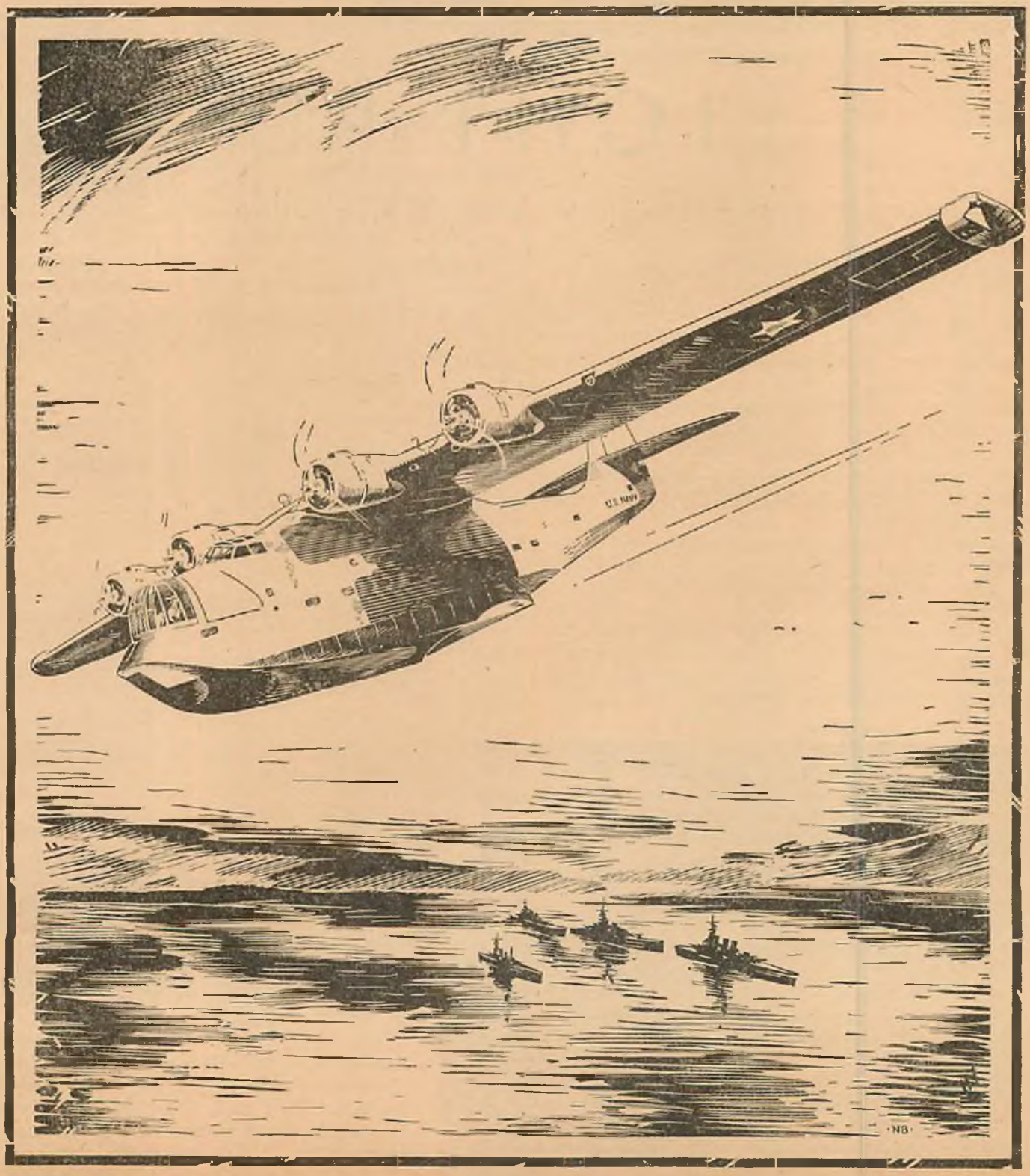
Official Photograph, U. S. Army Air Corps.

P-26As above the clouds.

SHIPS IN BLACK AND WHITE

The four-engined Consolidated Patrol Bomber

THE Consolidated XPB2Y-1 is the culmination of a series of flying boat designs that have won universal acclaim. The four P. & W. Twin Wasps, developing a total of 4,200 h.p., can be expected to drive this monster at speeds considerably in excess of any yet displayed by a large flying boat. Characteristic of Consolidated practice, the wing floats are retractable in flight, completing the wing tip outlines when folded. The older twin-engined PBY-1s already have gained the international limelight. Their group flights from the Coast to Hawaii have given some indication of the possibilities of this new four-engined experimental job. Specifications and performance figures had not been released by the Navy when this drawing was prepared. At present the aeronautical world is watching with bated breath the contest that is certain to ensue between the XPB2Y-1 and the Sikorsky XPBS-1.



The 1938 Aeronca KC, 40 h.p. Continental, features Oleo tripod landing gear. Top speed is 88-93 m.p.h.

If you own a light plane or are interested in any way in light plane activities send us your photos and news notes—A. W.

LIGHT PLANE

Conducted by Arch Whitehouse

PROBLEMS IN ORGANIZATION

THE most paradoxical situation in American aviation is the difficulty encountered in organizing private flying clubs. For a country where there is more available terrain suitable for flying than elsewhere in the northern hemisphere, where the standard of living is unquestionably the world's highest, where there are more good, moderately priced planes manufactured, and where the population is most temperamentally suited for flying, we seem to display an amazing agility for collecting problems that interfere with the general progress of popular aviation.

James McBride, instructor of the Richmond (Indiana) Flying Club, who takes time out to tell us what a good job we are doing in this department, comes through with a typical flying club problem.

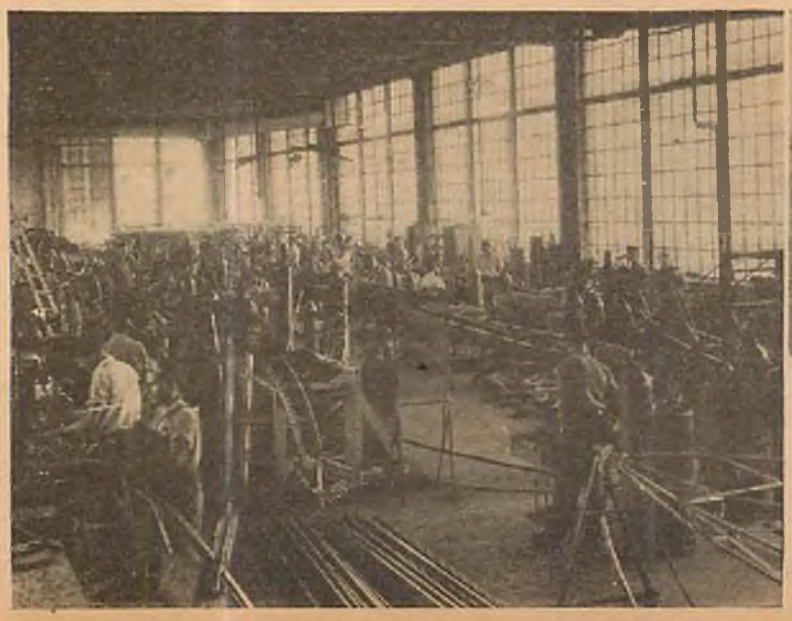
He has the usual complaint about the manufacturer who is only interested in making the sale of the plane and then dropping all interest in the purchaser, whether it be an organization or an individual.

But Jim goes further and presents his own particular problem. He writes:

"In the past year, I have experimented with a flying club of my own in a new manner and so far have found it a great success as far as the students are concerned, but a decided failure as to reasonable remuneration.

"In April, 1937, I gathered several young men and women together. They wanted to fly, but like many others did not have the capital. I agreed to give them flying lessons at a rate of $3.00 an hour. Instruction was carried out in a Class 1-A plane, weighing 2,330 pounds and using a 100 h.p. motor. In addition, I agreed to offer ground school courses two nights a week which included controls, construction, engines, simple aerodynamics, navigation and radio. I informed them that any student who failed in three examinations would be dropped from the club. Each student was assessed $1.50 a month dues.

"Everything started off splendidly and then I began to run into obstacles. First, I was refused permission to



Above—The Taylor Young with Edo floats.

Left—Welding department of Piper Aircraft Corporation, makers of the Cub. The fuselage is welded from steel tubing that has been minutely inspected, micrometer measured and precision cut. Welds are inspected under a searching light.

Offering valuable tips that may save money and trouble if you are either starting or joining a flying club.

Wide World

The Luscombe Fifty, powered by the 50 h.p. Continental, brings metal construction to the light plane field.

FLYING CLUBS

ATTENTION TO LIGHT PLANE ENTHUSIASTS!

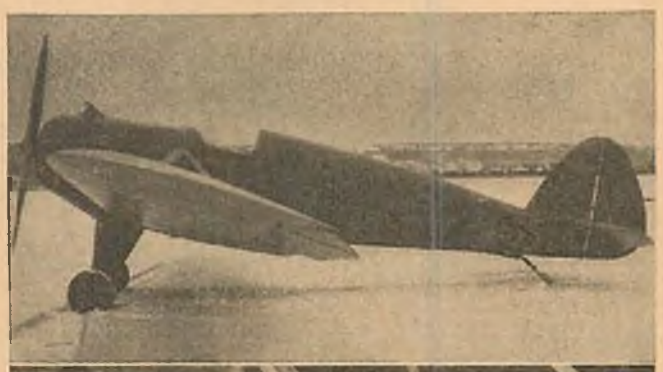
In response to many requests, and in keeping with our aim to further the sport of light plane flying and the forming of light plane clubs, we offer the following service to our readers.

Upon receipt of 10c in coin or stamps to cover printing and mailing costs we will send a simplified plan for the formation of a light plane flying club, a tested constitution and bylaws from which a workable governing and operating plan can be formulated. These have been arranged with the collaboration of the editors and heads of successful light plane flying clubs now in operation, with slight modifications due to regional and other circumstances.

Please be sure to note the make and type of any light plane you now own, or plan to purchase in the future either for club flying or individual member use.

This will enable us to gauge more accurately the flying club situation as it now stands.

If you're contemplating the formation of a club or are interested in getting the most from your present club, send for these valuable plans at once. Address your request to Light Plane Club Plan, AIR TRAILS, 79 Seventh Avenue, New York City. Be sure to enclose 10c in coin or stamps.



Rudy Arnold

Rudy Arnold

Above—The Aeronca low wing in flight.

Right, top to bottom—The popular Arrow Sport with Ford V-8 engine; the cabin arrangement of the Aeronca K, showing the twin wheels for side-by-side seating; the multiple rubber disc absorbers of the Porterfield Zephyr. The features evident in the photos are exemplary of modern light plane manufacture.

ANNOUNCING THE ANNUAL AIR TRAILS LIGHT PLANE SURVEY!

AS HAS BEEN OUR CUSTOM IN THE PAST, WE ANNOUNCE AT THIS TIME, FOR APPEARANCE IN THE JUNE ISSUE, OUR SURVEY OF AMERICAN LIGHT PLANES. THIS YEAR THE SURVEY WILL BE PRESENTED IN A NEW AND INTERESTING MANNER, FEATURING THREE VIEW PLANS, PHOTOGRAPHS, AND VITAL PERFORMANCE DATA, IN ADDITION TO DESCRIPTIVE PARAGRAPHS CALLING ATTENTION TO STRUCTURAL DETAILS.

BE SURE TO GET THIS EXTREMELY VALUABLE AND COMPREHENSIVE LIGHT PLANE SURVEY!

instruct from the local airport owing to the fact that it was leased to several unlicensed pilots who were flying unlicensed planes. They had had two crashes and had crippled two people. Thus, it was necessary for me to fly in a town 30 miles distant, furnishing my pupils with transportation. There was naturally a certain amount of ridicule, but then came the worst blow of all. My plane was deliberately destroyed by vandals. The Bureau of Air Commerce has all the details on NC-5781, if you care to look it up. My losses to date amount to $1,200, but I am satisfied that I have at least given the right start to a few youngsters who really want to fly."

There are the facts as encountered by one man who had an ideal. You may say that Jim McBride's case is the exception, but unfortunately, such is not the case. I have talked to many pilots who have been through it all before.

A few years ago, I was instrumental in organizing a flying club in New Jersey. We managed to gather a fine group of enthusiasts together and drew up the necessary papers and rented a field. A number of ex-service men blew in and offered their services as ground instructors and we managed to obtain the assistance of an instructor of wide experience. The club was started, the students were assigned their instruction periods and we were well on our way.

The Everel one-bladed propeller is "constant speed"; makes for faster take-off and climb, higher ceiling; saves fuel; reduces gyroscopic action.

Then commercialism began to rear its ugly head.

One member who professed to be interested only in learning to fly, suddenly blossomed out with ideas for making the club and our field a center for his personal ambitions. He soon had control and set himself up as a young magnate offering sales and service on anything from a Waco to a Ford Tri-motor. He began "passing the hat" around the parked cars over the week-end and the club soon received a black eye. Eventually, of course, the club activities were engulfed by the "sales and service" industry of this man, and we soon went out of the business of teaching members to fly.

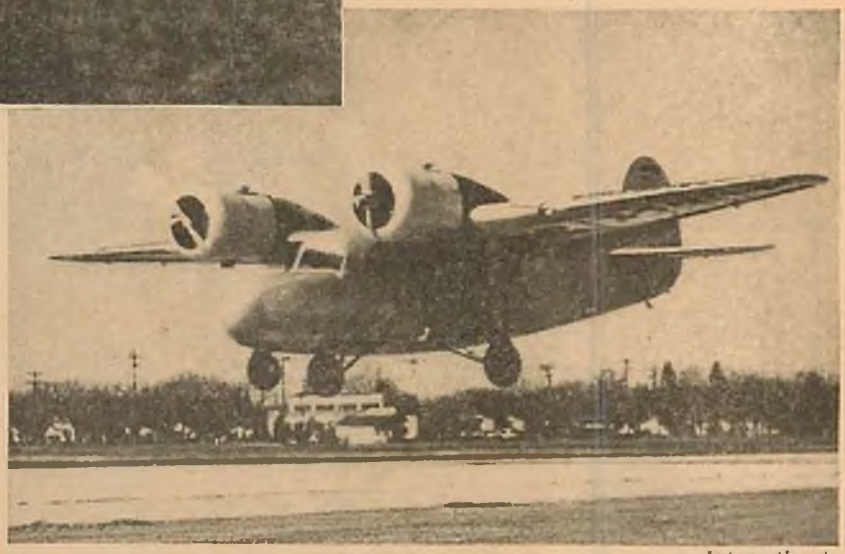
We do not wish to carry this negative attitude too far. We are presenting these facts and experiences of others, to show you what can happen, and what to avoid when you attempt to organize a club of your own. These are the things you should look for when you join a flying club. Make certain that it is being properly conducted. Be certain that your instructor carries a suitable license, that the ships *(Turn to page 79)*

THE AIR TRAILS GALLERY

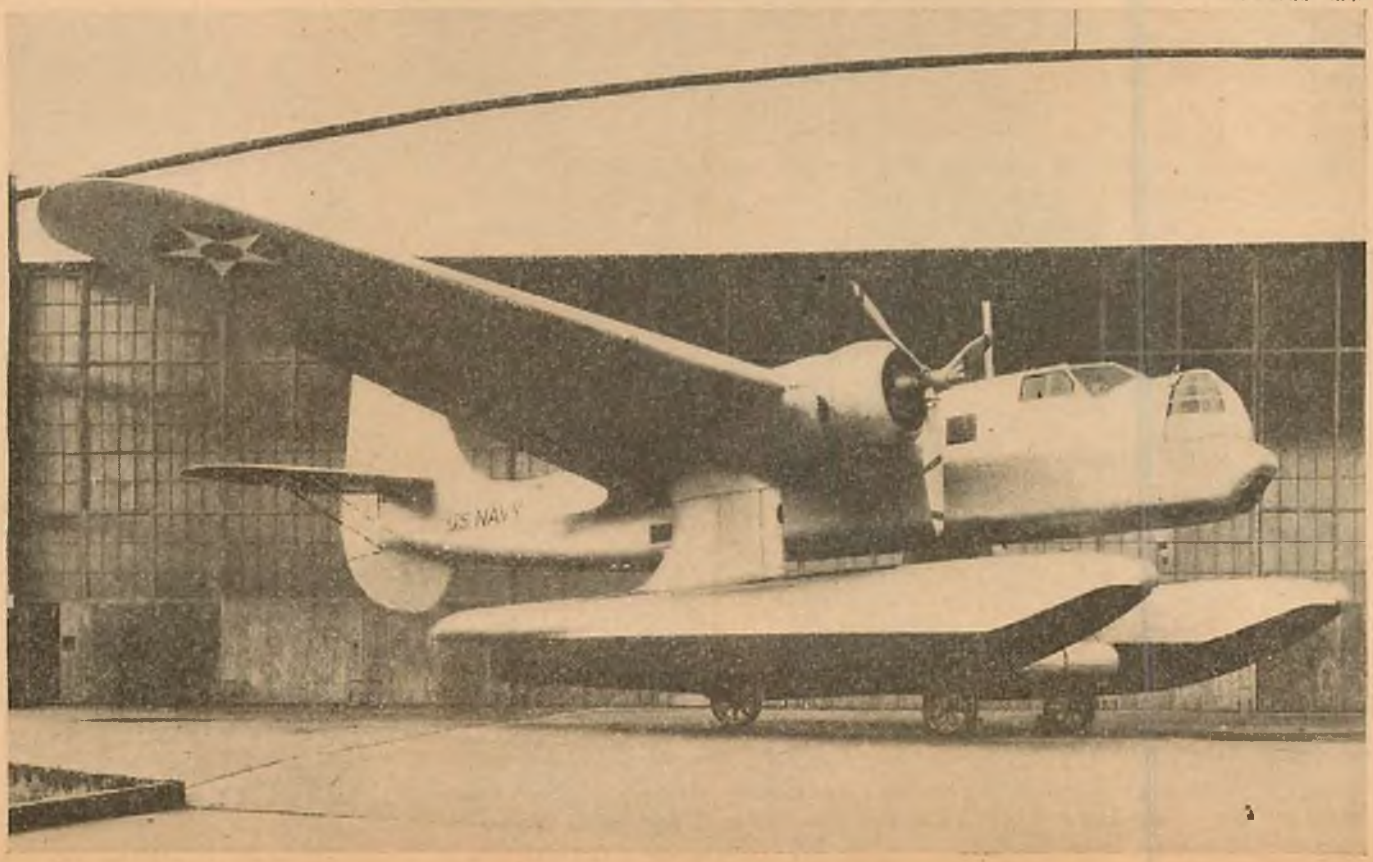
Three full pages of photographs of modern planes

Below—The Timm Transport, a craft of radical design, is the first transport to utilize the tri-cycle landing gear. Other innovations are said to reduce its landing run 75 per cent and the take-off run 30 per cent from the conventional type of transport. The ship is two-motored, high wing, semi-cantilever monoplane. Top speed is 207 m.p.h. at 5,000 feet and the cruising range is approximately 800 miles.

Above—The Bellanca Junior, a new three-place job with either the 70 or 90 h.p. Le Blond engines. Below—The latest and most formidable naval weapon is this "flying torpedo boat," built by the Hall-Aluminum Aircraft Corp. for the United States Navy. Officially it is the XPTBH-2 patrol, torpedo, bomber seaplane. Detailed specifications and performance estimates for this new seaplane are withheld by the Navy. Notice the clean lines of its monospar design.

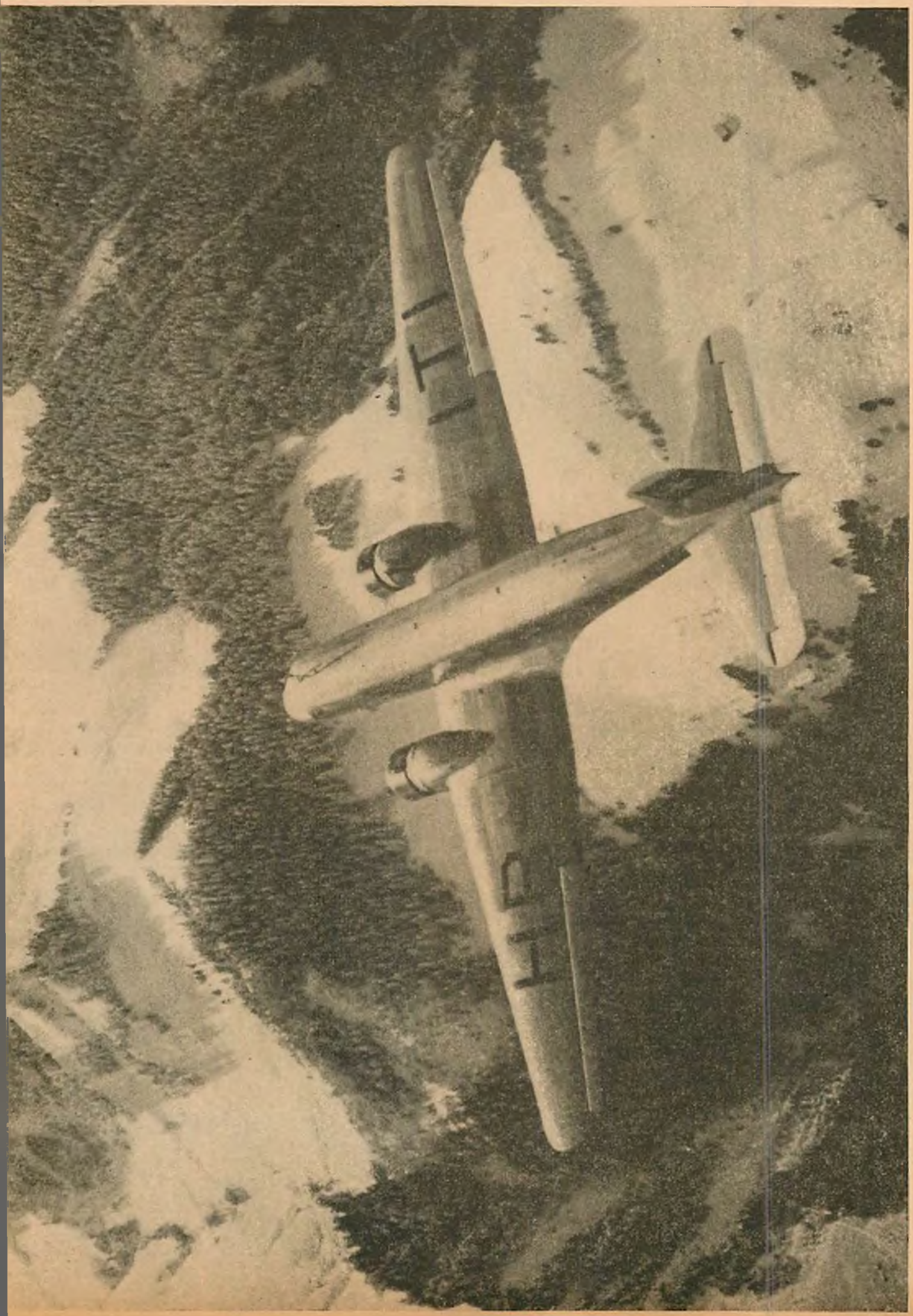


International



Wide World

The Mayo Composite, its total 5,000 h.p. roaring, banks in flight like some gigantic biplane, just before the first release was made. After instruments in both components reveal the proper trim for release, the lower pilot pulls his release, the upper pilot his, and finally a spring-loaded automatic hook disengages when the excess pull of the upper component has reached a predetermined load



Its two 760 h.p. Wright Cyclone engines roar defiantly as this American-built Douglas DC-2 flies high over the scenic splendor of the Alps. The Douglases are the most popular ships in air-line service throughout the world. The ship shown in the photo is one of those operated by Swissair and was on its way to Italy when this picture was made.

ELEMENTARY

Boxing the compass.

Presenting a valuable discussion on another phase of the science of aviation—a book's worth of knowledge concentrated in a clear and interesting article.

AERIAL navigation or avigation, the science of conducting aircraft from one point on the earth's surface to another, may be divided into three classifications, namely: Dead reckoning, piloting, and celestial avigation.

Dead reckoning consists of conducting the airplane from one point to another by steering definite compass courses over set distances, or during definite intervals of time.

Piloting consists of conducting the airplane over a certain whole route by flying from one known point to the next within it; for example, by passing over one town and steering for the next that can be observed ahead, by following the course of a known river or railroad track, by flying from one known mountain peak to the next one along the route, or shaping the course so that the plane will pass certain distances off known objects on the earth.

Celestial avigation consists in determining the plane's position by observations of the heavenly bodies. This method is seldom used except in long flights over water and will not be discussed inasmuch as its complexity puts it beyond the scope of this article.

It is a debatable question whether avigation by radio should be classed under piloting or be called a method by itself. Inasmuch as it consists chiefly in obtaining bearings of or from definitely located points, it will be catalogued under the heading of piloting.

In almost every flight of appreciable distance over land, both dead reckoning and piloting are employed either alternately or in combination.

It must be remembered that avigation in general covers a wide scope and consists of a great variety of processes ranging from comparatively simple ones to those involving considerable mathematics. The purpose of this article is to select and set forth one reliable, easily understandable method by which the ordinary pilot can navigate his plane overland with confidence and safety.

Certain instruments and articles of equipment are essential to any navigational flight, and the student must have a thorough understanding of them before he can hope to advance in the study of avigation. They consist of the following: magnetic compass, air speed meter, altimeter, aeronautical charts, and parallel rulers. To that list three familiar, but none the less important, articles must be added—a timepiece, a lead pencil and a pair of dividers.

VARIATION AND DEVIATION

If the north point of an airplane's compass actually pointed north, much troublesome work would be eliminated from aerial navigation. The fact is, however, that it almost never does, because of the existence of two magnetic phenomena known as variation and deviation.

Variation is the name given to the error which is virtually always present in the magnetic compass reading,

Tower at Floyd Bennett Airport showing beacon lights, anemometer, wind vanes.

AVIGATION

By James Smithson

Photos by Rudy Arnold

The radio room of the Pan American base at Port Washington, Long Island, keeps in touch with the Clippers by radio reports at stated intervals, so that the ground base can chart the planes' positions as they fly along.

due to the fact that the north-seeking end of the card points toward what is known as the "magnetic north pole" of the earth instead of the actual, or geographical north pole. To obtain a clearer picture of what is meant by that, secure an ordinary classroom globe and find the following position: Latitude 72° 00′ N, Longitude 96° 00′ W. That is the location of the magnetic north pole of the earth. (The magnetic south pole is in position 73° 00′ S, 155° 00′ E.)

For convenience, draw a circle around the position. Imagine yourself in a plane over any other position on the earth's surface—over Los Angeles, California, for instance. Now with your finger, follow the path of the nearest meridian (approximately 118° 00′ W) to the geographical north pole. That direction is *true* north. That is not the direction in which the north end of the plane's compass will point, because it seeks the north *magnetic* pole instead.

Therefore, whenever it is desired to steer a true course from one point to another on the earth's surface, this discrepency in the compass reading must be allowed for. Fortunately for the avigator, scientists have found out just how much error exists in our magnetic compasses, due to variation at almost every point in the world, and have laid these errors out on charts, so that they may be seen at a glance. It may be well to add here that this error changes slightly in any one position on the earth's surface over a considerable period of time, so that it is well to consult up-to-date maps whenever contemplating a navigational flight.

Deviation is another magnetic error found in the plane's compass, but it is something of an entirely different nature from variation. It is an error or combination of errors due to magnetic influences within the plane itself. It may be caused by magnetism within the metal parts of the airplane structure or within metallic equipment carried in the plane, or it may be brought about by the magnetic fields set up around the plane's electrical equipment. The disturbing influence of deviation varies with the changes in magnitude and distribution which are bound to take place among the magnetic forces within the plane and it also affects the compass differently on different headings. It is necessary, therefore, to check up and correct the plane's compass on the various headings at periods, which in any case, should not exceed six months. A brief description follows, showing how this is done.

Almost every large airport has what is known as a compass rose laid out on a cement slab somewhere near the landing field, in a position away from the vicinity of buildings, stacks, electrical wires or other objects which are likely to contain magnetic properties. This rose resembles a huge compass card showing the cardinal points of the compass. These points are always laid out in the magnetic directions of the earth, that is, the true geographical directions, plus or minus variation. Hence, to find out what errors due to deviation there are in a plane's compass, it is only necessary to place the plane on this rose and compare the readings of the plane's compass with the markings on the rose on each of the cardinal headings in turn. Most of the error due to deviation can be removed from the plane's compass by means of small magnets carried in a permanently fixed rack under the compass card; however, some error usually always remains even after that operation. The procedure then is to record the error remaining on each of the various headings, on a little card which can be carried in plain sight in the airplane somewhere near the compass. This card is consulted, and the error taken into consideration whenever a compass course is steered. Figure 1 shows a typical deviation card. *(Turn to page 91)*

The Rhonsperber sailplane. Globe Photo

109 MILES WITHOUT

AS I got up the morning of July 5th, the tenth day of the National Soaring Contest held at Elmira, N. Y., I saw Riedel, duPont and Barringer making preparations for take-offs. This looked as if soaring conditions were favorable, and I hurried to the Administration Building to get my barograph and the latest dope on the weather. Dr. Karl Lange, director of the contest committee and chief of the meteorological staff, told me that he expected thunderstorms to the northwest in the vicinity of Rochester. He thought that an out-and-return flight could be made by cloud-hopping to Rochester and returning with the storm. Thinking this over, I decided to make a goal flight to Watertown, N. Y.—140 miles from Elmira, air-line distance—which lay to the northeast of Harris Hill, because this would give me the farthest straight-line distance flight without getting mixed up with any storms. During a storm one encounters extremely turbulent air and I did not want to risk my brand-new ship in it.

Having decided on my course, I let Dr. Lange know about it and wandered out to the take-off point. It was noontime by then and Riedel, duPont and Barringer were in the air already. My Rhonsperber sailplane, the Gunther Groenhoff, was all set up in back of the tow plane and ready to go. As I strapped on the parachute, my barograph was installed in the ship's turtle back. I climbed into the cockpit, adjusted the safety belts, and made myself comfortable. I closed the transparent Plexiglass hood over my head, and one of my crew snapped the tow-line ring into the release hook. Earl Southee, who was in charge of flying activities, gave the signal and after a short run we were up, climbing steadily behind the plane.

While still on the tow line I flew through a few bumps which appeared to be indications of uprising air currents, but as I did not have enough altitude, I decided to hang on until I felt the ship lift and then cut loose. At an altitude of 1,700 feet by my altimeter, which was set at zero on top of Harris Hill (Harris Hill is 1,500 feet above sea level, so that my altitude was actually 3,200 feet above sea level), I released myself from the tow plane. But to my disappointment there was no lift in the air and the ship proceeded to drop rapidly. At the rate I was descending it seemed necessary to land on the American Airways airport, when suddenly a strong thermal up-current over a dry, plowed field started lifting my ship. Glancing at the variometer, I saw that I was being carried up at the rate of seven to ten feet per second. Circling in this thermal, I rose to an altitude of 3,500 feet—which enabled me to reach some big cumulus clouds about five miles to the north and directly on my course.

Ten miles farther, halfway between Horseheads and Watkins Glen, I saw another sailplane, which I thought to be Dick duPont's Minimoa, circling in the clouds. Approaching it at 4,000 feet I considered for a moment following it, but changed my mind. Flying blind in a cloud with another ship is apt to lead to a collision. So I pointed the nose of my ship north toward Watkins Glen, and after several miles caught a glimpse of still another Minimoa, probably Lew Barringer's, flying south. South of Watkins Glen I changed my course from north to northeast toward Cayuga Lake and Ithaca.

From then on—until Cayuga Lake—the going was very slow. I had to circle continually in the few existing thermals, which were very weak, in order to maintain my altitude. Nearing the lake at a point five miles north of Ithaca, I started to lose altitude because a northeast wind, blowing from the lake, prevented the formation of thermals. I thought of flying with the wind toward Buffalo, but decided finally to stick to my original course. Once my mind was made up I flew around the southern portion of the lake and turned west toward a high mountain near Ithaca, noting a good cloud condition in its immediate vicinity and realizing this would allow me to regain my lost altitude.

A Silver C pilot proves his independence of power in an outstanding soaring flight.

A MOTOR

By
Emil Lehecka

Flying over Ithaca airport at an altitude of 1,200 feet, I caught a small lift of two feet per second. Circling for half an hour I managed to get up to 3,400 feet. Later I was told that the airport people had been trying to talk to me over a loud-speaker system, but I did not hear them as the windows in my transparent hood were closed. (Earlier in the flight, when they were open, a bug had sailed in and almost put my eye out, and I wasn't taking any more chances.) Heading east toward a formation of cumulus clouds, I gained another 1,000 feet under them, but fearing they were about to break up and create a strong down current, I turned back on my course. Flying by my variometer I discovered I could gain altitude without any clouds being present, through dry thermals, and took advantage of them, although the necessary maneuvering frequently took me off my course.

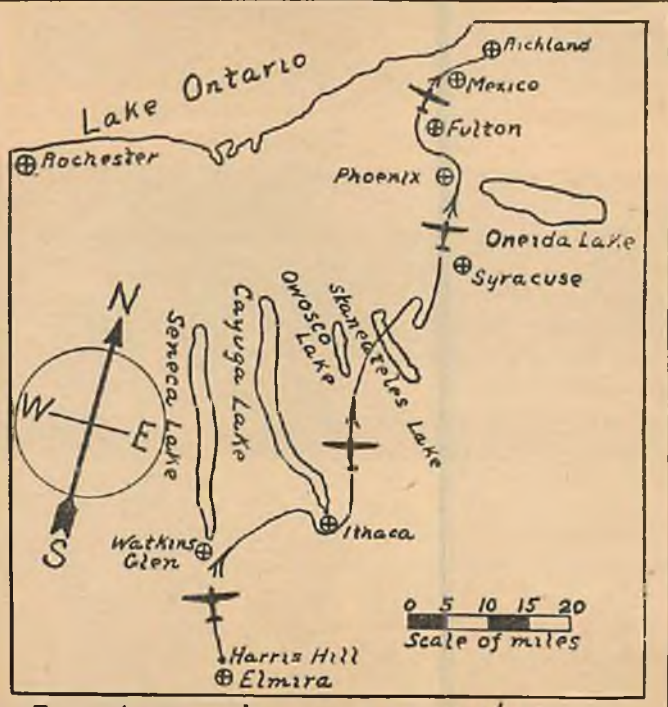
In this manner I flew until I neared the southern tip of Lake Owosco, where cumulus clouds were plentiful. I crossed Skaneateles Lake and at its northern tip gained the highest altitude of my entire flight—close to 6,000 feet—in a very large cumulus cloud. After leaving this friendly white mass and proceeding on my course, I could not find any more lift for quite a while. It started to look like the end of my flight, so figuring to salvage altitude if I couldn't have a distance record, I headed for that cloud again. But this idea seemed to be doomed as well. The 'Sperber refused to go higher than the cloud's base. Evidently the strong lift that existed earlier had petered out. So I turned back north where I could see some cumulus formations forming. It was hazy and the visibility was very poor while flying through their bottoms. Although I should have been able to see Syracuse, according to my calculations, I couldn't make out a sign of it.

I flew a straight compass course for about 20 miles, the airspeed indicator registering 60 miles an hour and the variometer at zero. (When the variometer reads zero the ship maintains its altitude, no loss, no gain.) Nearing Phoenix the sky cleared up and the ship started losing altitude at 40 miles an hour, the variometer showing a rate of descent of three feet per second. And the farther I flew, the more the 'Sperber sank. Sinking speed at times reached six feet per second. Not seeing any likelihood of lift in this direction, I turned west where I could see some cumulus clouds a few miles distant. Reaching these clouds with about 2,000 feet of altitude left, and circling under them, I climbed back to 5,000 and headed north. Near Fulton the thermal condition started getting weak again and, beyond it, disappeared entirely. The time was about 5 p. m., and glancing at my map I calculated that I had covered 90 miles air-line distance from Elmira. During the remainder of the flight I could not notice any wind at all and the skies were absolutely clear. My altitude then was 4,000 feet, and not seeing any clouds around me, I decided to stay on my course and fly toward the goal, Watertown, in a straight glide just as far as I could.

Occasionally I would feel bumps, and thinking that they might be thermals I would turn back into them, but my variometer would not register climb. In this manner I lost a lot of precious altitude which otherwise I could have turned into distance. While passing over Mexico, N. Y., I could faintly see Lake Ontario in the distance. The sun's reflection on it made it look like a molten silver ribbon. This gave me quite a thrill. The last few miles of my flight were all in a straight glide with the airspeed indicator registering 50 to 55 miles an hour.

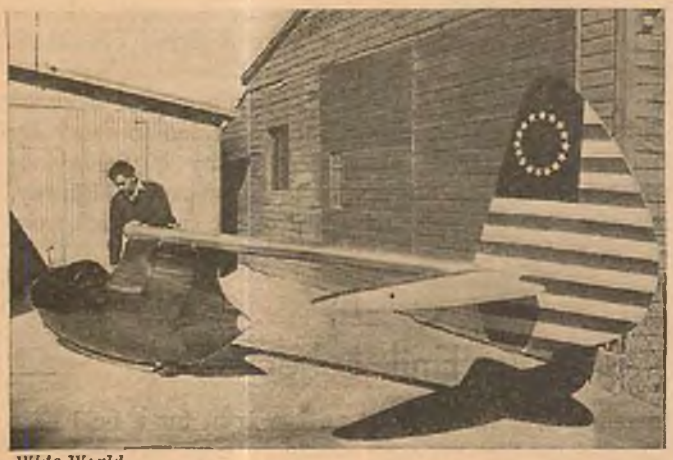
Several times, thinking that I dived my ship excessively, I would pull back on the stick to slow it up. This would bring the speed down to 40 or 45 miles an hour, but the sinking speed was only increased. I was rather puzzled because under normal flying conditions the minimum rate of descent of the Rhoensperber is 40 miles an hour. Seeing that I was covering good distance with a minimum loss of altitude, I decided to delay my landing inasmuch as there were plenty of fields into which I could come down safely. I flew over a highway, my speed being greater than that of the cars which were traveling over it, and kept an eye open for a field near the road, so that my crew would have as little difficulty as possible in disassembling the ship and loading it on the trailer.

Approaching the town of Richland and noticing there weren't any convenient landing places ahead, I turned back and flew toward a field that I just passed. The landing was made in a straight glide disregarding the wind direction, as I did not have sufficient altitude to circle the field. Stepping out of the Rhoensperber and stretching my weary limbs, I glanced at my watch—5:35 p.m. I had been 5 hours and 35 minutes in the air and covered 109½ miles. The spot that I landed on was a bare hundred feet from a telephone located in a gas station. While reporting to Harris *(Turn to page 89)*



EMIL LEHECKA'S FLIGHT OF 109½ MILES FROM ELMIRA TO RICHLAND N.Y. JULY 5, 1937

GLIDING AND SOARING



Wide World

Hawley Bowlus' "Oneota Rancho," a 44-foot sailplane under construction at his father's ranch.

The winch developed by Gus Scheurer and used at the 1936 Elmira Soaring Meet.

THE FIRST NATIONAL CONFERENCE

THE First National Gliding and Soaring Conference was held on February 11th and 12th, at Washington, D. C. Among the organizations represented were: Airhoppers Gliding and Soaring Club, North Jersey Soaring Association, Aero Club Albatross, Associated Glider Clubs of New Jersey, Wings Gliding and Soaring Club, Philadelphia Soaring Society, Delaware Soaring Society, Carnegie Tech Glider Club, Falcon Glider Club. Well-known individuals present included Lewin Barringer, Manager of the SSA, Mrs. Warren Eaton, Dr. Karl Lange, Director of the Contest Committee of the SSA, Charles Gale, Earl Southee, Jack Sommers, Inspector for the Bureau of Air Commerce, and Paul and Ernest Schweitzer.

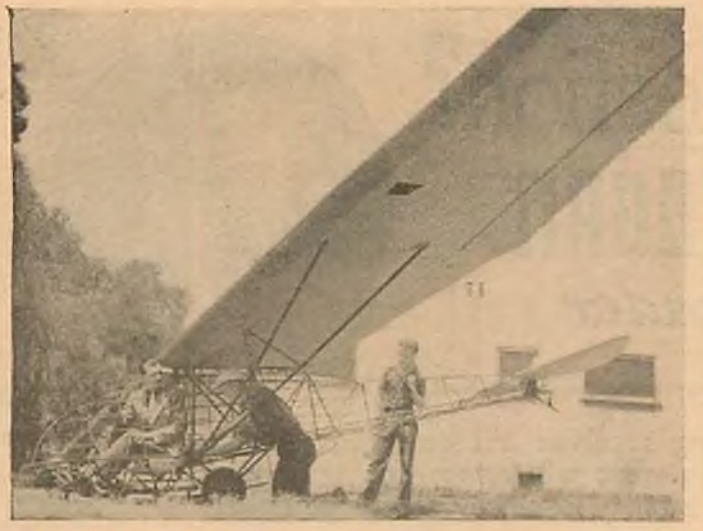
The conference opened at 3 p.m. with a meeting of directors of the SSA for the purpose of electing officers and additional directors. The results made Richard C. duPont president; Charles Gale, editor of the *Sportsman Pilot*, and Dr. W. Klemperer, research engineer with the Douglas Co., vice-presidents; Mrs. Warren Eaton, secretary and treasurer; and Lewin B. Barringer, general manager. William McGrath and Emil Lehecka were elected directors.

That evening the National Aeronautical Association held an informal smoker for the members of the SSA. A colored film of the 8th National Contest at Elmira was shown, together with a very interesting picture called "Clouds in Motion," which depicted the formation of clouds and air currents generated by them. Official host was Mr. William Enyart, of the NAA.

Members and guests of Chicagoland Glider Council at the Chicago Air Show.

The First National Gliding and Soaring Conference at Washington — Improving primary performance—Club notes and gliding news.

By Alexis Dawydoff



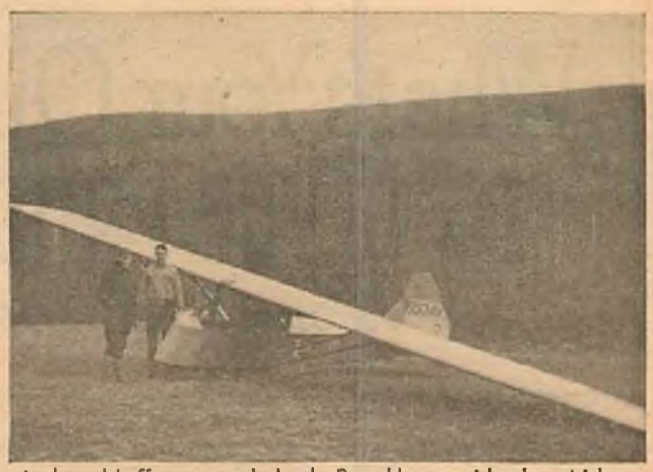
Don Stevens, Lewie Harper and Stan Corcoran with the partially completed Corcoran sailplane just recently tested by Stevens.

The next morning, February 12, the opening session of the conference was held at the Lafayette Hotel, with Charles Gale, Lewin Barringer and Larry Lawrence presiding. Barringer announced that Peter Riedel, who participated as a German entry in last year's contest, had been made German Air Attaché in Washington, and that a two-place high-performance Kranich sailplane was being shipped for Riedel's use from Germany. Barringer also stated that a $1,000 prize has been established, to be known as the Martindale Prize for any pilot who will soar from Wichita Falls, Tex., to Tulsa, Okla., a distance of 200 miles.

Dr. Karl Lange, Director of the Contest Committee, described how the prize money will be divided this year. The point award money is to be transferred to Frankfort, Mich., where a contest solely for utilities will be held. The Elmira Contest will be entirely for high-performance ships, as qualification flights to compete for the prize money have been raised to Silver "C" requirements. An additional $1,000 prize has been donated for breaking the American altitude record, and Mrs. Warren Eaton has established a trophy for the greatest achievement in the promotion of gliding.

The next speaker was J. Sommers, of the Bureau of Air Commerce, who said that the Bureau is keenly interested in the strides made by the gliding move- *(Turn to page 90)*

Don Lawrence and the special Franklin. He and Gus Scheurer redesigned the fuselage.



Arthur Hoffman and Jack Brookhart with the Airhoppers' Pruefleg at Wurtsboro, New York.

Frank Merritt of Glendale, California, with his 72-foot, 500-pound, two-place sailplane.

The Merritt sailplane showing the 23 to 1 aspect ratio wing and the semiboom mounted tail.

Globe Photo

The Falcon III drops the undercarriage after taking off at Dunstable Downs, England.

What's Your Question?

By CLYDE PANGBORN
Wing Commander

As soon as possible after being received, all questions will be answered. Those of general interest will appear on this page; others will be answered by mail. Enclose a stamped, self-addressed envelope to insure answering.

Question: Is it possible for girls or women to pilot an airliner? M. G., Harrison, Arkansas.

Answer: Considered practically, the answer is no. Undoubtedly many well-known women pilots have the skill and experience for the job, but the airlines wouldn't think of hiring them because of the popular distrust of woman's supposed physical frailty and temperamental incapacity. Furthermore, some women pilots have agreed with that opinion. So that's the situation, and I don't think it's likely to change very soon.

Question: I am particularly interested in lighter-than-air craft. Are there any large rigid airships in service today or under construction other than the new German ship being built? Would an all-metal airship 1,200 feet long, with metal skin like the navy's ZMC-2, be possible and practical for commercial routes? Has anything come of the Metalclad Airship Corporation's plans to build their all-metal airship MC-38? G. C., Edmonton, Canada.

Answer: There are two large rigids in existence today; neither is in active service any longer. The *Graf Zeppelin*, LZ-127, has been retired after an honorable career of eight years of ocean hopping and is now maintained as an airship "museum" at Frankfurt. The U. S. navy's *Los Angeles*, LZ-126, going on fourteen years old, has been removed from active service but is being used at Lakehurst for mooring experiments. Germany is building the LZ-130 and is about ready to start the LZ-131.

Metalclads are still a subject of controversy, although the little ZMC-2 has made a fine record. Metalclad engineers claim that a big one would actually weigh less than a fabric-covered type of the same cubic capacity, and that it would be stronger. If true, that would seem to answer the question of practicality. But for commercial use, you have to reckon the dollars and cents. The initial cost might be higher; I don't know. As to one 1,200 feet long——! The *Hindenburg*, largest dirigible ever built, measured only 772 feet. Furthermore, for best structural efficiency in the metalclad design, the hull must be fat, unlike that in a Zeppelin type. The "fineness" ratio—thickness vs. length—would be perhaps 1 to 3 or 4 (the ZMC-2 is 1:2.8). That would make your 1,200-foot ship 400 or 300 feet thick, requiring a monster dock—the Lakehurst hangar is about 200 feet high—and an enormous amount of gas.

I don't know what was done about the MC-38. The Metalclad Airship Corp., Marquette Bldg., Detroit, Mich., might give you this information.

Question: How many kinds of motors for airplanes are there in the United States? C. S., Hillburn, New Jersey.

Answer: Here are figures revealed by a survey of engine manufacturing companies which are more or less actively producing today.

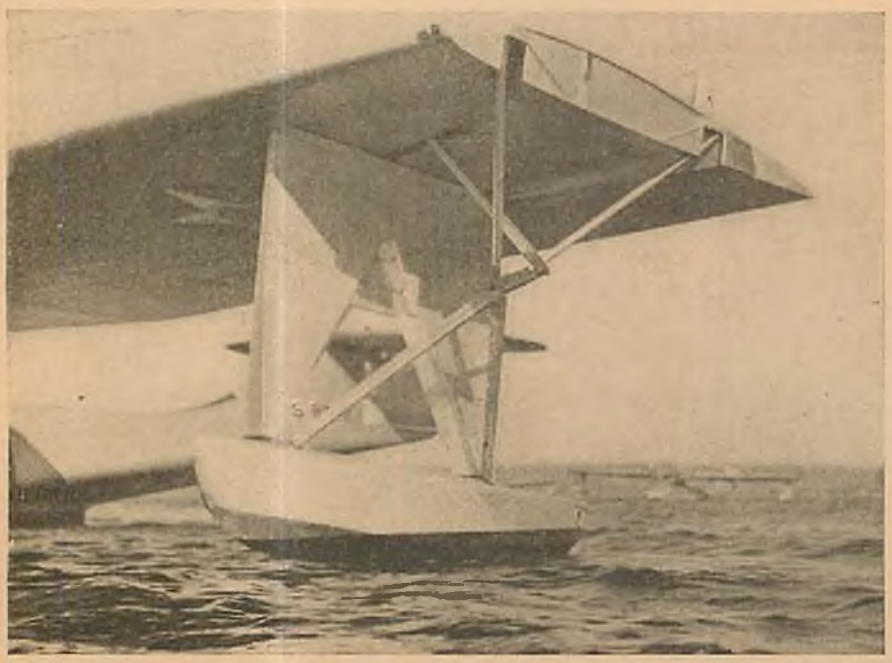
There are twenty manufacturers of gasoline engines. This does not include one manufacturer of a Diesel engine and one manufacturer who has produced an aero steam engine, neither of whom are doing much at present.

Three of the manufacturers make 4 models of horizontally opposed engines—cylinders lined up in opposite rows—including 2 to 8 cylinders, covering a power range of 40 to 120 h.p.

Five manufacturers make 13 models of air- or liquid-cooled in-line engines—3 set in V shape—of 4-12 cylinders and 25-1,000 h.p.

Thirteen manufacturers of radial engines (one is also included in the in-line total above) make 62 models of 3-14 cylinders representing 37-1,000 plus h.p.

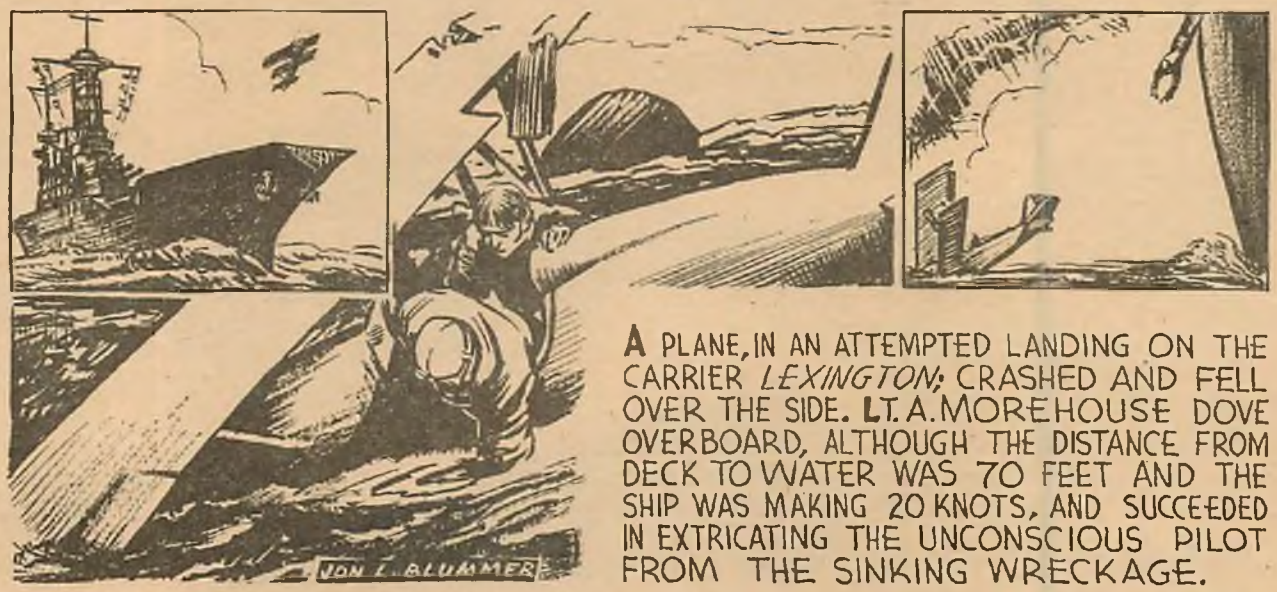
That gives a total of 89 modern gas aero engines, in addition to the converted automobile engines mentioned.



This interesting close-up shows how the wing tip of the Consolidated flying boat lowers to become a wing tip float.

SPLIT-SECOND ACTION

Hair-breadth escapes, hair-trigger decisions, dangerous moments that come once in a lifetime.



A PLANE, IN AN ATTEMPTED LANDING ON THE CARRIER *LEXINGTON*, CRASHED AND FELL OVER THE SIDE. LT. A. MOREHOUSE DOVE OVERBOARD, ALTHOUGH THE DISTANCE FROM DECK TO WATER WAS 70 FEET AND THE SHIP WAS MAKING 20 KNOTS, AND SUCCEEDED IN EXTRICATING THE UNCONSCIOUS PILOT FROM THE SINKING WRECKAGE.

MAJOR F.L. MARTIN AND SERGT. A. HARVEY, ONE OF THE TEAMS IN THE FAMOUS ARMY 'ROUND-THE-WORLD FLIGHT, BECAME SEPARATED FROM THE OTHER FLYERS WHEN THEY WERE FORCED TO LAND FOR ENGINE REPAIRS. IN AN EFFORT TO REJOIN THEIR SQUADRON THEY TOOK A SHORT CUT. BLINDED BY FOG THEY CRASHED INTO A MOUNTAIN SOMEWHERE IN ALASKA. THE PLANE WAS WRECKED BUT THE MEN WERE NOT INJURED. THEN, FOR TEN DAYS, UNTIL THEY CAME UPON A CANNERY, THEY GROPED ABOUT IN DENSE FOG OR ENDURED THE TORTURES OF SNOW BLINDNESS, AND SUFFERED FROM HUNGER AND BITTER COLD.

HAVING LOST HIS WAY AND USED UP ALL HIS FUEL, H.H. GREEN, AN AMATEUR PILOT WAS FORCED TO SEEK A LANDING ON THE BEACH AT CONEY ISLAND, N.Y.. TO AVOID THE CROWDS OF PEOPLE THERE, HE LANDED HIS PLANE IN THE WATER. THE PLANE TURNED OVER AND WAS WRECKED, BUT THE PILOT AND HIS WIFE ESCAPED INJURY.

THE LIONS ROARED AND LEAPED FOR THEY THOUGHT THEIR LUNCH HAD COME DRESSED IN A PARACHUTE JUMPER'S CLOTHES WHEN TURNER, AN ENGLISH PARACHUTE JUMPER, AFTER AN EXHIBITION LEAP, HAD LANDED ATOP A CAGE OF THE BEASTS IN A LONDON ZOO. HE WAS RESCUED BY THE ATTENDANTS.

Official Photographs U. S. Army Air Corps.

Substratosphere Ship

The Army looks to the future by developing a pressure-sealed cabin ship for high altitudes—about the plane on the cover, the Lockheed XC-35.

By Frank Tinsley

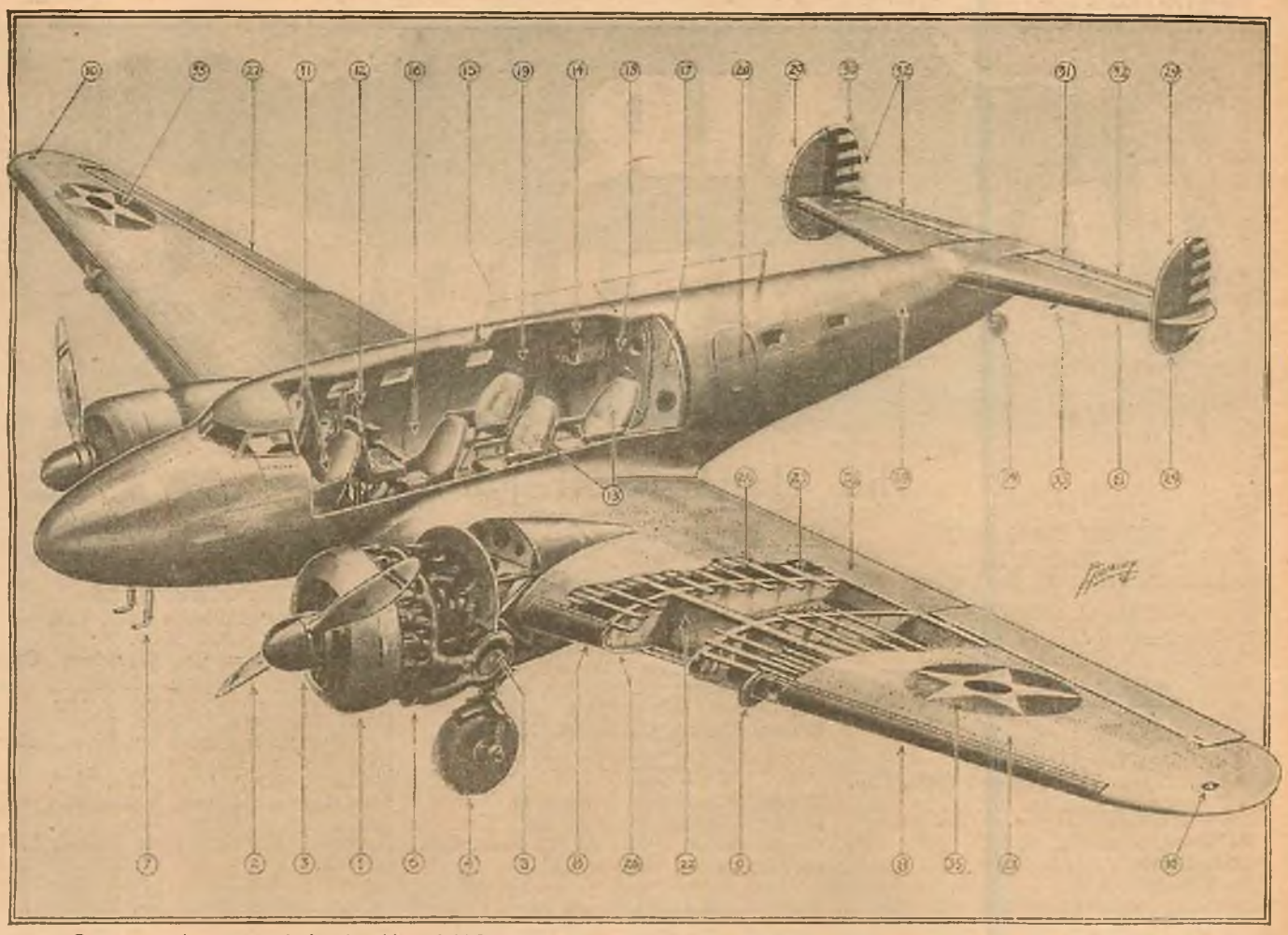
MANY problems, both technical and physiological, are involved in the army's present effort to solve the secret of transporting passengers in supercharged cabins through the substratosphere. Preliminary experimental studies, both here and abroad, have already brought to aviation's medical men and engineers, a considerable bulk of information relative to human reactions under high-altitude conditions. Much of this data is the fruit of experiments in the course of which human guinea pigs were imprisoned in metal chambers and subjected to controlled conditions of cold and oxygen starvation approximating those known to exist in the stratosphere and substratosphere.

These tests have established the absolute necessity of finding some means of supplying air passengers with normal amounts of oxygen at altitudes in excess of 15,000 feet.

Individual oxygen equipment of the type used by military and civil airplane pilots, is not adaptable to passenger transport for a number of reasons. Individual idiosyncrasies of air travelers plus an understandable lack of experience on the part of some of them in using the apparatus, would undoubtedly create a problem in practical management almost impossible of solution. The obvious answer is to turn the entire aircraft into an airtight structure inside of which sea-level atmospheric conditions can be maintained. This, like all obvious solutions, is not as easy as it sounds.

Many difficult angles require straightening before foolproof substratosphere flight can be made possible. The Air Corps has undertaken the job and is hard at work on the problem. In the specially built Lockheed XC-35 pictured on the cover, army pilots and engineers are taking off from Wright Field day after day and climbing to heights of 25,000 to 30,000 feet to study conditions and test equipment. The possibility of high-altitude flight in America rests in their competent hands.

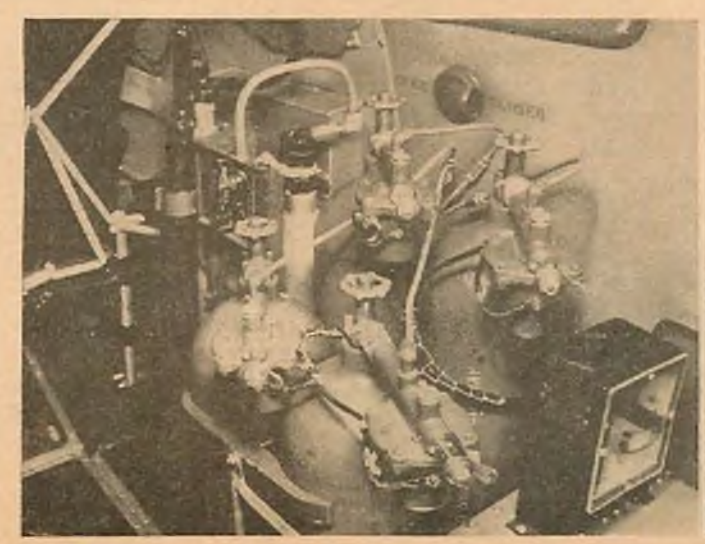
In external appearance the XC-35 closely resembles the standard Lockheed Electra. The only apparent difference consists of a rearrangement of the small cabin windows and the presence of superchargers on the motor nacelles. Internally, however, the XC-35 differs radically from the usual Lockheed passenger transport. The rectangular, portholelike windows open on a capacious pres-



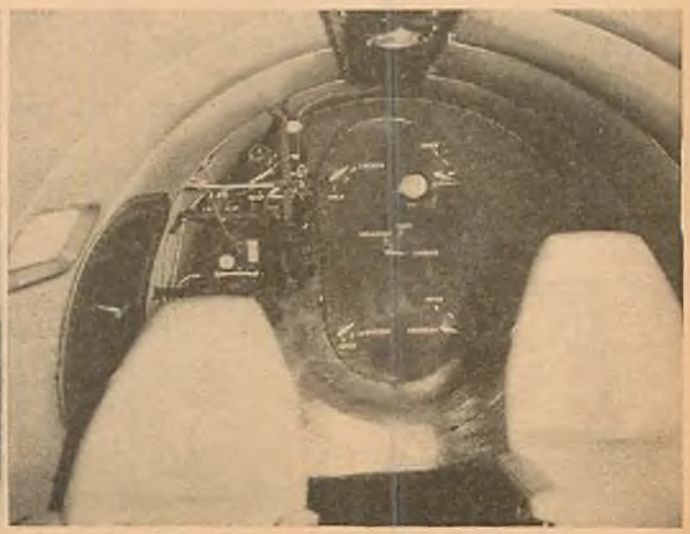
Cutaway drawing of the Lockheed XC-35; 1—Wasp engine; 2—Constant-speed propeller; 3—De-icing hub; 4—Retractable landing wheel; 5—Supercharger; 6—Air-intake scoops; 7—Pitot tubes; 8—De-icers; 9—Shielded landing light; 10—Navigation lights; 11—Pilots' seats; 12—Pressure compartment instrument board; 13—Observers' seats; 14—Radio; 15—Antenna; 16—Insulated walls; 17—Airtight bulkhead; 18—Pressure door; 19—Emergency door; 20—Entry door; 21—All-metal wing; 22—Spar; 23—Stringers; 24—Corrugated stiffening; 25—Outer skin; 26—Dural rib; 27—Aileron; 28—Heavy-skin fuselage; 29—Fins; 30—Rudders; 31—Elevator; 32—Tabs; 33—Balance weight; 34—Swivelling tail-wheel; 35—Army insignia.

sure-cabin which occupies the entire forward section of the ship. Sealed to maintain at all altitudes the atmospheric conditions usually found at 12,000 feet, the walls of the XC-35 are stressed to resist a pressure differential of fifteen pounds to the square inch. An airtight bulkhead separates the pressure cabin from the rear section of the fuselage, passageway being provided by a thick "icebox" door, fitted with a bull's-eye porthole and multiple locks.

A hot and cold air supply system insures equalized ventilation at all altitudes. A discharge *(Turn to page 81)*



Close-up of the XC-35's emergency oxygen and fire-extinguishing apparatus.



Rear airtight bulkhead and, left, emergency exit and radio.

The Honor Roll For May

FLIGHT CAPTAINS

Melvin Dupont, Rutland, Mass.
William H. Robey, D. O., Sullivan, Mo.

FLIGHT LIEUTENANTS

Eugene Hackett, Chicago, Ill.
Frank M. Allen, Littleton, Col.
Marcel Gould, Calgary, Alberta, Can.
David Keith Miller, Toronto, Ontario, Can.
Frank Randel, East Cleveland, O.
A. J. Hart, Fillmore, Mo.
Chester Anear, Prince Albert, Sask., Can.

ENGINE MECHANICS

Ed Sharp, Santa Fe, N. M.
Otnie Graves, Malden, Mass.
Clyde Wallace, Madison, Ind.
Frank J. Wilkins, Hamilton, Ont., Can.
Roland V. Brassard, Springfield, Mass.

PHOTOGRAPHERS

Shelby O'Brien Martin, Ross, Calif.
David Keith Miller, Toronto, Ont., Can.
Fred Greenberg, Philadelphia, Pa.
Bill Greeley, Milton, Mass.
Edward Duman, Old Forge, N. Y.

OBSERVERS

Eugene Schwarz, St. Bernard, O.
Hector McLean, Toronto, Ont., Can.
Chester Anear, Prince Albert, Sask., Can.
Anthony Lenac, Ottawa, Ill.
Harold Aaron, Richmond, Ind.
J. W. Foster, Miami, Fla.

TOPOGRAPHERS

Leonard Deere, Wichita Falls, Tex.
Alan Thayer, Athol, Mass.
Raymond Fowler, Jr., Waterbury, Conn.

AIRPLANE MECHANICS

David Thompson, Orlando, Fla.
Leo Powick, No. Auckland, New Zealand
John Rucigay, Brooklyn, N. Y.
Milton Rockwell, Jersey City, N. J.
Max Couche, Adelaide, S. Australia
Bob Rudolph, Morris Plains, N. J.
Joseph G. Singer, Queens Village, L. I., N. Y.

Stuffed Clouds

I THINK it was Al Williams who got off the prize aviation term a short time ago when he stated that one of the great drawbacks to the safety of flying was the hazard of stuffed clouds.

When he was asked what he meant, he said: "A stuffed cloud is one that has a mountain hidden in it."

I got a real laugh out of that when I first read it and then suddenly I realized the seriousness of the term. I realized that there were more stuffed clouds in aviation than appear in the skies.

No one can ignore stuffed clouds. There is a strict touch of finality about them, and you do not have to be in the cockpit of an airliner to get the full force of their effect. There are many forms of stuffed clouds masquerading under various guises.

Don't be a stuffed cloud! If you can't say a good word for aviation, keep quiet.

If you feel that there is something wrong with aviation, don't go blowing off steam before you put your case before someone who might be able to do something about it. If you know of something that is not strictly on the line, do something about it.

For instance, a short time ago a reader wrote a "beef" letter to me in which he called aviation and everyone connected with aviation all the names he could put on paper and still get through the mail. It seems that he had spent a certain sum of money for a certain aviation course and was astonished to realize that no one at th Boeing plant intended to do anything about him. Donald Douglas had never heard of him, apparently, and as for Lockheed, Curtiss and Grumman—well, he might as well have taken up oyster culture for all they cared.

In other words, after taking a course in aviation, he had been unable to find a job which he considered worthy of his brains and experience (?). So aviation was just another quack profession.

Just a stuffed cloud.

I know doctors who have spent four years on a college course. Then they have gone ahead and taken four more years in medical school. After that came two more as internes, and when it was all over, they found that they had a tough time for about five years working up a practice, and when they had finally worked one up, they required a lawyer to help them collect their bills.

But do they down the medical profession? They do not. They believe they are in the greatest business in the world.

The world-famous Fokker D-7. Photo by Robert Barton of South Bend, Indiana.

The other night I attended a dinner where many airline pilots were in attendance. I sat talking to one who interested me. He was a smart, upright chap who lived, ate and slept flying. After careful questioning I found out that he had worked his way through high school, worked his way through M. I. T. (one of the toughest colleges in the world to get through in that manner). He had worked day and night to raise the money to learn how to fly, and his tuition had taken at least ten years of his life, and to-day he proudly boasted that he was—a co-pilot.

A co-pilot! One of the toughest jobs in the world.

He takes all the hard spots, makes himself responsible for the flight plan, must kotow to the Flight Captain, and is allowed to take the wheel only over the most uninteresting and dreary portions of the run. His pay is but a fraction of that paid the Flight Captain—not much more than that given the hostess. He lives and dies just as hard as the man in the left-hand seat, and often has to sit there and watch another man fly him to glory or . . .

The Junkers F-13, photographed by Bill Burns of King's Mills, Ohio.

The old Boeing trimotored transport of 1929, by Robert J. Clark of Indianapolis, Indiana.

But my dinner friend was delighted with his position. The years he had put in to attain this comparatively low status were nothing in his young life. He was in aviation, and he wore his wings proudly.

He was no stuffed cloud. He worshipped his Flight Captain.

There are many of us who want to be on top all the time. We forget the hardships and work the man above us has been through, and many of us are only too eager to chop him down to clamber up to where he was.

Air Adventurers have a Creed and it's a shame if we can't instill it completely into aviation. Whether we are in commercial aviation or just a member of a model-building club we must keep the faith in flight. The desire to win and get on top is natural and must be encouraged. We must encourage our light-plane enthusiasts to carry on and move up from their 40 h.p. open-cockpit jobs to more elaborate and complex machines. We must assist our brother gliding pals to go beyond the primary stage and get into soaring. You model builders must lead the beginners along and make them try more difficult types which demand more skill, patience and effort.

Don't be a stuffed cloud!

The industry is wide open for those who want to get ahead. The Navy and the Air Corps have lowered their requirements and increased their flight cadet registration. More and bigger transports are being built and they will need Air Adventurers to man them. The light-plane manufacturers are adding space to their plants in an effort to turn out more and cheaper ships. Trained men are needed in every branch—to beat the stuffed-cloud menace.

Are you with us? Can you get one more member to sign the coupon below? Just his name and ten cents, and I'll do the rest.

Your Flight Commander,

Albert J. Carlson

AIR ADVENTURERS NEWS

NOW let's get on with the club business.

Boy! Are our Canadian members loading us down with information on the Imperial Airways *Cambria?* We can't blame them, of course, for the Empire flying boats are certainly putting up a splendid show in the transatlantic sweepstakes. Robert Currey of Toronto comes through with a grand letter describing his visit to the *Cambria* when she was moored at the Royal Canadian Yacht Club, and he tells us something we did not know about that flight. It seems when the flying boat attempted a landing for the Canadian National Exhibition, she hit a submerged obstruction and ripped off the port wing-tip float and had to stay there until a new one could be sent out from England. Currey sends us several interesting pictures which he took with a Model "A" Univex camera, a Belgian instrument which seems to turn out a well-defined shot. Despite its small size the photo was very clear.

One of the best letters we have ever received came from Warren E. Thomas of Waltham, Mass. Thomas, it seems, liked our little piece on "Ideals" and was not backward in saying so. He also informs us that he is a member of the 211th Coast Artillery, a National Guard outfit. He also gives us an inside on his attempt to get into naval aviation. "One must," he explains, "be a graduate of a recognized university or *(Turn to page 95)*

(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 .....

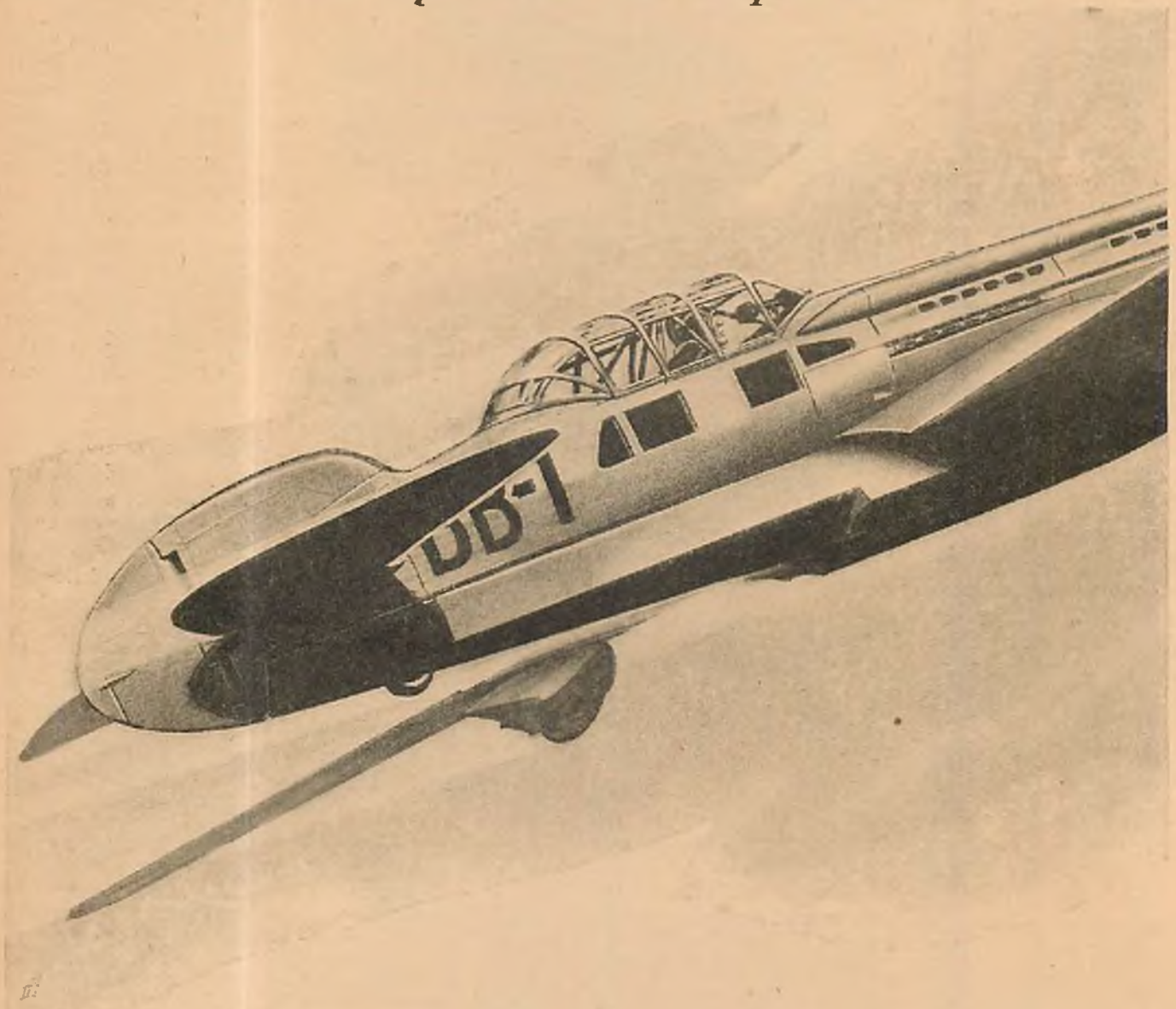
.....

☐ Check here if interested in model building.

(This coupon may not be used after June 15, 1935.)

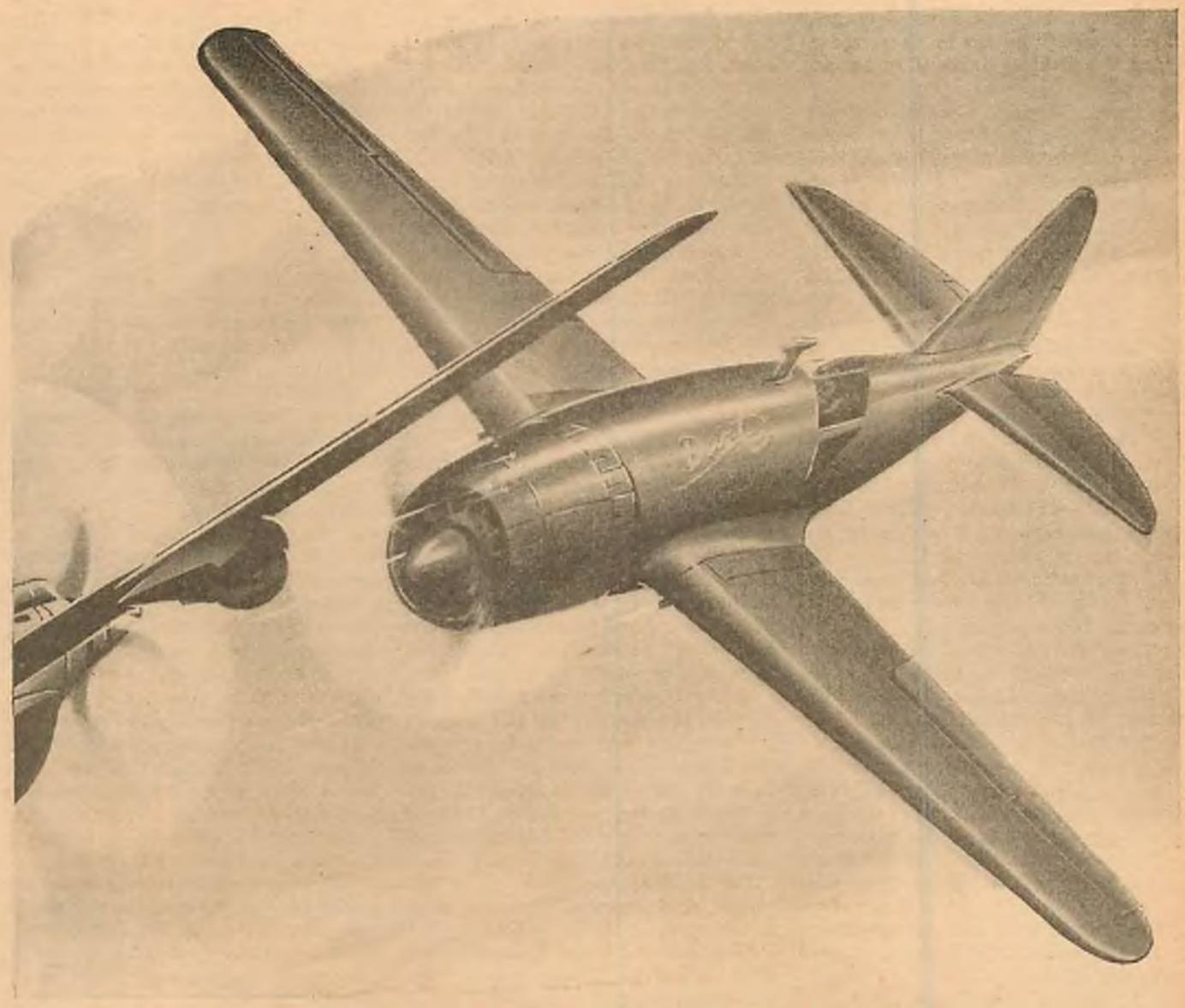
THE SAVER OF SOULS

Bill Barnes accepts a challenge on his home ground from a mysterious opponent who almost proves his superior—



By George L. Eaton

A Complete Bill Barnes Air Novel



They came roaring at one another, but both had the knack of seeming to fly on a straight course while they were actually drifting away from it——

BILL BARNES started nervously as the door of the living room of his bungalow on Barnes Field, Long Island, opened and "Shorty" Hassfurther, his chief of staff, entered.

He tried to conceal his nervousness from Shorty's keen, blue eyes without success. A frown creased Shorty's broad forehead as he saw Bill's right hand pull nervously at the collar of his white flannel shirt as though it was choking him.

Color stained Bill's bronzed face a deep red as he realized that Shorty's hard-bitten eyes had not missed a trick. His eyes fluttered away from Shorty's face to watch one of his black-and-scarlet-and-orange Snorters level off above the field for a landing.

"What's the matter, fellah?" Shorty said lightly. "You been smoking opium?"

"I sent for you over an hour ago," Bill said irritably.

Shorty stared at him in frank amazement. He could remember no time that Bill had ever spoken to him like that before.

"Sandy told me you wanted to see me when I was free," Shorty offered quietly. "He said there was no rush. I was talking to that tough lad from New Mexico."

"What's the matter with him?" Bill wanted to know.

"He's the one who claims we robbed him of several thousand acres when we made an aerial survey for his neighbor," Shorty said. "He says because of the survey his neighbor claimed, and the courts upheld him, a lot of his land. He blames it all on us."

"What the hell do we have to do with it?" Bill roared. "Throw him out on his nose!"

"And get a nice little lawsuit slapped on us," Shorty said. "A little diplomacy will do more good than a punch in the nose in this case. I have him almost convinced it isn't our fault. Don't worry about him. I'm more worried about you. What's the matter with you, Bill?"

"You named it," Bill said. "Worry! I can think of a lot of times when we've been in jams around here—all over the world, in fact. But I can't think of any time there have been so many different things hanging over my head. I'm as jittery as a cat on a hot stove. Now, you tell me about this dummy from New Mexico. Before this ends someone will be blaming us for the war in Spain."

"Tell papa," Shorty said. "You'll feel better."

"Well," Bill said, "listen to this one! You remember when I bought the land this field stands on in 1929?"

"I remember," Shorty said. "With your usual luck you managed to yank your dough out of an air-line project before the market fell down and went boom. You paid cash for it."

"I did," Bill said, "and got a swell bargain. The only trouble is I never got a guaranteed title. That was almost ten years ago. Now, up pops a bird who claims he has a quarter interest in it for which a release was never obtained by some previous owner. His lawyers are threatening to sue me if I don't pay him a lot of money."

"Why, he doesn't have a chance," Shorty said. "He has to secure redress from the previous owner if he has any claim."

"Sure," Bill said. "But he can cause me a hell of a lot of trouble and worry. On top of that one of my banks is heckling me about a loan I have there and it just happens that ready cash is tight. They've always been friendly but now they're getting disagreeable. Next," Bill held up three fingers, "the Maroma Mining people, who were going to replace our carrier-transport, are beginning to hedge. I gave 'em an estimate on the cost of a new one and they are shouting too much money."

"After that, what?" Shorty asked.

"That mysterious attack on Bev Bates over the Catskill Mountains a few days ago," Bill said. "You know that's a sign of trouble—big trouble. Those things don't just happen. Bev says he was lucky to get away with his life. The ship that attacked him had more speed and as great maneuverability as his Snorter, Bev says. He says if he hadn't got upstairs and turned on his oxygen he'd be fertilizing the Catskills."

Shorty's countenance was thoughtful now. His airiness had left him.

"On top of that Scotty tells me the men in the shops and hangars are dissatisfied about something," Bill continued. "He says he can't put his finger on it but someone is stirring up trouble. He has all of the men he is certain are loyal watching the rest of them. He says he's afraid he'll wake up some morning and find emery dust in the cylinders of the Lancer and the Snorters. A swell state of affairs!"

"Is that all?" Shorty asked.

"*All?*" Bill roared. "Isn't it enough? Now you tell me some coyote from New Mexico wants to sue us because someone else claims his property."

"They are all little things, Bill," Shorty said. "They aren't anything to be worried about."

"Well, what about this?" Bill asked as he picked up a letter from his desk. It was from the Bureau of Air Commerce in Washington. "'Certain aspects of your business and your planes have been called to our attention and it is requested that you visit the Director at his office at the earliest possible time,'" he read. "I suppose *that's* just a bag of shells too."

"That," Shorty admitted, "sounds as though it might mean a little bother. But it's nothing to worry about, Bill. Everything will iron itself out and you'll be laughing at yourself for getting the jumps. You have so damned much energy you can't sit back and take things in their stride. You have to tear things apart and see what makes 'em tick. Now, you take me——"

"You take you!" Bill snapped. "I got——"

But he didn't finish what he was going to say. Instead, he froze in his tracks as a long, high-pitched wail came out of the heavens above Barnes Field.

"It's a bomb!" Bill said, before the first one struck. He knew that familiar screaming whistle only too well.

They saw dust and dirt and débris shoot high in the air as they reached a window together. The force of that first detonation rattled the window through which they were gazing as the bomb plunged into the center of Barnes Field followed by another and another.

"Can you see the ship that's dropping them?" Shorty asked. His face was white and startled now as he strained to get a glimpse upward through the window.

Bill didn't answer him. He was, frantically, jiggling the saddle of a telephone.

"Give me Scotty MacCloskey, quick!" he shouted into the mouthpiece.

"Hello! Hello! Scotty!" he said to the majordomo and head technician of the field. "Is the Lancer ready to go?" There was a pause for an instant. "Get her warm," he directed. "I'll be out there in a minute."

Shorty Hassfurther was already going through the doorway as Bill dropped the telephone into its cradle and followed him. He grabbed at a helmet as he went out of the room on Shorty's heels. Their feet pounded on the hard concrete as they raced side by side toward the apron.

Far overhead they could see a low-winged, single-motored ship racing away to the south at terrific speed.

"She looks and sounds like a Northrop A-17A attack ship," Shorty gasped. "She has a rack for three twenty-five pound bombs underneath her. She's fast. You'll never catch her, Bill."

"I can try," Bill panted. "But I suppose she's nothing to worry about either!

"Anyone hurt?" he shouted at dour, old Scotty MacCloskey as he leaped into the front cockpit of the Lancer.

"No one, boy," Scotty said, trying to make himself heard above the roar of the Barnes twin Diesels in the nose of the Lancer. "He overshot. He was aiming at the hangars."

Bill watched the revs on his tachometer with one eye while he watched the fast-disappearing monoplane with the other. He licked his lips, nervously, as he waited for the revs to climb. The two triple-bladed, automatic-pitch props, revolving in opposite directions to neutralize torque, were shimmering discs in the late afternoon sunlight.

From the center of the prop cap peeped the muzzle of a 37mm. automatic engine cannon that was built integrally with motor in the V of the cylinders. Firing through the hollow prop shaft, it could pour explosive, incendiary or armor-piercing shells at the rate of three hundred shots a minute.

From troughs along each side of the engine peeped the noses of two .50-caliber machine guns. The guns were set on either side of the pilot's seat, within easy reach in case of jams. They were equipped with automatic ammunition counters and engine-driven synchronizing gear. The dull, burnished metal sight that sat directly before Bill's eyes was a telescopic one such as the U. S. Army uses.

At the ends of the silver, all-metal cantilever wings gleamed navigation lights. Underneath the belly, protruding slightly, were the slots containing emergency landing flares.

The pilot's cockpit, just back of the rear-wing spar, contained a complete set of blind-flying instruments, including the Kreusi short-wave direction finder, along with all the other instruments to be found in Bill's ships. The rear cockpit was equipped with a complete set of duplicate controls and navigating instruments and a flexible .30-caliber Browning mounted on a track in the rear of the pit. A sliding inclosure of shatterproof glass covered both cockpits completely, with an arrangement that permitted the rear section to be telescoped forward out of the gunner's way when in action.

In the fuselage, immediately behind the cockpits, in a locker, was the usual Barnes emergency equipment including a .45-caliber Thompson submachine gun, one Springfield rifle with a telescopic sight and one repeating shotgun.

The radio installation was easily accessible between the cockpits, with duplicate controls on each instrument panel. The head sets were adaptable for use as intercockpit phones, as they were on all of Bill's Snorters.

Bill gunned the twin Diesels until the whole world seemed to vibrate with their din. His hand came up above his head as Tony Lamport, the head radio operator on Barnes Field, gave him the all clear signal. He released his brakes and the gleaming silver ship rolled down the runway, carefully avoiding the three craters where the bombs had struck.

He whipped it off the ground with a smoothness and grace that was typical of his touch. The landing-gear light on the instrument panel gleamed as the amphibian gear folded completely into the fuselage and wings and the Lancer became a silver bullet that was a monoplane. The ship became a streak of grey light against the sky as Bill hung it on its props. He climbed to ten thousand feet, cursing steadily as he climbed because the low-winged monoplane that had dropped those bombs was gone completely from sight now. It had vanished as though it had flown inside some invisible aerial hangar.

Bill laid the nose of the Lancer due south and opened his throttles wide. His air-speed indicator climbed from three hundred to three-fifty, four hundred,

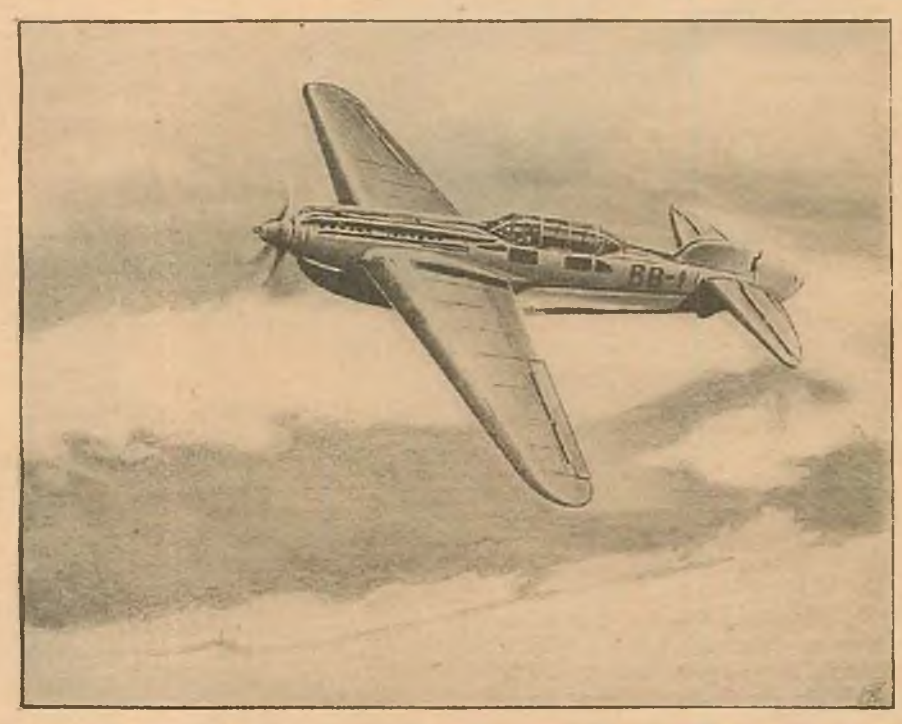
four-fifty. He swung around in a great sweeping circle, probing the air all about him, but the ship had disappeared.

His mind was a turmoil of seething emotions when he set the Lancer down on Barnes Field again. Shorty was standing on the apron when he climbed out of the Lancer.

" 'That,' Bill said to Scotty, quoting Shorty's recent remarks, " 'sounds as though we might have a little trouble. But it's nothing to worry about. Everything will iron itself out and we'll be laughing at ourselves for getting the jumps.' " He glared at Shorty. "Hell, no!" he went on. "That was just a fellah getting playful with seventy-five pounds of TNT. It was all in fun!"

"Listen, Bill," Shorty said.

"Listen, nothing!" Bill snapped. "I want you and Sandy and Bev Bates and Red Gleason over in my bungalow immediately. I want to see how loudly you can all laugh at these little jokes someone is playing on us!"



The long strip of brown and green and white sand that was Long Island rolled out under him——

II—UNSEEN ENEMY

IN A SMALL gymnasium that was part of a sumptuously furnished apartment on Park Avenue, New York City, the two men silently traded punches with light six-ounce gloves on their hands. They fought back and forth across the twenty-six-foot square of canvas that was laid in the center, neither asking nor giving any quarter. Once the knees of the younger man sagged and his opponent held him under the arms for a moment to keep him from falling. Only the smack of wet gloves, the shuffling of their feet and the painful drawing of their breath could be heard in the room.

The younger of the two men had the flat, broken nose of a professional pug. He was six feet, one inch in height and tipped the scales at a little over two hundred pounds. He was in the pink of condition and could hit with the force of a Missouri mule's kick. He had a punch in both hands and he could box. He was no ordinary pugilist. He could think as well as hit and he was using every bit of his skill now to keep his head from being torn from his shoulders.

The age of the older man might have been anything between thirty-eight and fifty, according to his mood. His hair was grey at the temples and his features were both ethereal and strong. The smile that occasionally flashed across his face was one moment pensive and the next as brittle and hard as winter sunshine. His lean, powerful frame was scarred like the body of any fighting man. His hands were long and thin, yet they had terrific strength. His blows never traveled more than ten or twelve inches but they had the smack of a pile driver.

He dropped his hands as the professional pug staggered again under the force of one of his blows. "That will be enough for today, Lee," he said.

"It was enough for me two rounds ago," Lee said, between swollen lips. "You're getting in fine shape, Mr. Murphy. You're hitting the way Dempsey used to hit."

Mordecai Murphy didn't answer because he was already thinking about something else. He lathered his body with soap in a shower off the gymnasium and stepped under a stream of hot water. After that he stepped in a steam room for five minutes and then ducked under an ice-cold shower. He beat at his stomach muscles with his fists while the cold water pelted his hard body.

A half hour later he was sitting behind a desk in the office that was a part of the twenty-room apartment. He wore his clothes draped on his body as only a Bond Street tailor can drape them.

Where Mordecai Murphy came from no one knew. There were rumors that his grandfather had been one of those hard-riding, hard-fighting Irishmen who helped to conquer the pampas of South America; that his grandmother had been the daughter of a Castilian don. His enormous fortune was supposed to have come from South American oil and emeralds. Others had it that it came from a half dozen filibustering expeditions in as many different countries.

He was known to have a finger in the affairs of dozens of enterprises of good and doubtful reputation in every part of the world. He had been decorated a half dozen times. Many items appeared about him in the press. But never anything definite.

He was both an amazing man and one of mystery.

He had apartments in New York, London and Paris. A hacienda surrounded by thousands of acres in Brazil, a villa on the Riviera and a yacht named the *Haman*, aboard which he touched all the known, and some unknown ports of the world.

He pressed a button on his desk and a slim, pale-faced man entered and crossed the room noiselessly. Murphy looked at him expectantly without speaking.

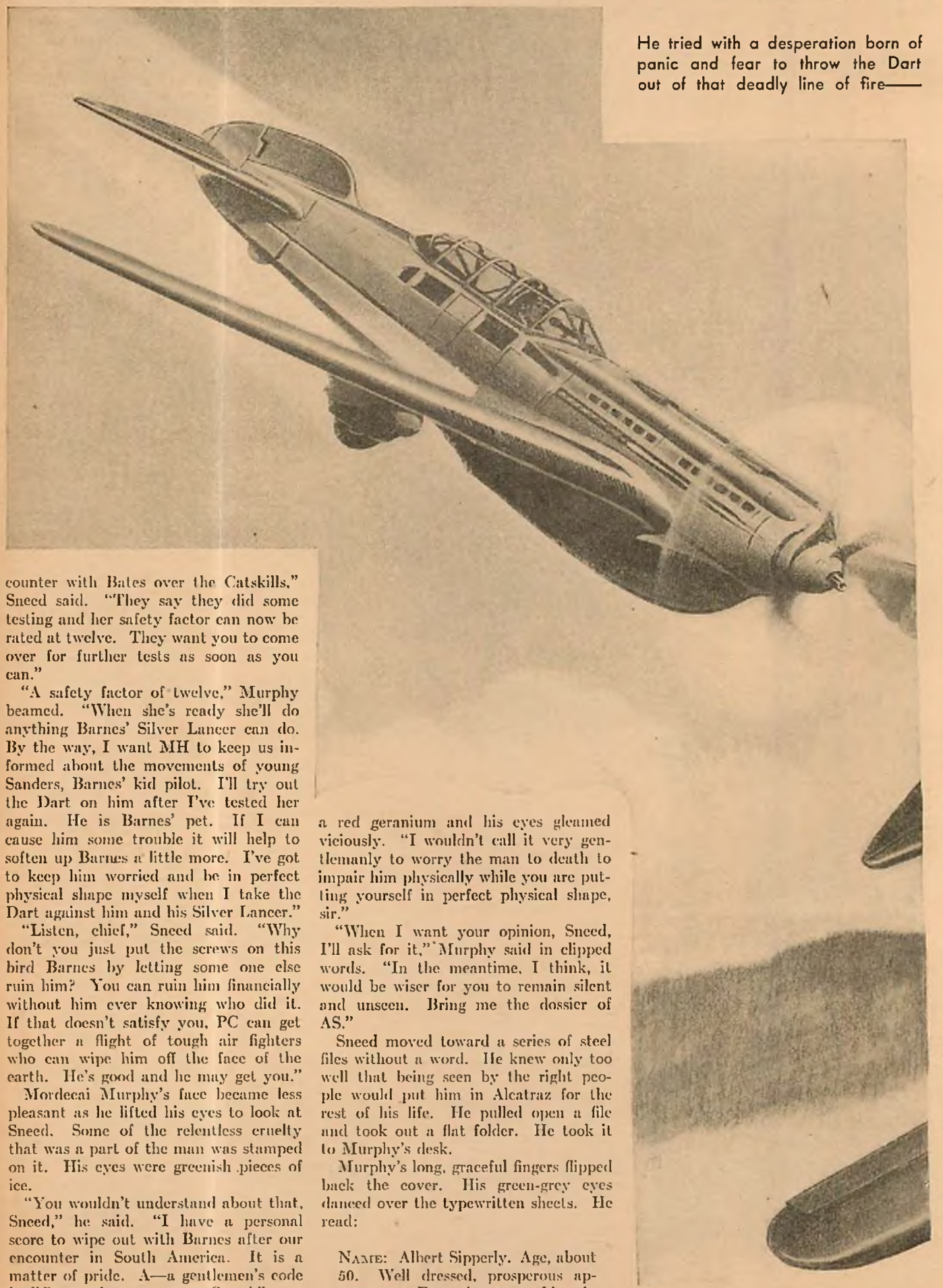
"PC flew above Barnes Field and dropped three bombs that detonated near the center of the field," said the man whose name was Lester Sneed. "He did not try to hit the hangars. Barnes, or one of his men, took the air a few minutes later but he was away before they could catch him. He purposely avoided hitting the hangars as you ordered."

"Fine," Murphy said. "That will put another harpoon in Barnes. What does MH report?"

"He reports that Barnes is visibly worried," Sneed said. "MH is spreading propaganda among Barnes' men on the field since he started working in the technical department. The men are becoming restless and Barnes can't find out why."

"Excellent," Murphy said. "Be sure MH does not commit any sabotage until we are ready. What do you hear from the Ludlow people about the Dart?"

"They telephoned a little bit ago to say they have made the corrections in the Dart you suggested after your en-



He tried with a desperation born of panic and fear to throw the Dart out of that deadly line of fire——

counter with Bates over the Catskills," Sneed said. "They say they did some testing and her safety factor can now be rated at twelve. They want you to come over for further tests as soon as you can."

"A safety factor of twelve," Murphy beamed. "When she's ready she'll do anything Barnes' Silver Lancer can do. By the way, I want MH to keep us informed about the movements of young Sanders, Barnes' kid pilot. I'll try out the Dart on him after I've tested her again. He is Barnes' pet. If I can cause him some trouble it will help to soften up Barnes a little more. I've got to keep him worried and be in perfect physical shape myself when I take the Dart against him and his Silver Lancer."

"Listen, chief," Sneed said. "Why don't you just put the screws on this bird Barnes by letting some one else ruin him? You can ruin him financially without him ever knowing who did it. If that doesn't satisfy you, PC can get together a flight of tough air fighters who can wipe him off the face of the earth. He's good and he may get you."

Mordecai Murphy's face became less pleasant as he lifted his eyes to look at Sneed. Some of the relentless cruelty that was a part of the man was stamped on it. His eyes were greenish pieces of ice.

"You wouldn't understand about that, Sneed," he said. "I have a personal score to wipe out with Barnes after our encounter in South America. It is a matter of pride. A—a gentlemen's code is different than your own, Sneed."

Sneed's pale face became the color of a red geranium and his eyes gleamed viciously. "I wouldn't call it very gentlemanly to worry the man to death to impair him physically while you are putting yourself in perfect physical shape, sir."

"When I want your opinion, Sneed, I'll ask for it," Murphy said in clipped words. "In the meantime, I think, it would be wiser for you to remain silent and unseen. Bring me the dossier of AS."

Sneed moved toward a series of steel files without a word. He knew only too well that being seen by the right people would put him in Alcatraz for the rest of his life. He pulled open a file and took out a flat folder. He took it to Murphy's desk.

Murphy's long, graceful fingers flipped back the cover. His green-grey eyes danced over the typewritten sheets. He read:

NAME: Albert Sipperly. Age, about 50. Well dressed, prosperous appearance. Executive type. Lives in Bound Brook, N. J. Belongs to

several clubs, including Princeton Club. Owns hunting lodge in North Carolina.

Occupation: Broker. A large clientele. Old college friends and women.

Where Encountered: Dinner party at MR'S home in Westchester in 1929.

Weakness: Gambling in any form. Lost $5000 at roulette at MR'S home, night encountered.

Difficulty From Which Saved: Hypothecating customers' securities during crash of 1929. About to be indicted and jailed when he was furnished with sufficient cash to clear himself. Was very grateful and promised to repay debt in any way requested at any time.

Method of Approach: Put him in line to make money. Lives beyond his means. Would enter into any doubtful proposition suggested if there was sufficient profit.

Record of Service:

There the record ended. There was no entry under Record of Service.

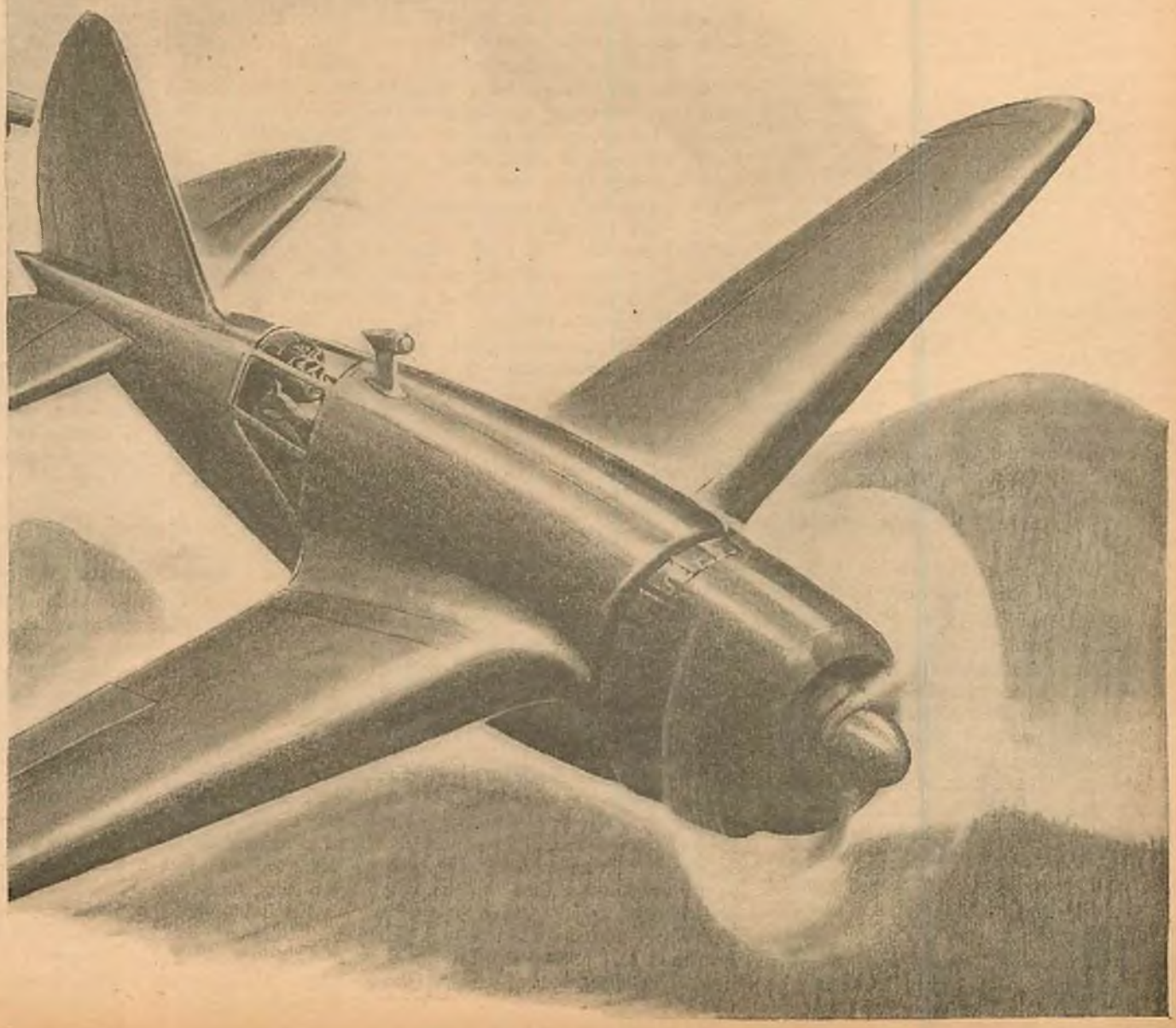
Mordecai Murphy closed the folder and leaned back in his chair. After a moment he said to Sneed, "Make contact with AS and invite him here for dinner with me tomorrow night. Impress on him that it is imperative that he let nothing else stand in the way."

"Yes, sir," Sneed said. "Just the two of you, sir?"

"Just the two of us," Murphy said. "Tell him I have some business I wish to talk over with him."

After Sneed had left the room Mordecai Murphy leaned back in his chair and closed his eyes. Through his amazing brain marched a long file of men and initials. They marched from every corner of the globe and joined in one long line in his brain. They came from North and South America; Europe and Asia; Africa and Australia.

They were a long array of men whose destiny he had once held in the palm of his hand. Men whom he had encoun-



tered when they were in desperate need of aid. Men he had snatched out of jails and dungeons, and the jaws of death to give them a new lease on life. To them he had been the great emancipator. The great saver of souls.

But he had not saved them for themselves. He had saved them to serve as stooges in his astounding mill of crime and greed.

He had saved their souls that he might sell them.

III—READY

BILL BARNES glanced around the little circle of faces assembled in the living room of his bungalow. His eyes flitted from the broad, Pennsylvania-Dutch face of I. Kinter "Shorty" Hassfurther to the round, hard-bitten face of Eric "The Red" Gleason, who had been Shorty's constant companion and friend since those days back in 1917 when they were flying French and British planes over the German lines. "Red" Gleason's carrot-colored hair was his trademark. It was known wherever airplanes were flown.

Beside Red sat Beverly Bates, the brown-eyed Bostonian who had become an expert and veteran pilot in Bill's service. His precise Harvard accent and genial courtesy had caused more than one of Bill's enemies to scoff at him—until they met him in combat in the air. Then their laughter turned to panic as he showed them the tricks of the trade Bill had taught him.

A faint smile curled a corner of Bill's mouth as his gaze settled on the freckled-face, blonde-haired, sixteen-year-old kid who was his particular protégé, Sandy Sanders.

At the moment young Sandy was showing Bev Bates how to make a fifty-cent piece disappear. He held the coin between his thumb and forefinger, dipped his hand downward and the coin was gone.

"Very clever," Bev said. "How do you do it?"

"Here, give me the coin, kid," Shorty said. "I'll show him how it's done."

Sandy made a lightninglike pass with his hand and the coin appeared again. He handed it to Shorty but his expression was one of suspicion as he did it. Shorty and Red Gleason devoted at least a quarter of their time to making Sandy's life miserable. Shorty took the coin and stuck it in his pocket.

"Thanks, kid," he said. "Now you only owe me a dollar and a half of that two bucks you borrowed last week."

"Why, you lousy gyp!" Sandy stormed.

"All right! All right!" Bill broke in. "Pipe down, Sandy."

"Listen, Bill," Sandy said and there were tears in his voice, "that thieving lug just stole fifty cents from me. He took——"

"I never saw the boy in my life before," Shorty said.

"Shut up, Sandy!" Bill snapped. "I didn't ask you here to quibble about a fifty-cent piece." He stopped for a moment to glare at Sandy. "I want to tell all of you what has been happening around here in the past few days. After I tell you you can put those three bombs that were dropped a bit ago in at the end as a period."

He went over the same things he had told Shorty earlier in the day, elaborating a bit more on details. Then he summed the whole thing up.

"Until someone dropped those bombs a bit ago," he said, "I was under the impression that it was just chance that all these things happened simultaneously. Now I know better. It is a concentrated effort to run us out of business and it is being engineered by someone with a lot of drag. They are after us directly this time, not because we've taken on some job to help some one else. They're gunning for me and if they keep putting on the pressure they may get me. If they can put enough weight behind their demands the Bureau of Air Commerce may take a hand. That will mean we all lose our licenses."

"Listen, Bill," Shorty said. "Considering your record and the things you've done for the government on a dozen different occasions, I don't think you'll have to worry about that angle. You can go pretty high up in government to ask for help yourself."

"Yes," Bill said, "but I don't want to unless it becomes absolutely necessary. I want to save the aces I have in the hole until I'm in a real jam. First, do any of you have any ideas as to who is creating the dissatisfaction in our own outfit?"

"What new men have you taken on?" Bev Bates asked.

"None," Bill said. "Unless you want to consider Marty Hogan. He is working with Scotty in the engineering department. But he is an old friend of Red's. He is an old-timer. You knew him first in France, didn't you, Red?"

"Yes," Red said slowly. "I knew him in France. He had an excellent record. But he got himself all jammed up later on." Red stopped and chewed at his lip for a moment. "Perhaps I should have told you this before, Bill, but Hogan got himself pretty far in the red with the Merton Aircraft people when he was managing their field in Pittsburgh. According to the stories that were whispered around he sold a lot of their equipment and pocketed the money. It was said at the time that he would probably go to jail. Then, it was all hushed up and the Merton people let him resign and we all decided that it was just office politics, or one of those things."

"Yes," Bill said, "you should have told me. Do you know where he got the money to square himself?"

"No," Red said. "I don't even know that any money was necessary. He has held a couple of good jobs since then. He quit the last one to come with us, you know. He told me he was dissatisfied and thought he would have a better opportunity here."

"I don't know what made him think that," Bill said. "His job doesn't amount to much. I think Mr. Hogan is going to bear watching. Don't let him know you suspect anything. Just keep your eyes open, all of you. He may have been placed here to cause us trouble."

"We had better find out a little more about his private life," Red said. "I've been out of touch with him for years."

"You do that, Red," Bill said.

"About this bird who claims to have a quarter interest in this property, Bill," Shorty said. "He doesn't have a leg to stand on."

"He doesn't need any leg to stand on if he can get me all tied up in litigation that will take a lot of my time," Bill said. "But I'm not so worried about him. I think my lawyer can handle him. I'm more interested in the person who attacked Bev over the Catskills. After that bombing this afternoon the attack on Bev means something. The two fit together. The only thing that's lacking in this whole affair is the motivation. We've been bombed and attacked before, as I said, but it has always been because we were working on some dangerous job for someone else. We're not working on any job right now."

"But remember, Bill," Sandy said, "sometimes we've been attacked or been warned to lay off a job before it was even offered to us. You remember on that South American job when we lost the carrier-transport, you received a warning not to touch the job before you even heard from Buzz Harding. I was with you at the time."

Suddenly Sandy's eyes widened and his mouth opened and closed like the mouth of a fish out of water.

"Say!" he said. "What about that Saver of Souls? He wrote you that note saying he was going to pay you for smearing up his plan to keep that machinery out of the Maroma Valley. Maybe he's behind this!"

"What note?" Shorty asked, quickly. "You never told us about it, Bill."

"I forgot about it," Bill said. "I didn't consider it of enough importance to mention. He has nothing to do with this. He was just a South American politician, probably. If he is bothering anyone he's probably bothering Buzz and Ned Bunyon. I've had too many notes like that to attach any importance to them. He wrote me a note the day we finished our job down there saying there was not room enough in the world for

him and me, just signing it 'Saver of Souls.' But we've wandered away from the thing we were talking about. What about that attack on you, Bev? Was there anything about the plane or the tactics of the pilot that would help us to identify him?"

"Nothing in particular that would be of any use to us," Bev said. "She was a low-winged monoplane, beautifully streamlined and finished in jet black. She had what sounded like a Meredith Twin Vulcan power plant that gave her a good four hundred miles an hour and she could climb like the Lancer. Her performance was something to make your eyes pop. She had a pair of .50-caliber Brownings that were synchronized through the prop.

"But none of that will be of any value to us because we don't know who produced or designed her. I've checked all over the country and can't find anyone who knows anything about the ship. All I know about the pilot is that he fitted the ship perfectly. They were both good. He knew tactics and strategy, and I've never seen anything quite like the plane before. I think, Bill, that it could match the Lancer in speed and maneuverability."

"Bosh!" Bill said angrily. "I'll have to see it before I'll believe it."

"I hope you don't see it under the same circumstances I did," Bev said, quietly, his face crimson.

"I'm sorry, Bev. I didn't mean that to sound the way it did. I'm jittery and irritable. Excuse, please."

"Forget it," Bev said.

"The thing is," Bill went on, "we've all got to keep our eyes open. I'm going to have Scotty keep the Lancer and a Snorter always ready to go on the apron, and double the guards around the field. If any of you take a ship off the field keep your eyes open every minute of the time.

"There is something insidious and cunning behind the whole thing. I don't like it. We've been having a run of lousy luck. We lost the carrier-transport and a Snorter on that South American trip. Before that we suffered the greatest loss in our career—one that the loss of planes cannot compare with. You know what I mean by that—the deaths of Cy Hawkins and Mort Henderson.

"I want to hold our little squadron together and go on doing business as we have done it in the past. But I can't take the chance of risking any more of your lives. That's something I can't stomach. I would sooner disband and call it a day. That's why I want you to be careful. This may be a crisis in our lives. Let's see if we can't handle it the way we've handled such things in the past. I think that's all we have to talk about," he finished.

They filed out of his living room with different expressions written on their faces. But in their minds there was but one tragic thought. That Bill had even considered disbanding his famous little squadron.

The Saver of Souls.

IV—BAIT

TWO MEN sat in a smoke-laden room of the office of a small airport and airplane factory, hidden deep in a little-inhabited section of tidewater Virginia.

It was early morning and the mists were just lifting off the field, giving it an air of unreality. Along the far side of the field, beside a diminutive hangar, were a half dozen nondescript planes. Next to the hangar was a larger building that was securely locked.

One of the men in the office, Bruce Swaidon, ground out his cigarette in an ash tray and walked to a window. Suddenly, he cocked his head on one side in an attitude of listening.

"That'll be Mr. Murphy," he said as a plane roared down across the field and came back for a landing.

The other man, Barney Little, nodded without speaking. He was thinking about that armed juggernaut that stood behind the locked doors of the shop on the other side of the field.

"It'll be clear in a little bit," Swaidon said as he went out on the field to greet Mordecai Murphy.

They talked for a moment, then Swaidon shouted at a couple of mechanics and went over to unlock the doors of the little airplane factory.

Mordecai Murphy's eyes shone with pride as he looked at the remarkably clean lines, and hand-rubbed black surface of mirrorlike smoothness of the little low-wing, cantilever monoplane that had the single word "Dart" written on the side in silver.

A mechanic kicked over the motor and the 1500 h. p. Twin Vulcan power plant roared into action. The three-bladed, constant-speed propeller became a shimmering disc as the automatic mixture control poured soup into the engine.

The landing wheels of the little fighter tucked smoothly into the wing and fuselage when the ship was in flight. The belly of the fuselage was strongly reenforced against emergency landings without wheels and the tail skid was a combination wheel and skid for soft and hard landings. All the control surfaces were provided with trimming tabs that could be adjusted from the cockpit during flight.

The cockpit cover was a pivoting wind screen which retracted during flight to form a skylight top to the pilot's compartment. Small elliptical windows in the sides of the fuselage provided fur-

ther visibility. The top and side lights, of safety glass, were faired smoothly into the fuselage form to present an unbroken line from nose to tail.

Fresh air was circulated through the cabin by means of an aluminum duct connected with an opening in the leading edge of the wing. This would prevent the concentration of carbon-monoxide fumes in the cockpit when the ship was in action.

Inside the cockpit was an automatic pilot for use if the twin .50-caliber machine guns jammed in the air. A Sperry gyro-magnetic compass and an aperiodic compass and exhaust-gas analyzer were on the instrument panel in addition to the regular set of complete instruments.

There was a 50-watt, two-way radio set designed to pick up beacon signals as well as messages on the communication bands. The transmitter was provided with two frequencies, 3,105 and 3,120 kilocycles. There was also an ultra-high-frequency transmitter and receiver to operate on a 1-to-5 meter wave band.

The little fighter carried an oil tank of twenty-five gallons capacity, separated by a fire wall from the 230-gallon gas container that would carry it nearly two thousand miles.

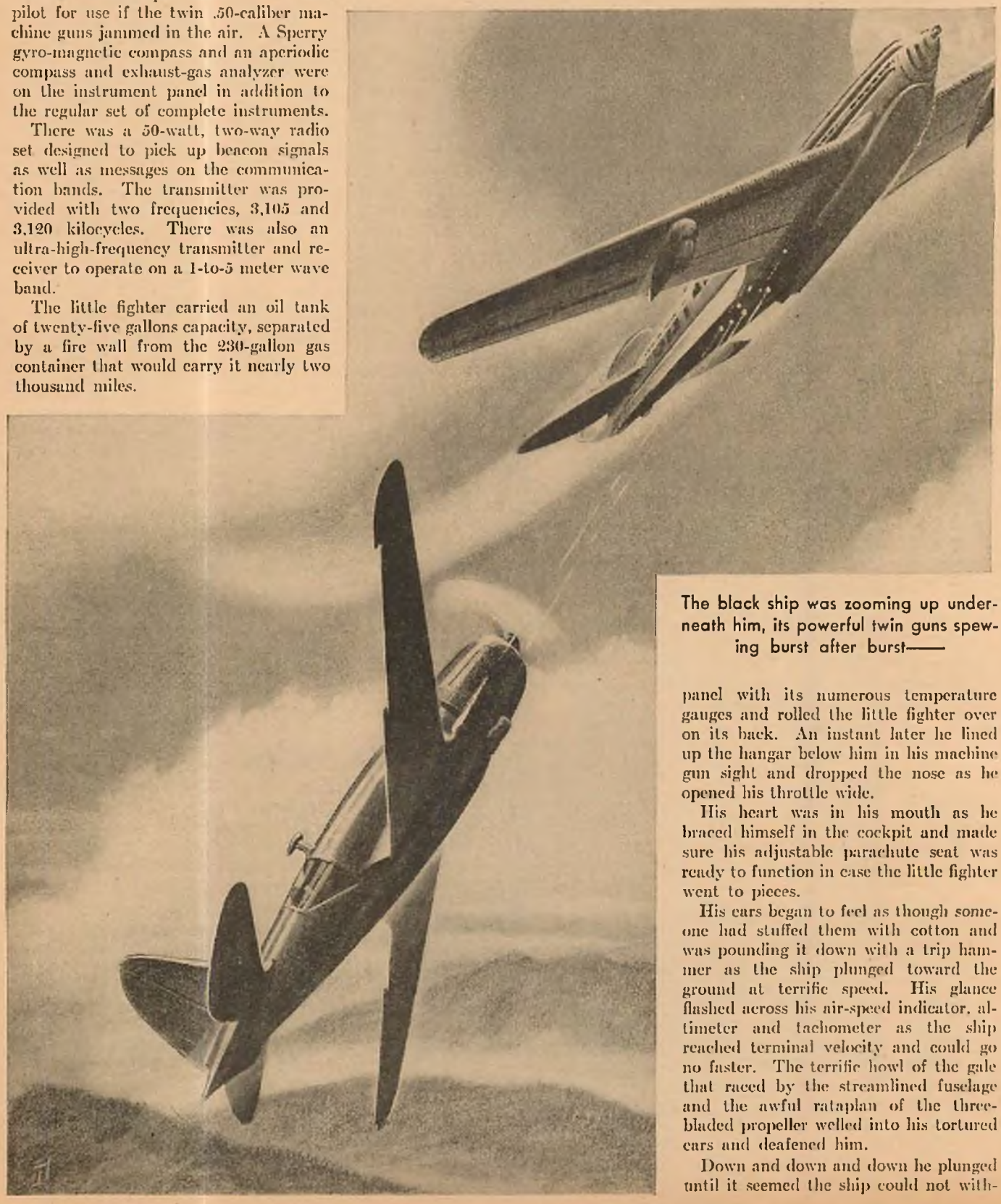
"Oh, oh!" Mordecai Murphy said. "Swaidon, she's a sweetheart! She'll do the job."

"You'll want to test her terminal velocity this morning?" Swaidon asked.

Murphy went outside the shop and probed the sky. "Right now," he said. "I'll want to use her within a few days. I'll want her ready."

He climbed into the cockpit and took the ship out of the shop under its own power. Swaidon gave him some instructions which he couldn't hear because of the deafening roar of the power plant, just before he took her into the air with the speed of a bullet.

Once off the ground he took the little fighter upstairs with the speed of light. At twenty thousand feet he switched on the oxygen supply that fed directly into the sealed cabin. He flicked his eyes across the instrument panel with its numerous temperature gauges and rolled the little fighter over on its back. An instant later he lined up the hangar below him in his machine gun sight and dropped the nose as he opened his throttle wide.



The black ship was zooming up underneath him, its powerful twin guns spewing burst after burst——

His heart was in his mouth as he braced himself in the cockpit and made sure his adjustable parachute seat was ready to function in case the little fighter went to pieces.

His ears began to feel as though someone had stuffed them with cotton and was pounding it down with a trip hammer as the ship plunged toward the ground at terrific speed. His glance flashed across his air-speed indicator, altimeter and tachometer as the ship reached terminal velocity and could go no faster. The terrific howl of the gale that raced by the streamlined fuselage and the awful rataplan of the three-bladed propeller welled into his tortured ears and deafened him.

Down and down and down he plunged until it seemed the ship could not with-

stand the fearful pressure. His stomach felt as though someone had wrapped a log chain around all of his vital organs and a pair of draft horses were pulling at the other end. The propeller blades were traveling faster than the speed of sound now, to leave a vacuum behind them. As the two continuous walls of air slammed against each other behind the ship the din was like the thunder of the gods.

The little group of men who were watching that three-mile dive on the ground had their hands clenched and their lips were taut as they waited in agony for his pull-out.

Every few seconds Mordecai Murphy slithered his eyes off to the right to see the earth that seemed to be climbing up to meet him. At six thousand feet he eased back on the stick.

The wings were still on as he headed her up at a forty-degree angle before he leveled off. His insides felt as though someone had put them through a wringer. Cold, clammy perspiration dripped off his face as he set the automatic pilot to work and half collapsed in his bucket seat.

But a few minutes later he hung the ship on its props again. At twelve thousand feet he leveled off and put the little fighter through every trick in the repertoire of airmen. He came up and down in outside loops, to chandelle up and around with a speed that was dazzling. He came up in normal loops and half rolled the Dart level at the top with a speed that was terrifying. He barrel-rolled, sideslipped, skidded, did wing-overs and split Ss until he had the men on the ground softly cursing the brilliance of his acrobatics.

He went through a series of flat and inverted spins and then into a tail spin that brought the hair up on the heads of the men below. At the last minute when it seemed he could never pull out, when it seemed he was in an uncontrolled spin, he neutralized his control, gave the motor all she would take to warp and yanked the ship out.

He followed that with a low-speed loop, a climbing loop, a rocket loop and a zooming flick loop and ended up with "the spectacles," in which he did a vertical figure 8 that only a ship powered as the Dart was powered could accomplish.

Then, he fluttered toward the airport in a falling leaf that brought a sigh of relief to the men on the ground watching him. He flattened the little ship out and took it in for a perfect fast landing.

"That," he said to Swaidon as he climbed out of the cockpit, "will do it. She's the greatest little fighter I ever saw. She has everything."

"If she could stand what you gave her she can stand anything," Swaidon said. "Now that you know what she'll do what are you going to do with her?"

"That," Murphy said, fastening him with his cold eyes, "is none of your business, Swaidon."

"But we ought to market her, Mr. Murphy," Swaidon said. "We can make a fortune with her. A half dozen nations would pay a lot of money for her."

"Not yet," Murphy said. "Perhaps later. I want her kept here in the shop fueled and with her ammunition carefully checked. I want her to be ready to go on a moment's notice. Don't let anyone get near her. Keep her locked up and carefully guarded. She'll have to be ready to do all the things you saw me do a few minutes ago, when the time comes. After I am through with her you can put her on the market."

"Yes, sir," Swaidon said, and he regretted more than ever that Mordecai Murphy was in possession of positive information that would send him, Swaidon, to the electric chair if it were known.

He watched Mordecai Murphy climb into the plane that had bombed Barnes Field the day before. He cursed softly through clenched teeth as Pedro Cassata, the pilot, took the plane off the field and laid the nose on New York City.

Mordecai Murphy managed, after the first half hour, to put Mr. Albert Sipperly at his ease when he came to dine at his apartment that night. At first Sipperly was like a man who had been on an extended bender. His face was a little pale and his hands shook as though he was afraid of something that might happen.

But after two of Murphy's excellent cocktails he began to lose his fear. He began to forget that Mordecai Murphy had once kept him from going to jail.

"I've been intending to get in touch with you for a long time," Murphy said. "But I travel a great deal and seldom have any time for anything but business when I'm in New York. How is your business coming along?"

"Better now," Sipperly said. "I've intended getting in touch with you also. I wanted to tell you why I haven't paid you the money I owe you."

"Don't worry about that," Mordecai Murphy laughed. "As a matter of fact, whenever I loan any money I write it off the books. That's the best way to keep friends and I value your friendship, Sipperly."

That was when Sipperly stopped being nervous. He had never quite known why Murphy had loaned him the money and now that he wasn't going to be dunned for it, or threatened, he didn't care.

They ate an excellent dinner, prepared as only Mordecai Murphy's chef could prepare it, and drank more than enough fine wine. After dinner, over a liqueur, Murphy got around to the reason for his invitation.

Sipperly was very nearly drunk and in an excellent condition for almost any proposition.

"Do you, by any chance," Murphy asked, "happen to be acquainted with Bill Barnes, the flyer?"

"No," Sipperly said, "I'm not. I know a man who knows him rather well."

"That's fine. I want you to have this friend introduce you in some way. I want you to know him well enough to ask him to visit that hunting lodge of yours in North Carolina."

"Eh?" Sipperly said, blankly. "What for?"

"He won't actually visit you," Murphy said. "But I want you to get to know him well enough to ask him and have him accept the invitation."

"How can I do a thing like that?" Sipperly asked. "He's a rather important figure. I don't imagine he'd accept any offhand invitation that came from me."

"I don't want it to be offhand," Murphy said. "You have a reputation for being a very entertaining man with a great many interesting friends. You should be able to manage it very easily."

"I don't imagine I could talk Barnes into such a visit. I'm not that good a talker."

"You were good enough to talk me out of nearly a hundred thousand dollars," Murphy said grimly.

Then it began to dawn on Sipperly that this wasn't just a casual little dinner party to renew old friendships. He frowned and shook his head to clear it.

"What's behind all this, Murphy?" he asked.

"That doesn't make any difference," Murphy snapped. "I imagine you want to keep your slightly tarnished reputation on Wall Street, don't you?"

"Certainly," Sipperly said. "I realize that I would probably be in jail now if you hadn't helped me out in 1929. I want to do anything I can to repay you."

"Then do what I tell you to and keep your mouth shut," Murphy said. "I want you to make Barnes' acquaintance and extend an invitation to him to visit your lodge in North Carolina."

"Naturally," Sipperly said. "After he gets there what do I do?"

"You won't have to worry about that," Murphy said. "He won't get there. Your lodge is twenty miles from Crownville. You will be waiting there for him in a car. But he won't arrive. Just handle the matter so that he accepts the invitation and tell me when he is leaving his field on Long Island. There your responsibility ends."

"What happens to him then?" Sipperly asked. "As I said he is an important figure and——"

"You don't have to worry about what is going to happen to him," Murphy said.

"All you'll know is that he was a friend of yours who was going to visit you and he didn't get there. If you don't know you can't get in any trouble. And don't mention my name to Barnes. He has never heard it and doesn't even know who I am. You'll take care of my request?"

"I suppose I'll have to," Sipperly said. "When do you want me to ask him?"

"Get acquainted with him first, well acquainted," Murphy directed. "The hunting season is almost here. I'll let you know just when to extend the invitation. What about another drink?"

"I will, thanks," Sipperly said dully. "I need it."

V—"YOUR TURN!"

YOUNG SANDY SANDERS stood in Tony Lamport's office on Barnes Field the next Saturday and made noises with his lips toward Tony that no one could mistake.

"Listen," he said to Tony, "for a guy who is supposed to be superintendent of communications around here you're not so hot. Why, you can't even get a long distance telephone call for me."

"Shut up, you pest!" the black-eyed Tony said. "They're trying to put your call through. There is something wrong with the lines."

"I could get down there quicker than you can get the call," Sandy said.

"Are you going to Norfolk?" Tony asked.

"Yeah. I had a wire last night from an old friend of mine. He goes to a military academy down there and wants me to come down for the week-end."

"Has Bill given you his permission to go?" Tony asked.

"Not yet," Sandy said. "I haven't asked him. He won't mind." But Sandy's expression indicated that he was afraid Bill might mind. "Say, wait a minute," he said. "Cancel that call. I can get down there in a hour. What's the use in wasting the money?"

"Okay," Tony said. "Now get out of here. I'm busy. And don't forget to tell Bill you're going."

Sandy's approach of the subject to Bill a few minutes later was one all his own. He went into Bill's office and sat down at the desk he occupied in the capacity of Bill's secretary. After a few minutes of pretending to be busy he got up, slammed shut a couple of drawers and said, "Well, I've got to be shoving if I'm going to get down to Norfolk on time."

"If you get where on time?" Bill said, noticing him for the first time.

"Norfolk," Sandy said, reaching for a helmet. "Don't you remember I asked you about using a Snorter because Burt Meadows, the fellow I'm going to visit, will want to take a hop? Naturally, I can't take him in the Eaglet."

"What the devil are you talking about?" Bill roared. "You didn't say anything to me about going to Norfolk to see any Burt Meadows in a Snorter."

"Oh, didn't I?" Sandy said blandly. "I intended to. It'll be all right, won't it?"

Bill chewed at his lip while a worried frown puckered his forehead.

"When are you coming back?" he asked.

"Monday morning," Sandy said. "Burt has to be back at his classes then."

"All right, kid," Bill said. "But be careful. I—I really shouldn't let you go. But you'll pester hell out of me if I don't. Get out of here!"

"Okay doke," Sandy said and disappeared as quickly as he could. He didn't want Bill to change his mind.

Fifteen minutes later he whipped a Snorter off a runway at the south end of the field and took it into the air in a long, low climb. He hadn't heard from his childhood friend, Burt Meadows, in over a year, and he was looking forward to seeing him. He knew what a kick Meadows would get out of having a friend visit him who was one of Bill Barnes' pilots and came in one of Bill's ships.

He took the Snorter up to eight thousand feet and checked his position as he sped above the lowlands of south Jersey.

Over that section of Chesapeake Bay where the Rappahannock River feeds into it he noticed a small, black low-wing monoplane far above him. But he didn't pay any attention to it. That is, he didn't pay any attention to it until it came screaming down on his tail to spray it with machine gun bullets. For one terrible moment Sandy sat frozen to his bucket seat, unable to move. Then he managed to slip his Snorter out of range.

He poured soup into his engine and zoomed up and over on his back as the black monoplane streaked underneath him with its prop screaming. At the top of his loop he half rolled the Snorter level and gazed over the side as the black ship pulled out of its dive and came around in a wide, sweeping bank.

"Oh, boy! Oh, boy! Oh, boy!" Sandy said aloud. "What the—what's the matter with him?"

He opened his throttle wide again and zoomed upward in an abrupt climbing turn until he almost stalled. Then he stuck the nose of his Snorter down as the black monoplane came roaring up to meet him. It came toward him as no ship had ever come toward him before. While he thought it was still too far away for accurate shooting he saw bullets chewing through the leading edge of his right wing. He skidded his Snorter out of line as anger half-choked him.

The pilot of the black ship hung it on its prop, then kicked it around in a flashing chandelle and was on Sandy's tail again. Sandy pulled his stick back and kicked his rudder to begin a turn as tracers wove a feathery course off his wing tip.

Sandy began to talk to himself through clenched teeth. His first feeling of panic had left him but he was so nervous he knew he was overcontrolling the Snorter. He was trying to talk himself into a feeling of security. But the tremendous speed and maneuverability of the black ship had unnerved him more than he realized. The color had drained out of his face to leave it chalk white. He knew already that this was the black ship Bev Bates had encountered over the Catskills. And down in his heart he knew, suddenly, that Burt Meadows had never sent him that telegram. The man at the control of that black ship had sent it or had it sent. He knew he had walked into another trap and that he was in imminent danger of losing not only his Snorter but his life.

The two ships streaked and tumbled across the sky, filling the air with the roar of their thundering motors and the chatter of their twin guns. Their pilots fired burst after burst at one another without telling effect.

Sandy's fingers clamped down on his gun trip again and again as the monoplane came under his sights. But before his bullets reached the other plane it had slipped away. He began to make little noises in his throat as his anger mounted.

He slipped the Snorter out of range as the black monoplane came roaring at him again with its guns yammering fire and death. He knew that he had better do the thing he hated most to do. He flipped his radio key and began to chant Barnes Field call letters into the microphone.

"Calling BBX. . . . calling BBX. . . . calling BBX," he said desperately. Then Tony Lamport's voice came back to him.

"BBX answering. . . . BBX answering. Go ahead," it said.

"Sandy calling BBX, Tony," he said. "Sandy calling BBX."

"All right, pest. Go ahead. Go ahead!" Tony said.

"Listen, Tony," Sandy panted. "I'm a few miles east of Deltaville over Chesapeake Bay. The black ship that attacked Bev the other day is on my tail. He's too much for me. Tell Bill."

"Hold it, kid!" Tony said. "Can't you get upstairs and get away from him?"

"I'm doing everything I can to get away from him," Sandy gasped. He slapped the control column of the Snorter forward and sent it toward the choppy waters of the bay in a screaming dive as the black ship roared in from his starboard side. Three thousand feet down he eased the stick back and brought the nose up. But the black ship was still on his tail and he had to pour

in more juice and come over on his back to keep from being annihilated.

He heard a voice in his earphones but it was only a blur until he rolled right side up. But he didn't have time to listen. He hung the Snorter on its props again and tried to get upstairs away from the black monoplane that was everywhere. Now he was above Sandy and diving on him with his guns flaming.

Only two thousand feet from the water and diving at terrific speed Sandy pushed the stick even farther forward to come up in an outside loop. He nearly blacked out as he hung head downward at the bottom of his loop. He opened his mouth and began to shout to relieve the pressure on his eardrums.

Then, he was up and climbing and his stomach felt as though it had climbed up into his throat to choke him. He gulped and probed the air for the black monoplane. It had overshot its mark and was coming around in a sweeping, climbing turn as Tony Lamport's voice drummed into his consciousness again.

"Calling SSB. . . . Calling SSB. . . . Calling SSB!" he was repeating over and over.

"SSB answering BBX," Sandy said. "Go ahead! Go ahead!"

"Okay, kid," Tony said and Sandy could tell that he was trying to control his excitement. "Bill left here a minute ago, Sandy. He wants you to hang on until he gets there. He says get upstairs. Do you hear me? Do you hear me?"

"I'm trying to get upstairs," Sandy panted. "I have a little advantage in altitude now. I think I can make it."

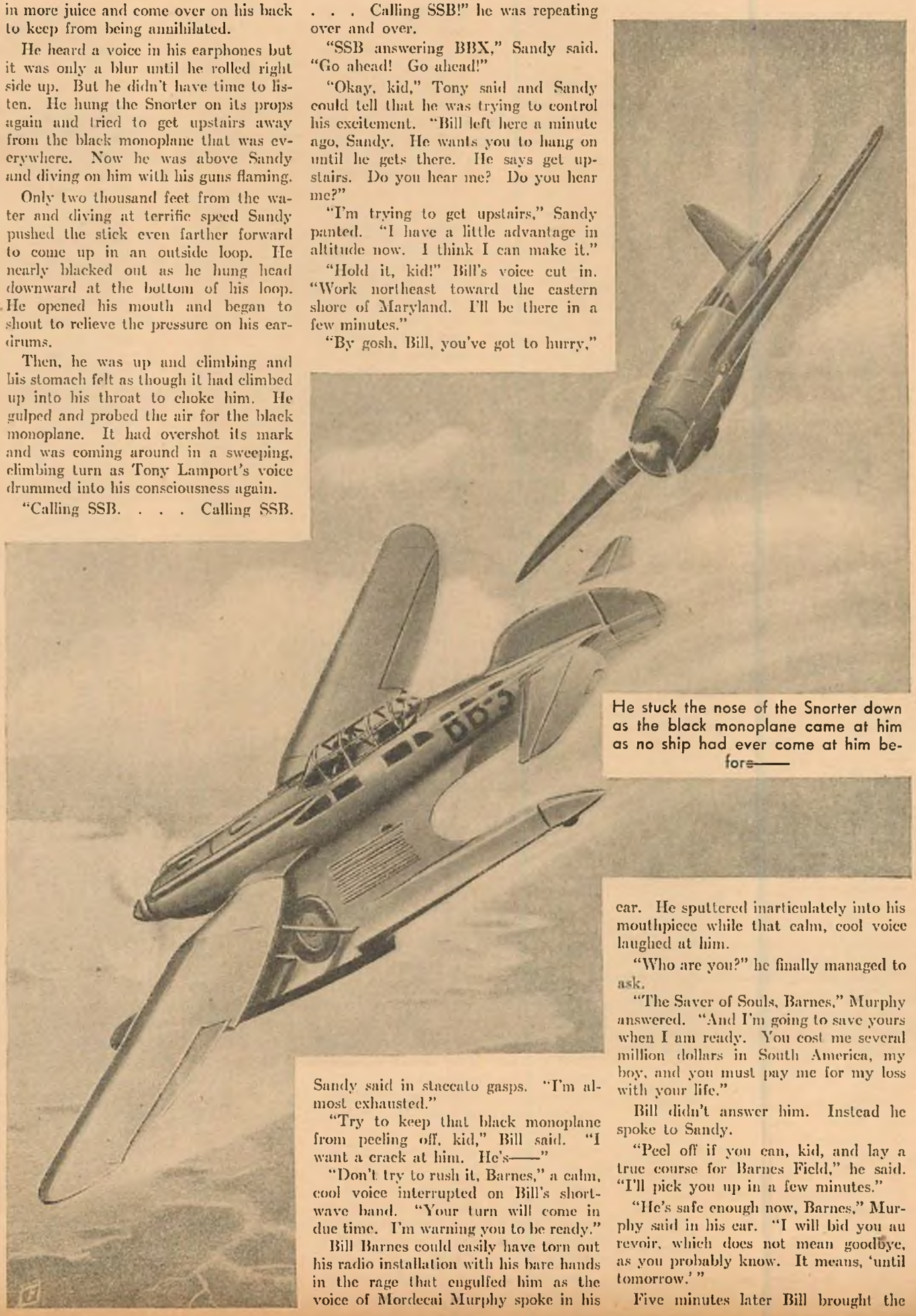
"Hold it, kid!" Bill's voice cut in. "Work northeast toward the eastern shore of Maryland. I'll be there in a few minutes."

"By gosh, Bill, you've got to hurry," Sandy said in staccato gasps. "I'm almost exhausted."

"Try to keep that black monoplane from peeling off, kid," Bill said. "I want a crack at him. He's——"

"Don't try to rush it, Barnes," a calm, cool voice interrupted on Bill's shortwave band. "Your turn will come in due time. I'm warning you to be ready."

Bill Barnes could easily have torn out his radio installation with his bare hands in the rage that engulfed him as the voice of Mordecai Murphy spoke in his ear. He sputtered inarticulately into his mouthpiece while that calm, cool voice laughed at him.



He stuck the nose of the Snorter down as the black monoplane came at him as no ship had ever come at him before——

"Who are you?" he finally managed to ask.

"The Saver of Souls, Barnes," Murphy answered. "And I'm going to save yours when I am ready. You cost me several million dollars in South America, my boy, and you must pay me for my loss with your life."

Bill didn't answer him. Instead he spoke to Sandy.

"Peel off if you can, kid, and lay a true course for Barnes Field," he said. "I'll pick you up in a few minutes."

"He's safe enough now, Barnes," Murphy said in his ear. "I will bid you au revoir, which does not mean goodbye, as you probably know. It means, 'until tomorrow.' "

Five minutes later Bill brought the

Lancer around in a sweeping turn and fell in alongside Sandy's Snorter.

"Who is that bird, Bill?" Sandy asked over the radiophone.

"I wish I knew, kid," Bill said, savagely. "He's certainly putting the screws on me. How did he know you were going to spend a week-end with this friend near Norfolk?"

"He must have found out in some way that Burt Meadows was a friend of mine and sent me a telegram with Burt's name signed to it," Sandy said.

"How does he learn these things?" Bill asked himself aloud.

"Gosh, Bill," Sandy said. "He gives me the willies. He said your turn would come when he was ready."

"It's inevitable, kid," Bill said. "It's as certain as night and day. He attacked both you and Bev to learn what he could about our tactics in combat. He's not leaving anything to chance."

"Say, Bill!" Sandy said excitedly. "I noticed one tactical error he made three or four times. If I had had a little more speed I might have got him because of it. But that ship of his was too fast for me. He——"

"Save it, kid," Bill said and threw his radio key.

VI—CONNECTION

LATE that same afternoon Bill was sitting in his office awaiting an answer to a dozen telegrams and cables he had sent out to try to learn the identity of the Saver of Souls.

When he had returned from eastern Maryland with Sandy he had made contact with the bank that was pressing him for payment of a note, and also with the man who was claiming a quarter interest in the ownership of Barnes Field. He thought he might find out some clue to his identity through them.

The bank claimed, under insistent pressure from Bill, that one of their own directors had heard a rumor about Bill's organization that had caused their anxiety about the note. When Bill located the director he could not even remember where he had heard the rumor.

The man who claimed a quarter interest in Barnes Field did not know he was claiming it. The executor for his father's estate had started the proceeding after a survey of certain papers. He could not remember just why he had delved into that angle but believed it was because of something someone had told him.

"A very clever man, the Saver of Souls," Bill said to himself as the phone on his desk rang. He knew that, whoever he was, he was behind both of the actions that were helping to drive him half crazy.

When he had first landed from Maryland he had gone storming into Scotty MacCloskey's office intending to yank Marty Hogan up on the carpet and make him talk. But Hogan had gone off for the week-end the day before.

"Dollars to lockwashers we never see him again," Bill said to Scotty.

He picked up the telephone now and spoke into the mouthpiece. The set, strained expression on his face changed as a pleasant voice that he recognized said, "And how is the old aerial comet today?"

"Hello, mug," Bill said to Earl Danning, an old friend of ten years' standing. "I suppose you have a hot tip to buy Folding Ashcans, preferred, at the market."

Earl Danning was the man who had warned Bill about a block of aviation stock he was holding before the crash came in 1929. After Bill's investigation of the man who headed the project he had quietly sold out his stock before its value vanished. He had bought Barnes Field with the cash he received. Since that time Danning had been his closest financial advisor.

"No," Danning said. "No ashcans today. Right now a friend of mine is sitting with me in my office and we're mostly interested in beer cans and liverwurst sandwiches. Come on over."

"I wish I could," Bill said. "But I'm up to my nose in trouble. The sins of my grandfathers are being placed on my shoulders."

"Well," Danning said, "you've got a pretty broad pair of shoulders. But listen, you remember you inquired about Transatlantic Transport stock a bit ago? This chap who is here with me says he knows where he can pick up a thousand shares. It's very tightly held, you know. I mentioned that I had a customer who was interested in it and he said he was pretty sure he could get it for you. He says he won't even rig the market to gyp you. All he'll charge is an eighth for commission."

"Wall Street going altruistic," Bill grunted. "He probably owns it himself!"

"No, he doesn't, Bill," Danning said. "He's a good guy. Why don't you run over here and talk to him? He says his party wants to sell and it's the only stock he knows of."

"What do I use for money?" Bill asked.

"I'll carry it for you if you're short," Danning said. "Get in that broken-down thing you call the Lancer and hop to the Wall Street Skyport. I'll have a taxi there for you. I'll give you a can of beer."

"That's a big inducement," Bill said, slowly. He had been trying for six months to get his hands on a block of the closely held Transatlantic Transport stock. He believed there would be a fortune in it within a few years.

"All right," he finally said. "I'll be over there in a half hour."

A few minutes later the big sesquiplane that was the Lancer sped down the center runway at terrific speed and Bill eased it into the air. He leveled off at three thousand feet and stuck the nose on the Statue of Liberty in New York Harbor. He circled once above the lower end of the island until a string of barges was out of the way, then, fish-tailing in, he landed on the East River and roared up to the landing. The floats of the big ship slid halfway up the face of the inclined turntable. The turntable came up and swung halfway around. Five minutes later he was shaking hands with the smiling Earl Danning in his office.

"I want you to know the bird who always had me in hot water when we were roommates at Princeton, Bill," Danning said. "Mr. Albert Sipperly, Mr. Bill Barnes."

"It's quite a privilege to know you, Mr. Barnes," the pale-faced Sipperly said.

They talked of this and that for an hour while they drank beer. Bill's troubles fell away from him under the spell of Sipperly's pleasant personality. He found himself liking the man immensely.

Finally Danning mentioned the Transatlantic Transport stock. Sipperly said he was quite sure the person who owned it would sell. But he wasn't certain.

"I'll tell you how you can make sure of getting it," he said. "The man who owns it has a hunting lodge not far from mine, down in North Carolina. He's a congenial soul who likes company. I'm going down to my lodge next Tuesday to stay for two weeks. He told me yesterday on the telephone that he would be there with some guests for the two weeks' bird season."

"You'll have a chance to talk him out of it," Danning said.

"I'm not sure I could talk him out of it," Sipperly said. "But Barnes could. He would be overwhelmed if I took you over to see him some evening, Barnes. He'd let you have the stock for the reward of saying he knew you."

"He'd be making a poor bargain," Bill said.

"He wouldn't think so," Sipperly said. "Danning is coming down the middle of next week to stay for a few days. Why don't you fly down over next week-end? I'll promise you some swell shooting."

"That's a thought," Danning said. "It would do you good, Bill. You'd lose that tired, haggard look that is spread all over your pan."

"There is an airport at Crownville which is about twenty miles from my place," Sipperly said. "We will meet you there."

"It sounds like something," Bill said. He began to chew on the knuckle of his left forefinger and the harassed expression came back into his eyes while he hesitated.

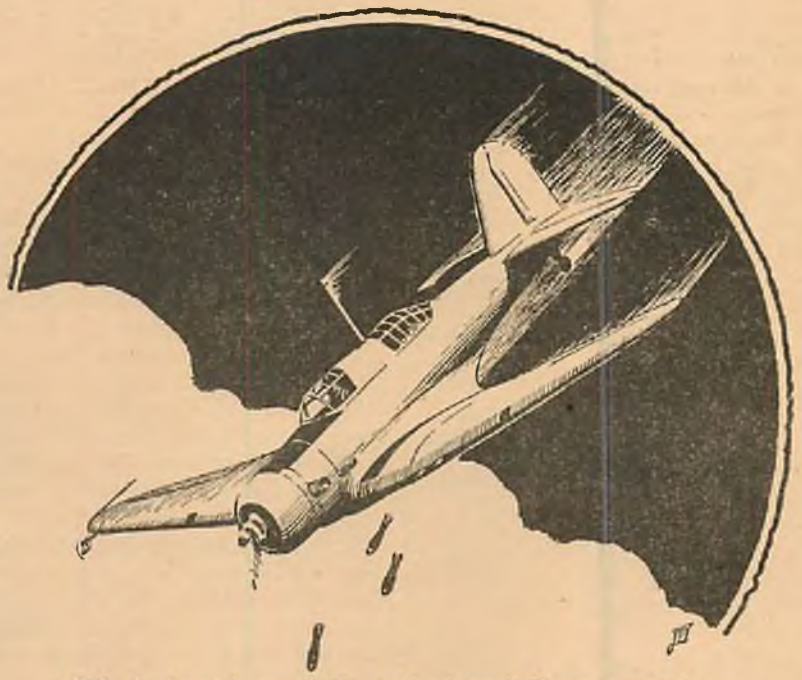
"Woodcock, pheasant and partridge," Sipperly said.

"I'd like to do some shooting," Bill said, "and I'd like to get that stock."

"Then why quibble about it?" Danning asked. "It's settled. We'll pick you up at noon at Crownville next Friday. Right, Sipperly?"

"If Barnes says so," Sipperly said. His eyes were gleaming, pleasantly.

"Okay," Bill said.



"She looks and sounds like a Northrop," Shorty gasped——

VII—GERFALCON TRICK

MORDECAI. MURPHY took the telephone call that came from Sipperly that evening on an extension in his sumptuous living room. It was a cold night in late October and the log fire before which he was sitting crackled merrily as wind howled around the cornices of the tall apartment building. He had been sitting there going over and over in his mind the things he had learned from Sandy Sanders that day. He was still marveling at the skill with which Sandy had handled his Snorter.

He picked up the telephone.

"This is Sipperly speaking," a voice said in his ear. "Barnes will leave here next Friday morning for Crownville. I am to pick him up there at noon."

"That is nice work, Sipperly," Murphy said. "How did you manage it?"

"He thinks a neighbor of mine, down there, has a block of aviation stock he wants," Sipperly said. "I'm depending on what you told me—that he won't get there because I don't know any of my neighbors and if I did they wouldn't have any of the stock he wants."

Murphy laughed. "I knew you would handle the thing adroitly," he said. "Does anyone know that you made such an arrangement?"

"Only the friend I mentioned who introduced me to Barnes," said Sipperly. "He will be there with me when I go to meet Barnes."

"Just keep your wits about you then," Murphy directed. "You'll be all right. You don't know anything more than what appears on the surface. It will be some time before they find Barnes. I'll get in touch with you later, Sipperly."

He put the telephone back in its cradle and got to his feet and stood in front of the fire. The shadows playing across his face gave it an appearance of subtle evil. He clenched his fists in front of him and turned them around, one above the other, as though he was wringing something out with his hands.

He was smiling a satisfied smile as he went out of the room and down a hallway to its end. There he opened a door that led into a room that was at least thirty feet from the floor to the ceiling, fifty feet long and twenty wide. The whole room was enclosed in a wire cage except for a runway about three feet wide along one side.

At one end there were a dozen small cages that housed as many birds of different kinds. But most of them were of the bird family, *Falconidæ*, and more specifically of the sub-family *Falconinæ*. They were all distinguished by a beak hooked at the point, with a notch or tooth on the cutting edge of the upper mandible. There was a peregrine, a gerfalcon, a North American duck-hawk, a pigeon-hawk, a sparrow-hawk and various others. They sat inside their cages with their sharp, powerful talons wrapped around their perches, their beady eyes blinking.

Mordecai Murphy nodded to the short, squat German who sat reading under a dim electric bulb.

"Get ready to release a mouse when I tell you," he said to the German as he got to his feet.

He went inside the larger cage, closing the door carefully after him and knelt down in front of one of the smaller ones to make clucking noises with his lips at the peregrine falcon inside. After a moment he stuck a finger through the wire and when the peregrine didn't snatch at it with its vicious hooked beak he opened the door and lifted it off its perch.

Balancing it carefully on one wrist he climbed the circular iron stairs that led to a platform near the ceiling at one end of the room. When he was standing on the platform, thirty feet above the floor, he spoke to the German again.

"All right," he said. "Put on the lights and release the mouse."

The high, dreary room became flooded with light from four hundred-watt bulbs in the ceiling.

Then the German placed a small cage at the bottom of the big cage and pulled up a gate. Down the runway scurried a tiny, frightened mouse about three inches long. It ran along the wall trying to find a hole where there were no holes.

Mordecai Murphy held the falcon out over the edge of the platform until its beady eyes caught the movement of the mouse on the floor. The bird watched it for a few seconds while it scurried back and forth trying to find a place to hide. Then its wings came up and it took flight from Murphy's wrist. It flew around the room once, circling, then plunged downward with the speed of light, its sharp, powerful talons spread. A foot away from the paralyzed mouse it swerved to the left to scoop it up and rise again.

Mordecai Murphy stood watching the bird with the intensity and fascination of a man in a trance. His whole body moved with the falcon as it made that last vicious swerve to the left to pounce on its prey with a maximum of force. He let the breath out of his body in one great sigh of appreciation as the falcon zoomed upward again.

"You see," he shouted at the German, "the way he threw all of his weight and strength into his pounce. He got leverage behind it the way a fighter gets leverage behind his blows by a twist of his wrist just before the impact of a blow."

"*Ja!*" the German said. "That is the way they always do."

"Get another mouse ready," Murphy said.

He went down the circular staircase and got the confidence of a gerfalcon the same way he had done before. Through weeks of training they had learned to know that a meal awaited them after Murphy took them out of their cages.

He stood poised on the platform again

with the gerfalcon on his wrist as another mouse was released. There was a sadistic gleam of triumph in Murphy's eyes as the gerfalcon swooped down on its defenseless quarry, swooping in from the left just as the peregrine had done. It zoomed upward with the crushed body of the mouse in its talons to land beside Mordecai Murphy.

"If I can perfect that little trick," he said to the gerfalcon, "Barnes won't stand a chance against me."

He went down the stairs and out of the room and back to sit before the crackling logs in the fireplace. Anyone seeing him would have thought he was a tired business man glad to be home from his office to sit and dream before his hearth.

Bill Barnes sat in his living room that evening opening the telegrams and cables that were sent over to him from the administration building.

None of them gave him the slightest clue as to the identity of the man who called himself the Saver of Souls.

The one from James Morton, Chief of the Bureau of Criminal Investigation in Washington, brought a smile to his lips. It read: NEVER HEARD OF THE MAN STOP ARE YOU SURE YOU DID NOT DREAM HIM QUESTION MARK MORTON.

The one from "Buzz" Harding, the man who had been stabbed in the back by one of the agents of the Saver of Souls a few months before read: HAVE NOT SEEN OR HEARD OF HIM SINCE WE BROUGHT LAST LOAD OF MACHINERY OVER THE CORDILLERA STOP HAVE NO IDEA OF HIS IDENTITY.

Bill scooped all of them into a pile and threw them in the waste paper basket. He noticed that his hands were trembling as he did it.

He walked across the room and gazed at himself in a mirror. He saw that his face was lined and haggard from worry.

"He has a neat system," he said aloud. "Very, very neat. He is putting all kinds of obstacles in my way to soften me up and worry me. I know it, yet I can't help worrying because the obstacles are real ones. I'll be glad when it's over one way or another. The sooner the better."

He went over to a telephone and got Scotty MacCloskey on the wire.

"I don't want anyone to take a ship, I mean one of our men with one of our ships, out of here without my personal permission," he said.

"Okay, boy," Scotty said. "What about that new aerial mapping job Bev Bates is working on?"

"Not even that," Bill said. "And tomorrow, Scotty, we're going to take the Lancer apart and check her thoroughly. I'm going to have to use her any time and when I do she's got to be right."

"Right, boy," old Scotty said. "We'll get her ready. Don't you worry about that."

"I won't," Bill said. "I've got enough things to worry about."

VIII—SANDY'S GRAPH

DURING the next few days Scotty MacCloskey, Bill Barnes, Martin, the master mechanic and a half dozen assistants took the Silver Lancer down and put her together again. They worked with the precision and care that an expert trainer and his staff would give to the grooming of a favorite for the Kentucky Derby. They treated the Lancer as though she was a thing alive, knowing that Bill's existence would depend on the terrific test she must stand.

They tore down the powerful Barnes twin Diesel engines in the nose and checked them from the fuel injection pumps and nozzles to the cap screws on the valve tappet assemblies. They made sure that the fuel nozzle injectors delivered their fuel to the spherical combustion chambers at the top of the cylinders at the precise moment the pistons were at 18° before top center when the compressed air that was used to ignite the fuel had reached a temperature of 1050° Fahrenheit.

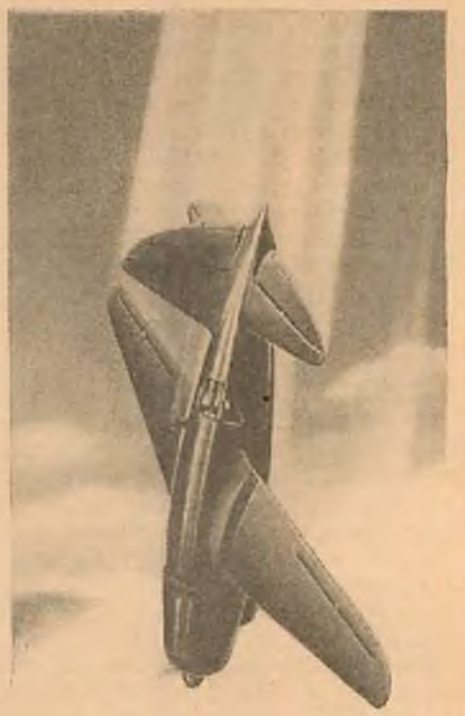
They knew only too well that if there was a slowing up or decelleration of air turbulence at the most critical point—just as the piston approached top center and at the time the fuel oil was injected—there would be a tremendous loss of power. In the Barnes Diesel the period of fuel injection was the period of greatest turbulence.

The Barnes Diesel combustion chamber was spherical in shape and had a tangential passageway opening into the side of the cylinder. As the piston reached the end of its travel it closed the connecting passageway—forcing the air through the aperture of reduced area with what might be termed "cyclonic velocity." As this compressed air reached its maximum temperature the injection nozzles atomized the fuel into very fine particles in the form of mist and sprayed the mist into the hot compressed air, igniting it to drive the piston down for its power stroke.

The downward force of this power stroke was transmitted to the crankshaft, through the piston pin, connecting rod, and connecting rod bearing, where its force was converted to rotary motion and the turn of the enormous twin props in the nose of the Lancer.

They checked the complete fuel pump assembly, including the governor, time after time until they were certain that everything was accurate beyond doubt.

They knocked down the twin .50-caliber Browning guns and the 37mm. automatic cannon and reinstalled them after overhauling. They checked the ammunition counters and Scotty MacCloskey, with two of his assistants, checked and rechecked every instrument on the panel while Tony Lamport tuned the radio installation.



He dropped the nose as he opened the throttle wide—the din was like the thunder of the gods——

When they had finished she was ready from the tip of her spinner to the trimming tabs on her rudder. She was a gleaming creature of alloy steel and shining dural. She was the personification of beauty and speed and light. And she was as responsive to the touch of her master as a racehorse.

"If this Saver of Souls has a ship as good as she is he's got something," Bill said grimly.

"Who said he had a ship as good, boy?" Scotty wanted to know.

"Bev," Bill said. "He intimated that the ship that attacked him was a better one."

"He's balmy, boy," Scotty said. "It may have as much speed, but I doubt it. It may have as great maneuverability, but it doesn't have the insides. The Lancer has guts, boy. She's a thoroughbred."

"I'm going to take her up for a test in a bit," Bill said.

"She'll do anything you ask her to," Scotty said, his eyes skimming proudly over the glistening ship.

If Bill was the creator and father of the Lancer old Scotty was its grandfather. And like a proud grandfather it was the apple of his eye. There might be thousands upon thousands of other ships in the world but there was only one Lancer. And it was supreme beyond all others.

"Has Red been able to find out any-

thing about Hogan?" he asked Bill after a moment.

"Not a sign of him," Bill said. "There is no doubt that he was the little trouble instigator on the inside. He got wind that we were wise to him and blew. He has disappeared, completely."

"We're lucky he got out before he did a lot of damage," Scotty said.

"He may have done things we haven't discovered," Bill said. "I'll be over in my bungalow for the next hour if you want me for anything. Then I'll give the Lancer a try-out."

"Okay, boy," Scotty said and he gazed at Bill's lined face anxiously. "Take it easy," he added.

Bill didn't answer. He crossed the apron and rounded the corner of the administration building with his head bent and his eyes on the concrete.

When he opened the door of his bungalow he found young Sandy Sanders sitting at the desk in his living room. The top of the desk was littered with papers and open books. Young Sandy's freckled face was a study in concentration. He gazed at Bill for a moment as though he had never seen him before. Then a grin spread from ear to ear.

"I have your Graph almost ready, Bill," he said.

"My what?" Bill said, irritably.

"Your Graph," Sandy repeated. "You know I told you I was going to make one for you. I made one for all the fellows. Shorty and Red didn't have enough sense to appreciate them, but the rest of them did. Tony Lamport reads his every night before he goes to bed."

"Listen, kid," Bill said. "I'm tired and I'm in no mood to listen to your hocus-pocus. Clear that stuff up and get to hell out of here. I want to get an hour's rest before I test the Lancer."

The expression that swept over Sandy's face was one that would be hard to describe. It was a combination of hurt childish pride and mature indignation.

"Gosh, Bill," he said. "I've spent hours on this thing. It will mean a lot to you if you'll only listen."

"What is it, kid?" Bill asked wearily. He had seen Sandy's hurt expression and knew he had worked diligently on something that he thought would please him.

"You see, Bill," Sandy said eagerly. "I take the date of your birth and work out the pattern of your life from these books I have here. There can be neither chance nor superstition in such a pattern, because it is based on orderly and systematic Law operation. I can't give you any magic method for the immediate elimination of any problem but——"

"I suppose I'm going to fall in love with a girl with dark hair and go on a long ocean voyage," Bill grinned.

"No," Sandy said indignantly. "Your Pattern of Life is the individual combination of conditions, environment and problems that are to be met all through your life. Recent research in science indicates that every individual is born with a special arrangement of brain and gland cells that literally set the tempo for life. This, in turn, is a matrix that is governed by Laws operating as orderly as any other universal law."

"It's got to be true, eh?" Bill said. A grin still twisted his lips but his eyes were interested.

"Sure," Sandy said. "Your Pattern shows an individual with a very strong ambition, sometimes baffled by your shifting Channel Law. But it is a lucky Pattern in that fortune favors it with plenty of breaks—just in time."

"Yeah, and I usually need them," Bill grunted.

"It is the Pattern of a dauntless individual," Sandy went on reading from a paper in his hand, "who is tremendously susceptible to both friendships and sympathies. The Reaction Law governs your responses to life and all conditions. In your case, flexible and fair and cooperative. Your Quality Law governs your inherited and acquired traits necessary to enable you to make adjustments. In your case these are all inspirational, resourceful and resilient.

"The Channel Law indicates the type of avenue through which all of your successes must be attained. In your case these are romantic, independent and colorfully unexpected. You must have a spice of adventure now and then to keep you stimulated."

"People seem to take care of that part for me," Bill said dryly.

"And your Cycle Law," Sandy read, "changes each successive year. This year for you has been strenuous and nervously tense, burgeoning with mercurial ambitions and demands. You have a genius for breathing sparkle and animation into projects that others would give up as impossible. And in 1938, one or two of these opportunities for cooperative work will drop into your lap and should receive respectful attention."

Sandy leafed over a few of the pages, saying, "I won't read it all to you now. You'll want a chance to study it. I'll just read you the month-by-month study for this month."

"Good," Bill said and his eyes were half closed. "I'll want to study this—what do you call it?"

"Graph," Sandy said.

"Graph," Bill repeated. "If there is anything I don't understand I'll ask you about it."

"Yeah. That's right," Sandy said. "Now listen carefully. There will be an excellent opportunity this month to prepare the way for the rather literal obligations of the rest of the year. That is, you must use your self-discipline by attention to details that will be of the utmost importance to you. You must be sure that everything is right before you go ahead. But you must be sure everything is right as this is your danger month. You should keep out of the air this month, too. The Law that is operating in your orbit indicates that if you persist in flying this month you may be forced to face the greatest danger you have ever faced and you may not survive it. Too much haste will be fatal to you. You——"

"Listen, kid!" Bill snapped and he got to his feet and crossed the room to glance at the books and papers Sandy had spread out on his desk. "Does this Graph you've made come out of these books or out of your own head?"

"Out of my studies, Bill," Sandy said. "It all lies in the combination of numbers that make up the date of your birth."

"And you didn't delve into your own mind without consulting your combination of numbers to warn me to stay out of the air this month?" Bill asked. The grin was gone from his lips now and his eyes were deadly earnest.

"Gosh, no, Bill!" Sandy said. "It's all in your Pattern. You can't escape it."

"You're sure you aren't working for this Saver of Souls?" Bill half mumbled to himself.

"What's that, Bill?" Sandy asked.

"Nothing," Bill said, and his cheeks were even more lined than they had been before. "Just leave that Graph, kid, and I'll read it when I have time. Gather up that other stuff and get out of here. I've got to have some rest."

"Okay, Bill," Sandy said. "Remember, if there is anything you want to know just ask me."

"I will, kid. Thanks a lot for the Graph."

He waited until Sandy closed the door behind him, then leafed through the bound pages Sandy had marked with his name and the date of his birth. He found the current month and read: "You should keep out of the air this month, too. The Law that is operating in your orbit indicates that if you persist in flying this month you may be forced to face the greatest danger you have ever faced and you may not survive it."

Something that was akin to panic suddenly seized him and he found himself crumpling the pages between his two powerful hands. He realized only too well that this man who called himself the Saver of Souls was doing his job to perfection.

Never before in his life had he entertained doubts of his own ability. But now, he knew, he was near the breaking point. The insidious threats of disaster had created a mental hazard that was beginning to tell. He knew there was only one thing to do to relieve the ten-

sion of mind and body that gripped him, and he did it.

He got Scotty MacCloskey on the telephone and told him he would be out immediately to put the Lancer through her paces. He knew there was only one place where he could get hold of himself—in the air.

His face was grim and determined as he threw himself into the bucket seat in the front cockpit of the Lancer and adjusted the seat pack. His eyes flitted across the instrument panel as he gunned the twin Diesels and listened to their full-throated roar.

The next instant he released his wheel brakes and blasted the tail around to kick the big ship into the wind. The field seemed to melt away on each side of him as he raced the silver bullet down the center runway into the wind. The tail came up and he eased the nose upward with that master's touch that only he could achieve.

He slid back the overhead hatch and let the gale the Lancer created beat against his face. He drew great breaths of fresh air into his lungs as he hung the Lancer on her props and took her upstairs in a dazzling climb.

At fifteen thousand feet he leveled off and brought the streamlined bullet around in a great sweeping bank. The long strip of brown and green and white sand that was Long Island rolled out under him. Off to starboard the great swells of the Atlantic broke up as they neared the irregular sand dunes of the island and came roaring inward, their tops laced with dancing foam.

Off his port side the long, brown waters of the Sound faded into the dim haze that was the Connecticut shore line. Pleasure craft and Sound steamers seemed to barely crawl on the surface of the water as he raced above them.

Something of the peace and serenity that is the natural heritage of the airman crept into his being. All of the things that had seemed like tremendous obstacles to him only a short time before faded into insignificance. He stretched his right hand out straight in front of him and it was as steady as the drone of the twin Diesels.

The gale that lashed his face snatched the laughter that sprang to his lips and whipped it away in his wake. The lines seemed to iron themselves out of his bronzed face.

He pulled the nose of the Lancer up and began a squirrel cage, one loop after another, gaining altitude with each one. At the top of the last one he rolled right side up and yanked the nose of the Lancer up in a climbing turn. The silver ship responded as she had never responded before. At the peak he brought her around and down in a flashing chandelle that reversed his direction.

He stuck the nose on the traffic tower of Barnes Field far below him and opened his throttle. Down and down he plunged fighting to keep the nose from coming up before he had reached terminal velocity. At five thousand feet he began to pull out, easing back gently until the nose began to rise.

Two minutes later he raced up to the apron, set his brakes and killed his power plant. He was grinning as he dropped out of the cockpit to the ground.

"You didn't give her much of a workout, boy," old Scotty said to him. He had not taken his eyes off the Lancer since Bill left the ground.

"I gave her all she needs," Bill said. "She's hair trigger, Scotty. She wants to go. She's ready."

IX—"THIS IS IT!"

WHEN Bill Barnes climbed out of bed and ducked under a shower that Friday morning he was feeling like a new man. It was the first time he had had a good eight-hours' sleep in as many weeks. His eyes were clear and his bronzed skin glowed with health.

He ate a large breakfast of fruit juice, eggs Benedictine, toast and coffee that old Charlie, the cook, prepared for him. He was humming a little off key when he picked up the telephone and got Scotty MacCloskey on the wire.

"Have the Lancer on the line ready to go at ten o'clock," he ordered briskly. "I'm hopping down to North Carolina this morning. I'll send Sandy over with my luggage and that new Spanish bird gun I bought last fall. Stow 'em away in the after cockpit. I'll want to talk to you before I go because I won't be back until Monday or Tuesday."

"Okay, boy," Scotty said. "Anything else?"

"That's all," Bill said, and his expression was one of pleased anticipation as he laid the phone back in its cradle.

"It's the first time I've had a break in weeks," he said to himself. "I'll get a-hold of that block of Transatlantic Transport stock and have a nice weekend of shooting with some good fellows and be able to forget my troubles."

For an instant the cool, mechanical voice of the Saver of Souls flashed through his consciousness as it had come to him that day Sandy had been in deadly peril.

"I'm warning you to be ready," it said. "You must pay me for my loss with your life."

Bill stopped midway in the act of pulling a white leather overall over his hunting clothes and softly cursed. For a moment that strained, haggard expression he had been wearing for the past few weeks flashed on his countenance. And then, it was as quickly gone.

"That's over," he said aloud. "The bird is all bluff and no guts. If he throws any more trouble my way I'll just take it in my stride and then forget about it. But he was clever. I'll hand him that. He almost drove me crazy.

"Come in!" he shouted as a knock sounded on his door.

"Scotty said you wanted me," young Sandy said, entering. His face was streaked with oil and grime. "I was checking the timing on the Eaglet."

"You look it, Toots," Bill grinned. "Why didn't you send some one else over? I just want to get those two guns and my kit bag over to the Lancer. Scotty knows what to do with 'em. Tote 'em over as we say down in North Carolina, will you, kid?"

Young Sandy closed the door behind him and a half dozen lines creased his forehead as he regarded Bill with worried eyes.

"You're going some place, Bill?" he asked.

"I'm going down to shoot me some birds," Bill grinned. "Monday night we'll have roast partridge for dinner."

"After what I told you yesterday?" Sandy said querulously.

"What do you mean, 'after what I told you yesterday'?" Bill snapped.

"That Graph I made for you," Sandy said. "I warned you to stay out of the air this month. That Graph doesn't lie, Bill. It's based on systematic and orderly law operation. You can't beat it. You've got to work with it or you'll defeat yourself."

"Oh, I can't, can't I?" Bill roared at him. "Listen, kid! I've had enough

Albert Sipperly.

mental hazards put in my path in the past few weeks without you adding to them. You take those guns and that bag and take 'em over to Scotty and keep your trap closed until I ask your advice."

A trace of a smile curled the corners of Bill's mouth to take the sting out of his words. But no answering smile came from Sandy. His usual grin was replaced by sober silence. He picked up the two guns and the bag and started toward the door.

"Don't go away mad, kid," Bill said in a bantering voice.

"I'm not mad, Bill," Sandy said, paus-

ing. "I'm just worried. You want to keep your eyes open and be ready for anything that might happen."

"I always keep my eyes open!" Bill snapped. "And as for worrying—forget it. I've been doing enough for both of us."

He followed Sandy over to the apron a few minutes later. But his buoyant good nature had departed. He was grim and businesslike as he gave Scotty MacCloskey parting instructions and gave the Lancer a last check before climbing into the forward cockpit.

He cursed softly as the thought flashed through his mind that he could telegraph Danning and Sipperly that he could not come. Then he shrugged his powerful shoulders as he gunned the twin Diesels and listened to their rhythmic roar.

"What the hell," he said to himself. "You can't run away from things in this life. You've got to stand up and take it on the nose sooner or later. If it's coming it's coming."

He wasn't just sure what he meant but in his subconscious mind he was telling himself that the reign of terror of the Saver of Souls was over.

He took the Lancer into the air in a long, low climb. Leveling off at ten thousand feet, he took his bearings and charted a true course for Crownville on the edge of the Great Smoky Mountains. After he had made corrections for drift he put his automatic pilot to work and sat back in his bucket seat to study his instrument panel.

It was the kind of day the poets write about, fair and clear with only a few tufts of cumulus clouds hanging like spun cotton in the sky. Below him the fertile Shenandoah Valley spread out in a checkerboard of greens and browns until it merged on each side with the Allegheny Mountains on the right and the hazy Blue Ridge on the left.

He studied the little cities of the valley below him until he was over Bristol that sits in the corner where Tennessee and Virginia come together. There he took his bearings, checked his instruments and laid the nose of the Lancer on Crownville, nestling in the heart of the mountains.

He was gazing downward at the battered, unpainted shack of a mountaineer and marveling how it could hold its position, perched precariously on the side of a little clearing above a roaring stream, when that first warning note came to his ears.

It was a sound that struck stark terror in his heart because it caught him so entirely unprepared.

Just that single high-pitched rataplan of a diving prop that was carried to his ears above the roar of his own engines and then the slashing drum of machine gun bullets as they ripped through the metal skin of the Lancer just behind the forward cockpit.

His blood turned to ice water as that sleek, coal-black, low-wing monoplane went by him like something catapulted out of hell.

In that one glance, while he yanked the control column of the Lancer back into his stomach, he saw the blurred letters of the word "Dart" written on the ship in silver, and the roar of the 1500 h. p. Twin Vulcan in the nose told him that this was the ship Bev Bates and Sandy had encountered.

"This," he said to himself, "is it. This is the time for which he has been preparing."

Through his mind rushed a chain of thoughts in lightninglike procession and he knew that the man he had trusted, Earl Danning, or Danning's old Princeton roommate, Sipperly, had sold him out.

The anger that surged through him warmed his blood until he could feel it beating against his temples and throbbing in his throat. He looked over the side as the Lancer's twin props took it upstairs, and saw the little black bullet pull out of its dive and begin to climb with a speed that was terrifying.

"This," he said again, "is it. Only one of us can live."

His face became a grim mask of determination as the muscles stood out like whipcord in his cheeks. Sandy's words of warning flashed through his mind and were gone as his finger fastened down on the trip of his .50-caliber gun. He fired a short burst to be certain they were not jammed and then he became a part of the Lancer.

And then Bill saw that the black monoplane was actually climbing faster than the Lancer. He could hardly believe his eyes as he opened his throttles wide and saw that he was only holding his own.

They were both trying desperately to get that all-important advantage of altitude before they began their duel. They were over two thousand feet apart when they leveled off at fifteen thousand and started the first feinting thrusts that would lock them in combat.

Suddenly, the air above the Great Smoky Mountains became a madhouse of screaming props and roaring engines, interspersed with the blood-curdling chatter of machine guns. The two pilots jockeyed back and forth, each conserving his ammunition, firing only when the other ship came under the hair sights for a split fraction of a second.

Those gone but not forgotten air fighters such as Von Richthofen, Ball the Englishman and Guynemer the Frenchman, must have stirred uneasily in the Valhalla that is the last resting place of airmen as those two super planes and super pilots blazed their thundering path across the heavens.

It was an aerial combat such as no man had ever witnessed. There was no quarter given and no quarter asked. They both knew that one of them must die.

They came roaring at one another with their guns vomiting fire and death but they both had the knack of seeming to fly on a straight course while actually they were drifting a little away from it to keep out of the line of fire. Not one of their bullets found their mark during that first head-on encounter. They roared by one another so close that their wing tips almost touched.

Then they were up and back, each in a flashing chandelle with their guns screaming again. And this time Bill noticed that the pilot of the black ship swerved it in fast to the left for a death dealing burst of fire just before they passed. He yanked the Lancer out of its mad path to avoid the crash that seemed for an instant inevitable.

He yanked back on his stick and zoomed the Lancer up and over on its back, as the Dart held to its course. At the top he half rolled the Lancer level and gazed over the side.

The black ship had returned and was zooming up underneath him with its powerful twin guns spewing burst after burst. Lead chewed through the leading edge of his starboard wing before he could throw the Lancer out of range.

The black monoplane roared upward in a climbing turn and came back down on Bill's tail as he began a sharp turn to the right. He was ready to skid the Lancer out of range as the Dart nosed down and came within range. But no burst came from the guns of the black ship until it had dived under the Lancer to nose up with a terrific blast of fire.

Bill cursed with rage as he slipped out of range of that deadly hail of lead and he knew now that Bev Bates had not exaggerated the speed and maneuverability of the black monoplane. It had everything Bev said, and it had a master craftsman at the controls.

"You are the louse," Bill gritted between his set teeth, "who has been trying to ruin my business and kill my men. And now you are trying to kill me. You came to me and asked for it. And you're going to get what you asked for. We'll see if you can take it!"

One moment Mordecai Murphy was confident of his ability to outfight and outsmart Bill Barnes. The next instant complete panic almost seized him.

Mordecai Murphy found himself being maneuvered into errors that brought Bill's deadly aim closer and closer to his helmeted head.

Bill's breath was coming in short, sharp gasps now, as he took the Lancer through the sky like a flaming chariot. He eased the control column of the Lancer forward, as the black monoplane

tried to escape in a vertical dive that ended in a loop.

Then Bill closed in to discard the dive-and-zoom method for infighting. He came up and over in a series of Immelmann turns until he got on the tail of the black monoplane. He saw his tracers weave about the tail assembly of the black ship and then chew into the rudder before Mordecai Murphy half-rolled out of range.

Again they came roaring at each other head-on and this time Bill waited until Murphy made that quick swerve to the left with his guns yammering. Then he kicked his rudder with that touch that was just enough as his finger clamped down on his gun trips. His bullets drew a thin line from the engine housing to the tail assembly of the Dart, but they were too low on the fuselage to do any vital damage.

Bill came up and back in a flashing chandelle and slapped the stick forward, as the black monoplane nosed down in a vertical dive, then came up and over in an Immelmann with Bill right behind him.

But Murphy had gained altitude and was diving again with his guns flaming. Bill's arms felt like great pieces of lead as he yanked the Lancer up on its props. He was tired now. So tired that he knew he must win the conflict soon or die.

Then Bill came over on his back and neutralized his controls as the black monoplane came up beneath him and waited for him to roll level. Before Murphy realized that Bill was not going to roll level the bullets that were to spell his destruction were winging through the air as Bill hung head downward. They crashed into his tail surfaces and crept forward as he began a sharp turn.

Mordecai Murphy tried with a desperation born of panic and fear to throw the Dart out of that deadly line of fire. But this time he was too late. Bullets smashed into his instrument panel and into his guns. The nose of the noble little monoplane lifted like a frantic horse rearing to throw its rider. Seemed to hang there for an instant before the nose dropped and it began a dizzy descent toward the interminable green forest below.

As Bill Barnes saw the nose fall away he adjusted his throttles and locked his controls with the last bit of strength that was in him. Then his arms fell on his crash pad and his head fell on his arms. He was completely and entirely exhausted.

How long he stayed there gasping for breath and strength he did not know. When he lifted his head and gazed over the side of the Lancer the black ship and its master had disappeared from sight. He circled back in great swinging circles trying to find the spot where it had crashed, but he could see no trace of it.

He raised one hand in farewell salute to as gallant and cunning a fighter as he had ever encountered.

"The most skillful rogue who ever touched a joy stick!" he said aloud.

Then he checked his bearings and laid the nose of the Lancer on the little city of Crownville. He knew that at last he would be able to find out from Danning or Sipperly who his opponent had been. One of them must know and he was determined to find out whatever course he had to take.

He circled twice above the little airport while he studied the field and wind. He noticed as he taxied toward the single hangar that an ambulance and two police cars were drawn up beside it.

Earl Danning greeted him as he slid out of the forward cockpit of the Lancer. But it was not the Danning he had last seen. It was a man who had shocked horror written on his face.

"Something pretty terrible has happened, Bill," Danning said as Bill shook his hand.

"Sipperly?" Bill said, quickly. A confusion of thoughts rushed through his mind.

"Sipperly," Danning repeated. "While we were waiting for you he went into the lavatory and—and blew out his brains."

"He knew," Bill said softly.

"Knew what, Bill?" Danning asked.

"He was an old friend of yours, Earl?" Bill said.

"My oldest and best friend," Danning said. "He had faults, many of them. But I loved him in spite of them."

"That is true friendship," Bill said. "Loving your friends in spite of their faults. I won't tell you now what he knew because it will only complicate things for you. Just let the police think he committed suicide because of business troubles."

"But Bill——" Danning began.

"Don't ask me any questions now," Bill said. "If you know you'll have to tell the police and Sipperly will be buried in complete disgrace. Let it lie!"

After the police had asked Bill a number of routine questions he went back out to the Lancer. Danning was by his side.

"Did Sipperly introduce you to the man who owned that Transatlantic Transport stock?" Bill said to him just before he climbed into the Lancer.

"No," Danning said. "He acted very peculiarly about it. He seemed to want to avoid talking about it."

"He didn't know anyone who had any Transatlantic stock," Bill said. "That was a frame-up to get me down here."

"But why?" Danning asked.

Bill pointed to a half dozen bullet holes in the starboard wing of the Lancer. "I'll tell you more when it's safe for you to know," he said.

At two o'clock that afternoon Bill threw the radio switch on the panel, twirled the master control and chanted Barnes Field call letters into the microphone.

"BBX answering. . . . BBX answering. . . . Go ahead. . . . Go ahead," Tony Lamport's voice said in his ear.

"Bill speaking, Tony," Bill said. "I'm on my way back. I decided not to stay for the week-end. Is there anything new? I've got to land at the Downtown Skyport and make a report to the police before I come out to the field. I'll be in there by dinner time."

"There's nothing new, Bill," Tony said. "Nothing but a telegram that has Scotty guessing."

Even before Tony read it to him Bill knew what it was going to be.

"Read it to me," he said.

"Just a minute," Tony said. "I'll be right back." There was a pause.

"Tony speaking, Bill," he said in a few seconds. "Here it is: 'We shall meet again.' That's all it says. It's signed: 'The S of S.' Do you understand it?"

"I understand it," Bill said, wearily. "I'm signing off, Tony. I'll be in there in a half hour. I won't have to make a report to the police now."

"Okay," Tony said.

Bill shook his head in amazement as he remembered how he had seen his tracers drive into the cockpit of the little black fighter and had seen it start its plummet to destruction. And how had the man ever got out of those mountains? Those and a dozen other questions flashed through his mind.

"I don't know yet who he is," he said aloud. "But he has guts."

And Bill knew that they *would* meet again.

THE END.

MODEL MAKING—

Air Trails Department of Practical Construction

Guest Editorial

By Pat Sweeney

Pat Sweeney—a modeler for 20 years—is president of the Central Gas Modelplane Society. Was in the Air Service during the War. Can be counted on to do anything to boost our hobby. Chief interests are running model shops in Chicago and experimenting with radio-controlled gas models.

Why does anyone or anybody take it upon himself to attempt to tell others what models they are to build? If he would only think long enough he would see that the benefit of model building lies in what it does for the individual, the amount of interest it arouses in him. Your hobby is what you are interested in. Forget the other fellow and what he thinks of it. It may be railroads, boats, covered wagons—in fact, whatever you like to model.

As far as gas models stealing the show from rubber jobs—that's progress. If you want to keep some of the interest in rubber models, then I believe they should be built as near to scale as possible and still fly. It is no wonder that people took to gas models when, in the past, contests were for the type of models that the average man on the street would fail to recognize. Figure it out for yourself. A model with a span of 36" weighing about 1/32 of an ounce with a propeller turning so slowly that you can count the r.p.m.—well, I fail to see it as an airplane model. The airplane today is designed to fly at a given speed with a given payload and have a maximum of safety. Now, brother, if you can attach any of these qualities to the flying "skeeter," then you have a powerful imagination.

Gas models are the top in holding the interest of the builder and encouraging him to improve his modeling skill. And even more important, gas modeling is selling aviation to the people both through the modelers who branch out into the large plane field and through interested spectators.

BUT, as I said, that's only the way I feel about it, and not only will I refuse to argue if you prefer the rubber jobs, I'll even give you three cheers to boot!

So let's take this hobby of ours and do all we can to keep it going and not fight among ourselves as to the type of model that is best. If we live to be a hundred years of age we will not leave this old world knowing all there is to know about airplanes and flying.

10 Model Building Items

GUEST EDITORIAL ..... BY PAT SWEENEY 59
Live and let live, the keystone of progressive model building.

THE DISCUSSION CORNER 60
Pro and con of model design problems. This month readers discuss one-bladed propellers.

THE MIDGET-MOTORED MITE ..... BY FRANCIS TLUSH 61
Real performance and duration in a small job. A design by the winner of the 1936 Texaco Trophy.

MODEL BUILDING IN GERMANY 64
Two pages of photos taken at a German contest—a cross section of the hobby as developed on the Continent.

THE SPEE DEE ..... BY ALAN D. BOOTON 66
A jaunty little parasol design, easy to build and easier to fly.

MODEL MATTERS 68
Reviewing current happenings, news, contest results, pictures.

THE CONTEST CALENDAR 68
A schedule of coming contests presented to keep Air Trails readers up to the minute in model activities.

LET'S GET ACQUAINTED 70
Highlighting the manufacturer's efforts to please model builders.

THE MAYO COMPOSITE ..... BY MARTIN E. DICKINSON 71
Three pages of detailed plans by the foremost scale modeler of the day.

THE RYAN SC ..... BY ALAN D. BOOTON 74
A large-size flying scale design of a popular ship.

AIR TRAILS ADVERTISERS—MAY, 1938

Aero Industries Technical Institute ..... Back Cover
Aeronautical Chamber of Commerce of America, Inc. 94
Aeronautical University 92
Aircraft ..... 2nd Cover
Aircraft Industries 81
Charles Atlas 91
Aviation Institute of America, Inc 3
Baltimore Fireworks Co., Inc. 89
Burd Model Airplane Co. 89
Cleveland Model & Supply Co. 92
Curtiss Wright Technical Institute 81
Fleischmann's Yeast 95
G. H. Q. Motors 95
Gun Model Co. 93
Heathe Model Airplane Co. 83
Imperial Model Aero Supply 91
Industrial Products Co. 95
International Correspondence Schools 1
Johnson Smith & Co. ..... 3rd Cover
Donald Lessard 93
Mechanix Universal Aviation Service 93
Megow's 79
Miniature Aircraft Corp. 95
Model Airplane News 87
Newell Pharmacal Co. 95
E. M. Paine 92
Paramount Products Co. 93
Roosevelt Aviation School 85
Skyway 93
Universal Aircraft Co. 92
Vacumatic Co. 96
Waterbury Model Builders 92
Westlake Model Co. 95

The model art progresses through the exchange of ideas. The Discussion Corner is a monthly sounding board for your opinions. 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.

This month's topic: 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 its chief advantages and disadvantages?

Next month's topic: "Streamline" airfoils.

For July—Other factors of design being equal, do you believe that dihedral should be used in excess of what is actually required for stability? Is excessive dihedral beneficial, or is it a dangerous design feature? Answers must reach us by April 15th.

For August—Does the profile or projected area of a model directly affect the stability characteristics of the design? If so, should the plan be laid out with requirements of profile proportions in mind? Answers must reach us by May 15th.

The Discussion Corner

PRO

In my experience with one-bladed propellers I found that models so equipped showed a faster and steeper climb with less strands of rubber and greater slack in the length of motor. While the one-bladed propeller is highly successful, it alone cannot do much toward increasing contest duration. When used on a high-climbing and flat-gliding model the duration will definitely be better.—Mark Kert, New York City.

The one-bladed propeller is likely to improve contest times to the extent that all model designs will be forced to be equipped with it. The one-bladed propeller provides faster take-off and climb; higher speed; less vibration; power economy; reduced bending moments on blade; and reduced gyroscopic action.—Louis Loeffler, Oklahoma City, Okla.

A one-bladed propeller shows considerable vibration when freewheeling unless it is equipped with a folding blade device. However, this disadvantage is easily overcome. A high-pitched one-bladed propeller is more efficient than a low-pitched two-bladed and is well worth the slight additional trouble in installation.—G. MacD. Haliburton, Halifax, N. S., Can.

One-bladed propellers are good—when you have a broken propeller blade. This otherwise worthless piece of equipment can be balanced and mounted on the model for experimental flying.—Saul Zussman, Dorchester, Mass.

With the advent of heavier models, the one-bladed propeller will help improve contest times. Jim Cahill's winning the Moffett Trophy with a one-bladed propeller is typical of improved performance with this new type propeller. I have used a counter-weight placed about three-quarters the radius from the hub. This produced a smoother power flight. The one-bladed propeller gave a better climb on the same power, but had a slightly shorter prop run than the conventional two-blades.—Ted Just, Johnstown, Pa.

CON

A properly constructed one-blader is superior to other types of props. Unfortunately their installation on gas engines is difficult because unequal thrust causes rapid wearing of crankshaft bearings. This disadvantage immediately rules them out for use in gas models.—Edurn Elliot, San José, Cal.

During the last two months I have been using one-bladed props on outdoor models. From my experiences I have learned that the two-blader is more efficient. While the climb is not as steep, the prop run with two blades is longer and the resulting flight is of greater duration.—Stanley Effross, Far Rockaway, N. Y.

On an endurance model there would be little increased efficiency in the use of the single-bladed propeller because of the slow propeller speed required. The one blade would have to be of larger diameter to have the required area. Naturally this means a longer landing gear and an increase in weight. And, too, with a large single blade it is increasingly difficult to counter-balance without adding excessive weight.—Edward Brown, Reedley, Cal.

Contest times will not be improved by use of the one-bladed propeller. This type is heavier because the counterweight must be placed nearer to the center of rotation and must be heavier than a second blade. It is difficult to make a one-bladed propeller with sufficient area—deemed necessary for efficient flying. When freewheeling the one-bladed propeller shows considerable vibration. As far as I can see the two-bladed propeller will remain on top.—Bruce Hallock, Medina, O.

I think modelers will stick to the two-bladed prop because it has a neater appearance and still provides the maximum in propeller efficiency. A two-bladed propeller is easier to balance and simpler to install in the model. The one-bladed propeller will never seriously threaten the popularity or the efficiency of the two-bladed.—Ted Burzynski, Wyandotte, Mich.

The Midget-Powered Mite

Away in a stable, steady climb.

Plans for duplicating a four-foot gas model that disappeared after a 54-minute, 30-second motor run—an inexpensive construction project.

By Francis Tlush

In collaboration with Gordon S. Light

THIS model was designed and built primarily to test a small engine which we had just built. First results were not satisfactory. But after a new propeller had been designed and installed the flights made us sit up and take notice. The little ship behaved even better than we had expected, packed more of a thrill than the larger contest models. However, the fun of flying this model was destined to be shortlived.

We had been flying it all morning. It had turned in one perfect flight after another. After several unsuccessful attempts to pack up and go home for lunch, we finally decided on one last flight. It was this extra flight that made us late for lunch and sent us on an unscheduled tour of the neighboring country. The motor run averaged 30 seconds, just as it had previously. But after the motor stopped the model showed no intentions of returning to the field. Instead it continued to climb on a helpful thermal and leisurely drifted toward New York City. We continued to follow it as far as Jersey City, where it disappeared high in the sky leaving no clue as to its ultimate landing place. The stop watch showed 54 minutes up until the time of disappearance. And no news of the model has ever been received despite the name and address being clearly marked on the fuselage.

Francis Tlush starting the engine. The size of the model is ideal for the beginner's first gas job.

Fortunately, photographs had been taken that morning. Such thoughtfulness is praiseworthy. Usually the model has disappeared before you think seriously of photographing it.

Construction follows the general methods used in building a simple rubber-powered job. The size of the model should fit the requirements of the rubber modeler who is beginning to branch out into the gas-model field, and the relatively small cost of materials will help bridge the gap between the cost of rubber models and the large gas ships.

CONSTRUCTION

The first step is to lay out the full size view of the fuselage side-panel and also the top view of the wing and tail. $^3/_{16}$" square balsa longerons are used throughout the fuselage. The front motor mount bulkhead is ⅛" hard plywood. The bulkhead is dimensioned in the drawing and fits the front of the fuselage. No specific dimensions are given for the motor mount. This detail will depend on the type of motor you intend to use.

Motors with radial mounting can be bolted directly to the front bulkhead with the gas tank extending back into the fuselage. This practice permits the use of a shorter motor mount, which is less likely to break and is lightweight.

Motors with the conventional mounting flanges can be attached to hardwood motor mounts extending from the front of the fuselage. These mounts are ¼x⅜" and pass through the front bulkhead and are further secured to the fuselage structure with cross-bracing of $^3/_{16}$x$^3/_{16}$" balsa.

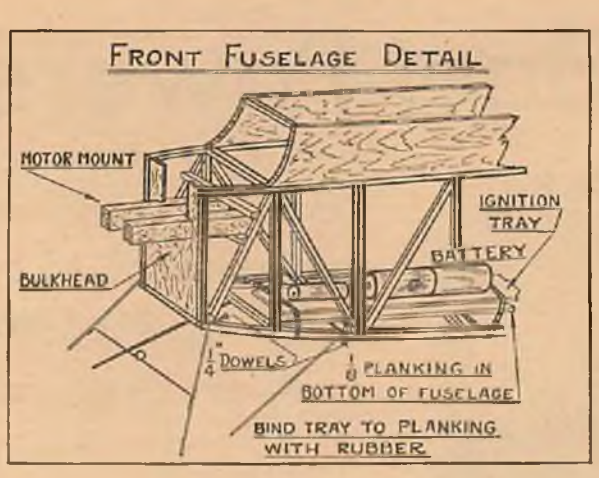
The bottom of the motor is cowled, using a block of balsa carved to fit the bottom curve of the crankcase and fairing into front bulkhead. Cement this block directly to the bulkhead.

The shaded portions of the fuselage are covered with ⅛" sheet balsa. It's important to keep the two top fuselage longerons perfectly level. They serve as convenient reference lines when determining wing and tail settings. Note also that no cross-braces are used at the top of the fuselage at the wing position. This will make it possible to put the ignition tray into the bottom of the fuselage. The bottom of the fuselage is floored with ⅛" sheet balsa as a base for mounting the ignition tray.

The entire fuselage is covered with a light grade of

bamboo paper. Spray with water and dope after the paper has dried.

Rubber bands hold the ignition tray to the bottom of the fuselage. The bands pass over the top of the tray and through the sides of the fuselage covering, extending down and around the bottom of the fuselage. The holes in the bamboo paper are reinforced with several extra layers of paper given liberal coatings of cement.



WING

The ribs are cut from 1/16" flat balsa. First they are attached to the 1/8×3/4" main spar. Make the wing in two halves and join after each half has been completed. Line up the ribs on the spar and cement in place, adding the leading and trailing edges. Wing tips are merely blocks of balsa shaped to fit the end rib. Cement to the end ribs and then carve to any desired shape. The wing halves are joined by pieces of 1/16" plywood cemented to both sides of the spar. The leading and trailing edges are butt-joined with liberal coatings of cement.

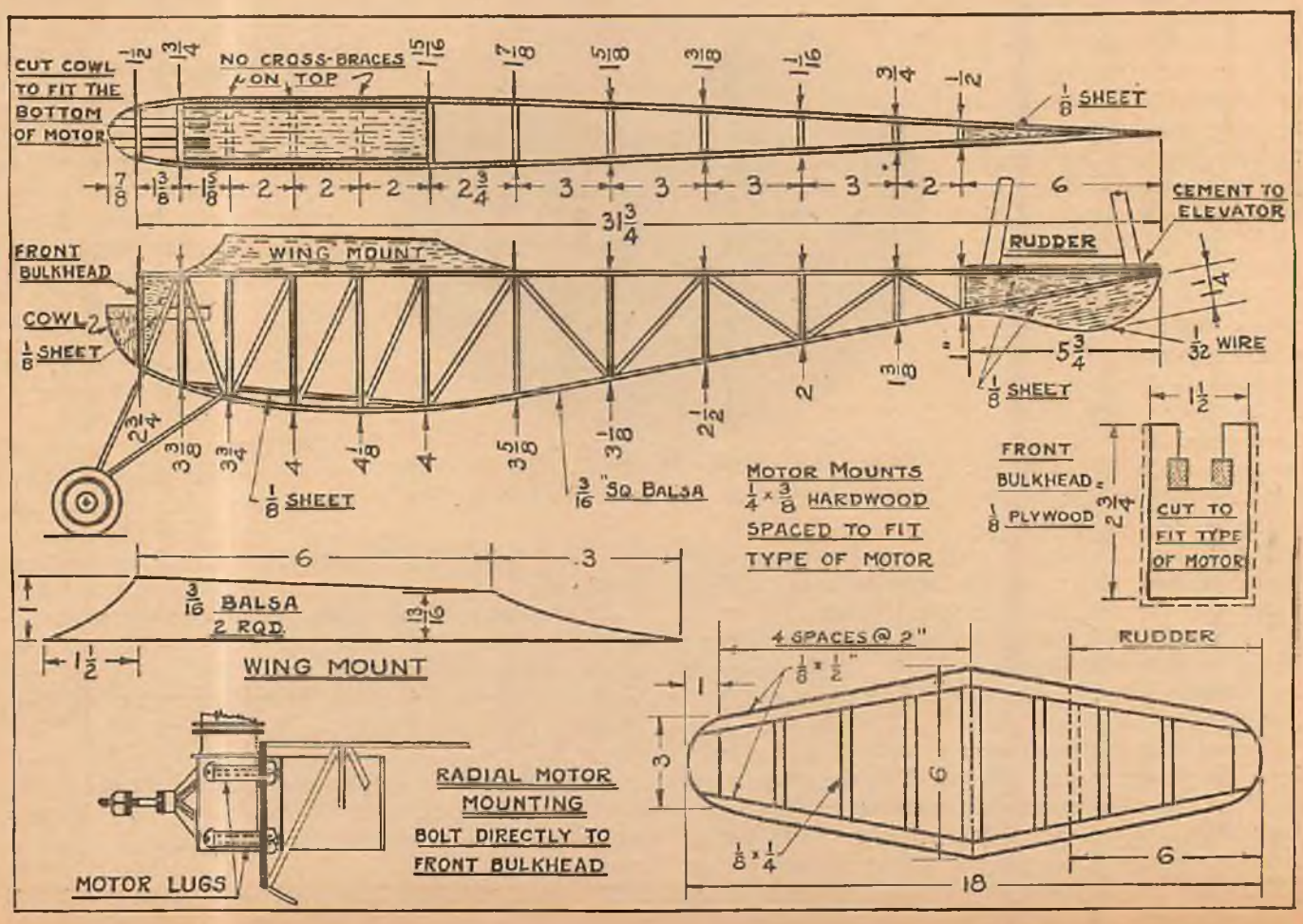
Bamboo paper is used for the covering. The bottom is covered first to facilitate cementing the paper to the cambered undersurface of the wing. The paper is first cemented to the trailing edge and onto the ribs as far forward as the spar and is then cemented to the leading edge. The top of the wing is covered—paper being cemented to the leading and trailing edges only. Spray the bamboo paper with water before doping.

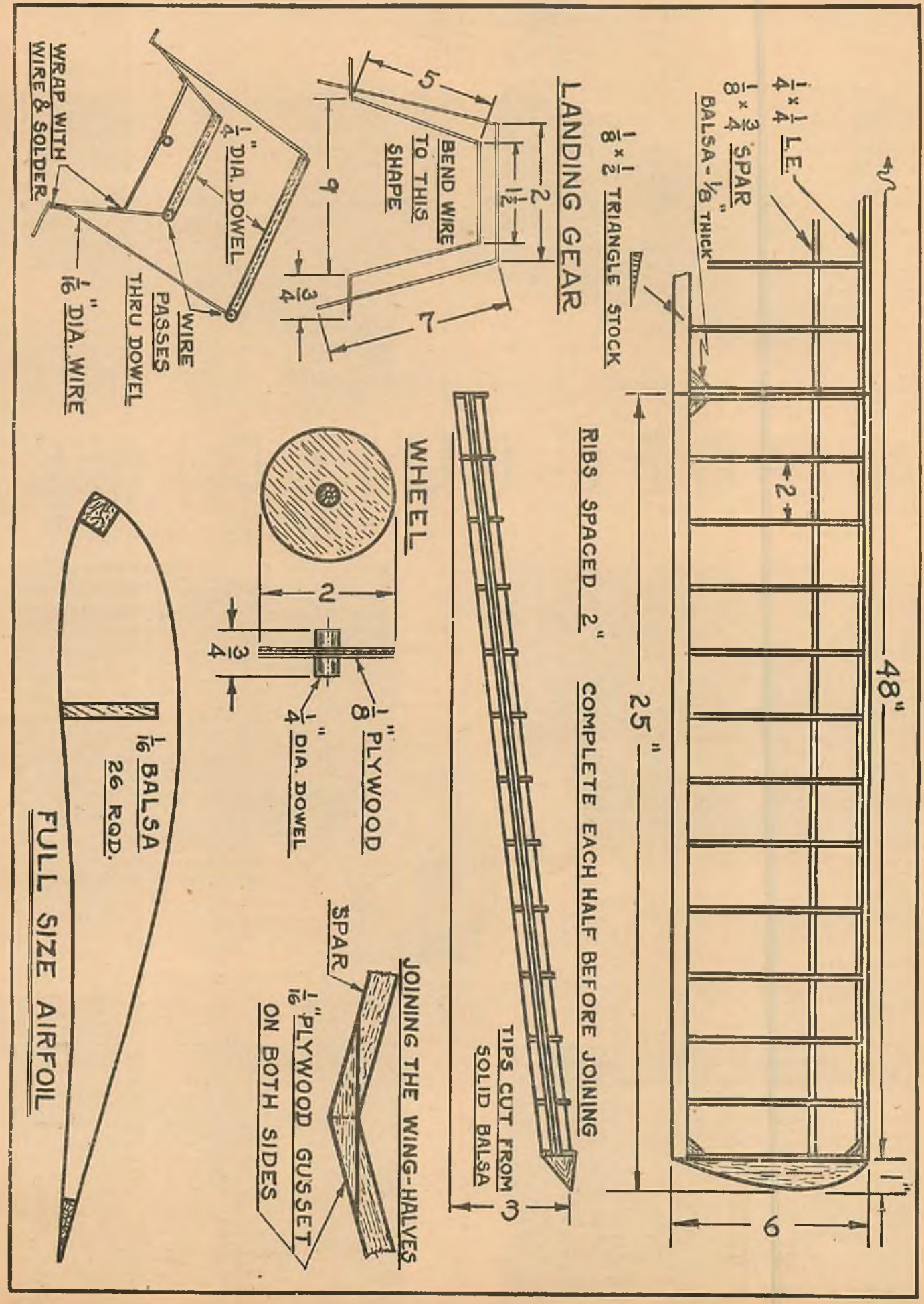
TAIL SURFACES

1/8" thick balsa is used throughout the tail surfaces. Ribs are of flat section with sharpened leading and trailing edges. The rudder is simply a portion of the elevator as indicated by the dotted line in the drawing. After completing construction of the elevator and rudder, join them with cement. Set the rudder at zero. The tail unit is then cemented flat atop the fuselage. Or if you prefer a demountable tail, mount it to the fuselage with rubber bands. The fin underneath the fuselage is made with 1/8" sheet balsa carved to a streamline section. 1/32" wire is cemented to the outline of the fin to protect it against wear, since this fin serves as a tail skid.

LANDING GEAR

1/16" music wire is used for the landing gear. The landing impact is absorbed by two 1/4" diameter maple dowels. The landing gear wire passes through these dowels, which are attached to the fuselage. Experience showed that airwheels available for rubber models of this size did not stand up under the increased weight. The size of airwheels available for gas models proved too large and bulky. Consequently, plywood wheels were substituted. While they're not as (Turn to page 89)




1/4 × 1/4 L.E.
1/8 × 3/4 SPAR
BALSA - 1/8" THICK
1/8 × 1/2 TRIANGLE STOCK
48"
25"
2
1"
6
RIBS SPACED 2"
COMPLETE EACH HALF BEFORE JOINING
TIPS CUT FROM SOLID BALSA
LANDING GEAR
BEND WIRE TO THIS SHAPE
5
2
1 1/2
9
3/4
7
1/4" DIA. DOWEL
WIRE PASSES THRU DOWEL
1/16" DIA. WIRE
WRAP WITH WIRE & SOLDER
WHEEL
2
3/4
1/8" PLYWOOD
1/4" DIA. DOWEL
JOINING THE WING-HALVES
SPAR
1/16" PLYWOOD GUSSET ON BOTH SIDES
1/16 BALSA 26 REQ.
FULL SIZE AIRFOIL

Some of the gas models at the contest. It is interesting to note the tendency to high-wing cabin designs.

A radio-controlled ship with turbine drive. Turbine runs at 30,000 r.p.m., geared prop at 1,000 r.p.m.

MODEL BUILDING

Pictures taken at a

A gas-powered model of a powered glider. This model flew well at the contest and displayed an excellent gliding angle.

A seaplane model at rest on the "tank." The large-sized pool especially prepared for the meet is typical of the seriousness of model flying in Germany.

An ornithopter with movable wing tips, now to be developed by the Institute for Glider Development.

This scale model of a Koolhoven F.K.55 proved to be an outstanding performer.

A double autogiro, an interesting original design, proved difficult to fly.

An endurance model with three rubber motors geared to the single prop. The prop run is four to five minutes.

A gas-powered Dornier built of aluminum. No type of plane seems too difficult for the Germans to duplicate in model form.

IN GERMANY

recent German contest

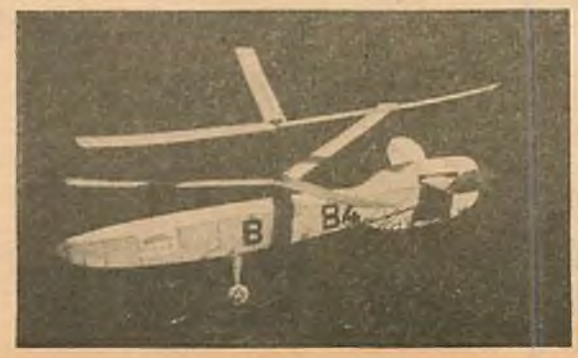
A pusher type gas model. The panted rear wheel acts as a fin surface

Typical of German craftsmanship was this gas-powered Henschel military machine.

A gas model of the Rumpler Taube, a good performer but disqualified because of its weight.

A rubber-powered Stosser. The detachable rear offers access to the geared motors.

An exact scale model of the Focke-Wulf Stosser, a beautiful gas-powered model.



This helicopter had rotors turning in opposite directions.

Below—Designed expressly for beginners, the Spee Dee possesses fine stability, yet displays surprising performance. Right—"Squads left!" aptly describes these jaunty ships.

Below—The wing is adjustable, held in place by rubber bands. The landing gear is crashproof, just a single wire strut. The little ship bears a composite resemblance to many planes of the day.

By Alan D. Booton

THE SPEE DEE

THE primary interest of the novice builder is to build a model that will fly. Usually the haste in assembling the chosen design spoils the possibilities of good performance and a fretful aftermath ensues. The novice has seen that particular design do well in the hands of another, perhaps younger builder, and wonders why his will not equal the rival model's performance. Care and patience are of the utmost importance in building accepted designs, and then there is the prudent matter of careful adjustment in trial flying before making showy flights.

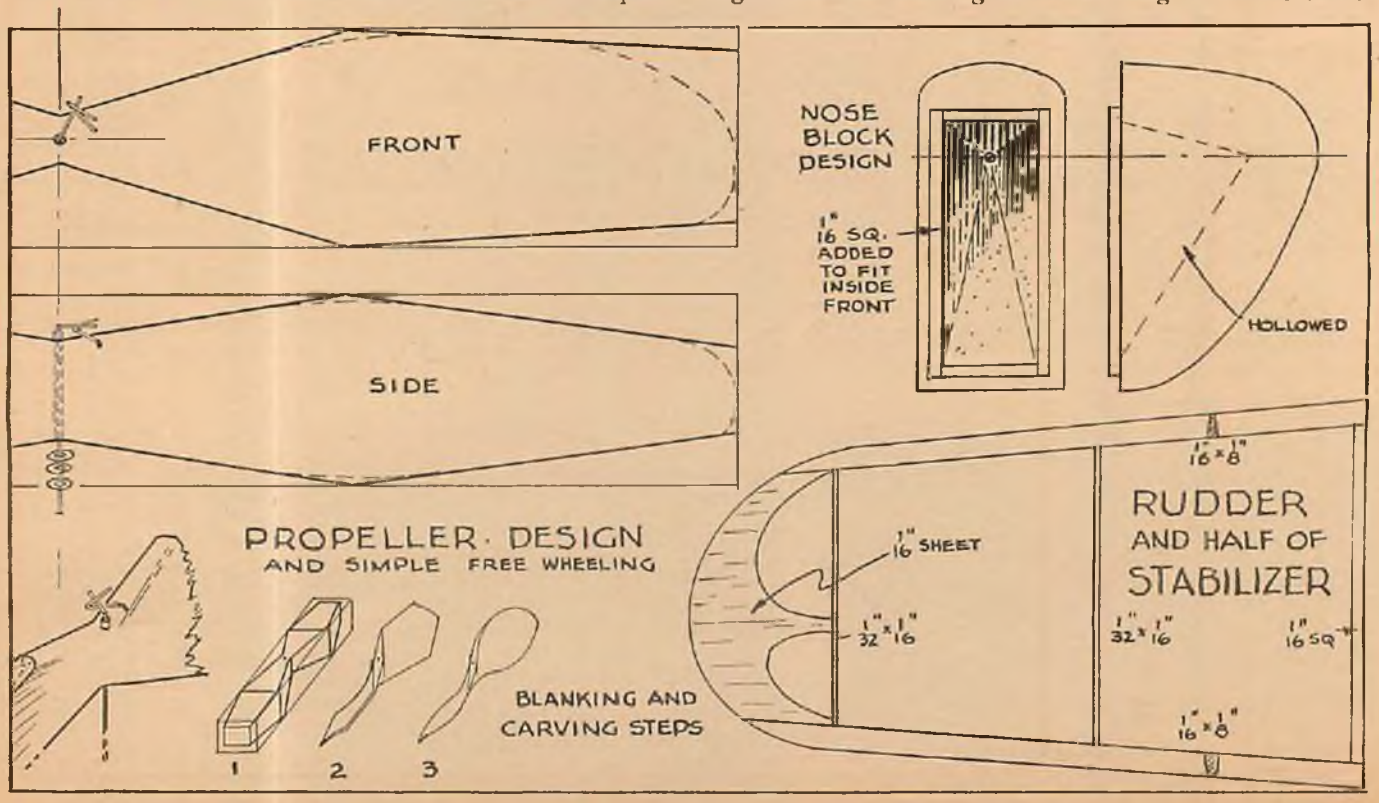
The Spee Dee makes an excellent design for the novice who has built several small models. It is not an experimental model, because the author took care of that in successive steps before presenting the final design.

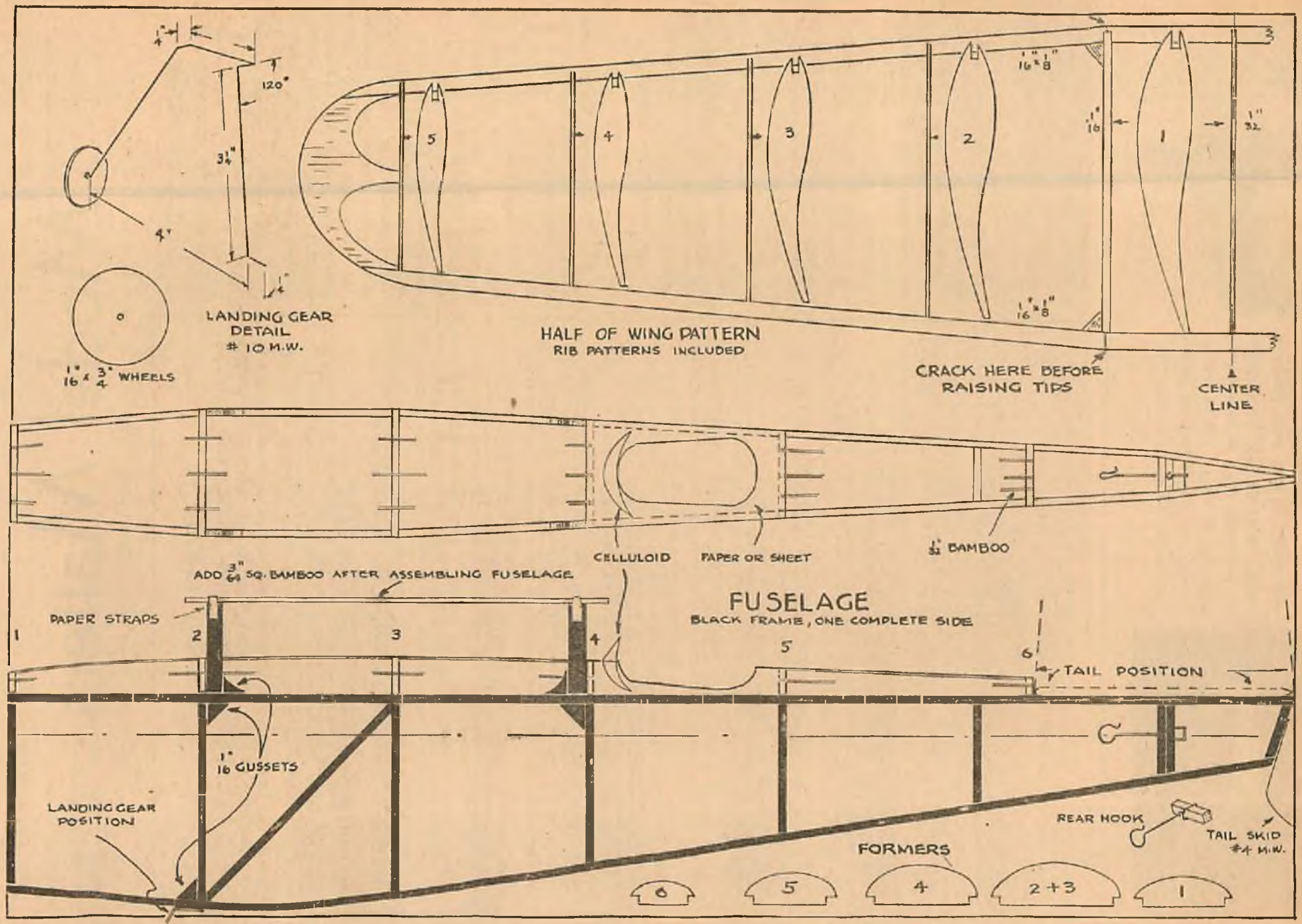
CONSTRUCTION

Assemble two fuselage sides and then space them with the formers and corresponding bottom spacers. Cement the $^1/_{32}$" bamboo stringers in place, then the $^3/_{64}$" bamboo wing rests. No spacers are used between the rests.

Carve the nose block and hollow it slightly as shown after cementing on the $^1/_{16}$" sq. pieces. The shaft hole must center as shown.

The wing is built by pinning the leading and trailing edges over the drawing and cementing *(Turn to page 82)*




1/4"
120°
3 1/4"
4"
1/4"
LANDING GEAR DETAIL
10 M.W.
1/16 x 3/4" WHEELS
5
4
3
2
1
1/16 x 1/8"
1/16"
1/32"
1/16 x 1/8"
HALF OF WING PATTERN
RIB PATTERNS INCLUDED
CRACK HERE BEFORE RAISING TIPS
CENTER LINE
CELLULOID
PAPER OR SHEET
1/32" BAMBOO
ADD 3/64" SQ. BAMBOO AFTER ASSEMBLING FUSELAGE
FUSELAGE
BLACK FRAME, ONE COMPLETE SIDE
PAPER STRAPS
1
2
3
4
5
6
TAIL POSITION
1/16" GUSSETS
LANDING GEAR POSITION
REAR HOOK
TAIL SKID
#4 M.W.
FORMERS
6
5
4
2+3
1

Flight records and contestants in competitions.

Model Matters

Club notes and news of model organizations.

(In contest tabulations, results are to be read as minutes (to left of colon), seconds, and fractions.)

Syracuse Club

Syracuse Model Airplane Club has recently changed officers. The new list of officers is: president, Wayne Fulmer; first vice-president, William Rogers; second vice-president, Robert Dillman; secretary, Robert Strader; treasurer, William Hayes. Harry C. Copeland continues as chairman of the advisory council. The club is fortunate in having such an enthusiastic model fan as H. C. Copeland. He's done much valuable work in interesting Exchange Clubs in sponsoring model activities throughout all parts of the country. The S. M. A. C. is sponsored by the Syracuse Exchange Club. At present the membership is 46. Business meetings are held each Friday at 7:30 p. m. in the Syracuse Y. M. C. A. building. Correspondence of modelers interested in joining the club should be sent to Robert Strader at this address.

Quaker City Club

The Quaker City Gas Model Airplane Club of Philadelphia held their monthly meeting February 25th, in the Germantown Y. M. C. A. Mr. Renato Contini, aeronautical engineer of the Budd Manufacturing Company, discussed the subject of low-speed airfoil sections most suitable for gas models. He interpreted the available experimental airfoil data to fit the gas modeler's requirements: good climbing and gliding characteristics together with adaptability to gas model construction. His clear semi-technical explanations of lift and drag forces, Reynolds Number, best glide angle, and a variety of other terms did much to stir Q. C. G. M. A. C. members into constructive thought—as evidenced by their interest in the lecture and subsequent questions. Wm. S. Berry, club director, was chairman of the meeting. His enthusiasm about modeling in general and the club's activities in particular is contagious. Club members share

(Turn to page 82)

Contest Calendar

READERS AND CLUBS. Notices should be mailed to the Contest Calendar, Air Trails, 79 7th Ave., New York City, at least 5 weeks in advance; news of winners and results immediately after the events.

SAN DIEGO THIRD ANNUAL GAS MEET, Camp Kearney Mesa, April 24th. Sponsored by the San Diego Aeroneers and directed by S. P. Andrews, I.G.M.A.A. contest director, and Jim Roche, N.A.A. contest director. Regional in scope, approximately 125 contestants being expected from all parts of California. Meet to be of the limited motor run, endurance kind, with simple rules: all types, no weight rule, two flights allowed (no delayed). Tentatively, prizes will be $100 in cash awards and various merchandise awards.

GAS MODEL MEET, Seversky Field, Farmingdale, Long Island, N. Y. April 24th. Timer and duration events. Information from contest director Irwin S. Polk, 421 Seventh Ave., New York City.

CONTEST, Wausau, Wis. Approximate date, May 1st, weather permitting, at Alexander Airport. For Class C and D fuselage and C and D stick according to N.A.A. rules of weight. Prizes of kits and model supplies. Information from Leonard Wiederhoeft, Route 5, Wausau, Wis.

FIRST ANNUAL MODEL CLASSIC, sponsored by the Philadelphia Gas Model Association, Sunday, May 29th. Timer flying will probably be the order of the day, with plentiful prizes. For further information contact Mr. Jesse Bieberman, 3213 E. Brighton St., Philadelphia, Pa.

NORTHEASTERN STATES MEET sponsored by the Junior Aviation League of Boston, Mass. Open to modelers from all sections of the country. Indoor flying at the Boston Garden, June 4th; outdoor events at the Harvard practice field, June 5th. A full list of trophies, plaques, cups, gas engines and other awards. Information and entry blanks from Al Lewis, Junior Aviation League, Jordan Marsh Company, Boston, Mass.

ANNUAL MODEL AIRPLANE CHAMPIONSHIP MEET, June 5th, for rubber-powered models, August 7th for gas models. Sponsored by the Flying Keystone Model Airplane Club. Rubber events will include hand-launched gliders, stick and cabin models and the Wakefield events. Gas events will be announced later in the season. Prizes will include merchandise, medals and trophies. For further information and requests for entry blanks write to Flying Keystone, Y.M.C.A. Building, Center Square, Allentown, Pa.

STIX, BAER, AND FULLER NATIONAL ELIMINATION CONTEST, June 23rd-25th. Winners will represent S.B.&F. at the National Meet in Detroit in July. Modelers in vicinity of St. Louis are eligible.

FIRST NEW JERSEY STATE GAS MODEL MEET, Hadley Airport, date tentatively set June 25th. Sponsored by the Linden Model Aircraft Club. Entry blanks and contest rules from the sponsors at Old City Hall, Linden, New Jersey.

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.

NATIONAL CONTEST, Detroit, Mich. Date tentatively set July 6th to 9th, inc. Complete list of N.A.A. contests for the National trophies. Information and entry blanks, National Aeronautic Association, Dupont Circle, Washington, D. C.

ANNUAL GAS MODEL CONTEST, Miller Field, Staten Island, N. Y. C., sponsored by the Richmond Model Flying Club. Tentative date August 14th; announcements to be made later. For information address Richmond Model Flying Club, 26 Bond St., Staten Island, N. Y. C.

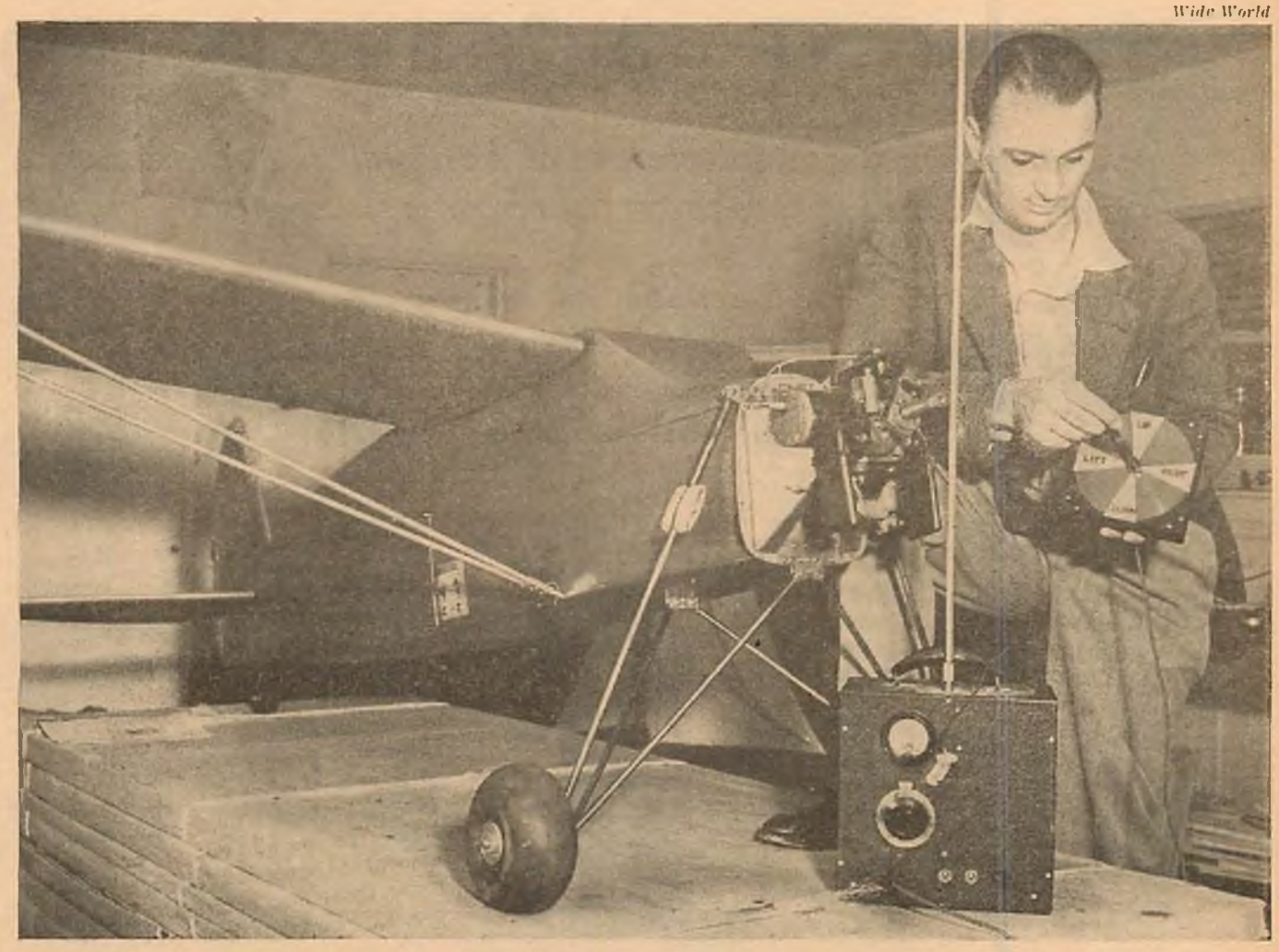
SIXTH ANNUAL MISSISSIPPI VALLEY TOURNAMENT, August 13th and 14th. A full list of indoor and outdoor events. Any modeler eligible. Trophies, medals, merchandise, trips, and other attractive prizes. Information from Contest Director, Stix, Baer, and Fuller Model Club, St. Louis, Missouri.

SECOND ANNUAL TRENTON EASTERN STATES GAS MODEL MEET sponsored by Trenton Chapter of the N.A.A. Permanent trophies and cash awards for first place winners; numerous awards for other place winners. Date: Sunday, August 21st; place: Mercer Airport. For further information address the Trenton Aero Society, 212 Centre Street, Trenton, N. J.

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.

Left—Mr. "X," new gas model designed by Pete Dillon, the duPont Trophy holder. Plans for the duPont winner of 1937 appeared in the February 1938 Air Trails. Right—Moyer Sport, built by Jerry Ruby of Paterson.

Wide World



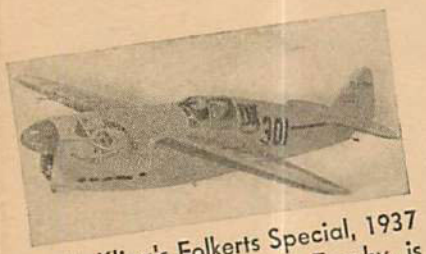
A radio-controlled model airplane which, if successful, will pave the way for general use of such machines to train anti-aircraft and coast artillerymen. Paul Whittier, veteran airman and Reginald Denny, actor-modelmaker, constructed the gasoline-powered plane. The craft's wing-spread is twelve feet; from tail to propeller it measures eight and one half feet; once the model's three horse-power engine pulls it skyward, the radio controls go into action. In the fuselage of the plane the builders have installed a secret, three-tube set which sends impulses to tiny electric motors; these operate to the tail, rudder and elevators. Ground equipment consists merely of a short wave sending set and a control box, with contact points which modulate the wavelengths of the radio impulses. These send the plane up, down—left or right.

Twin-motored gas model weighing six pounds, with a wing span of eight feet. Powered by two Brown Juniors fed by gravity feed, four flashlight cells are in the nose of the model just ahead of the wing. Plane could take off on one engine—the other engine dead. Synchronizing device prevents spins when one motor cuts out.

This five-foot model is covered with bamboo paper and weighs three and a half pounds. It is powered by a Brown Junior, has made 260 flights, and has made six minutes on a 25-second motor run. Wing section is Eiffel 400, tail section Clark Y. Both this and the model to the left were built by Henry Stiglmeier of Inglewood, California.

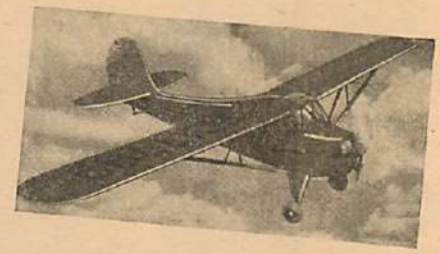
LET'S GET ACQUAINTED

A page open to Air Trails advertisers of kits, engines and accessories. Reviewing outstanding products in response to popular request.

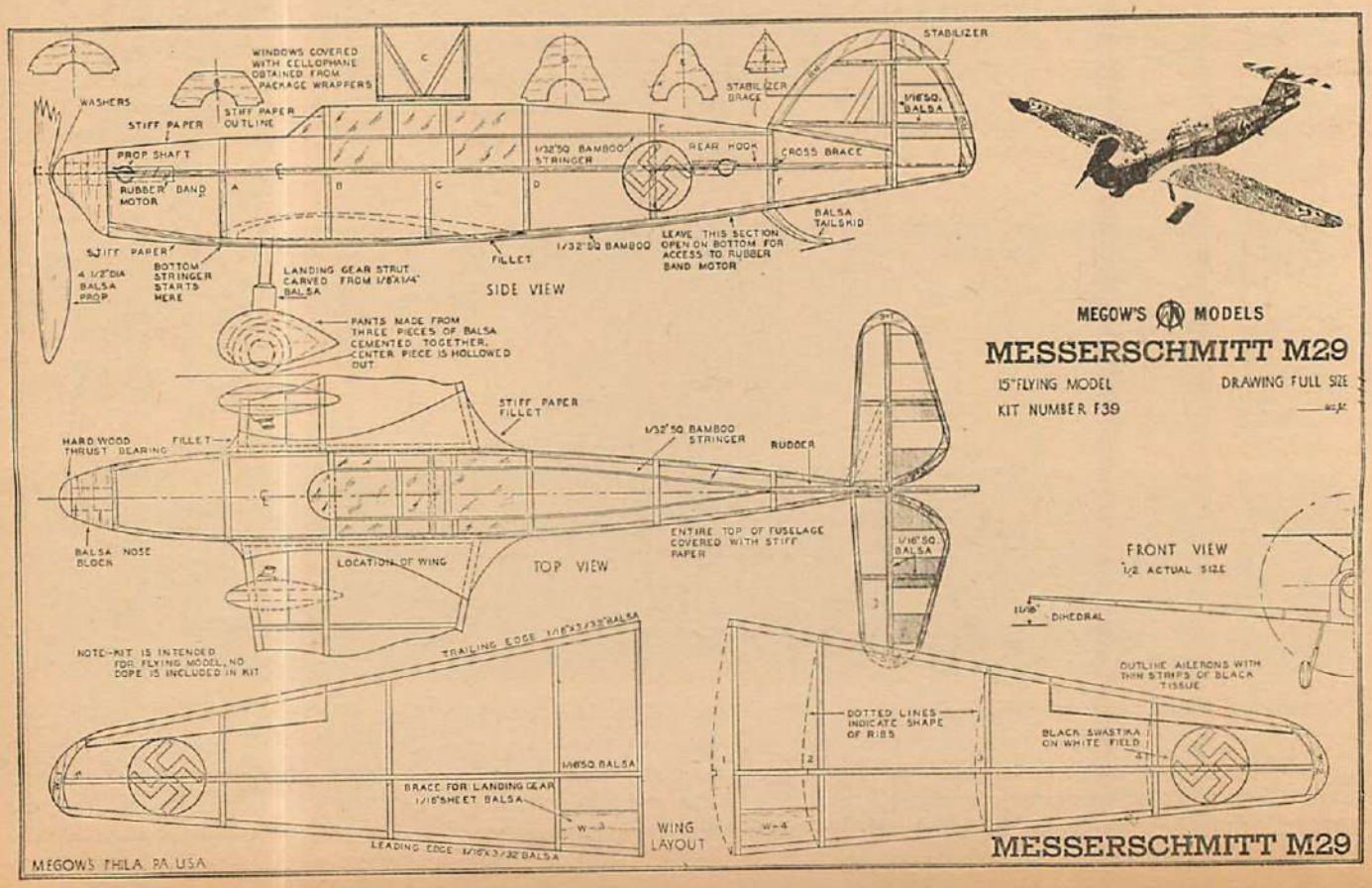


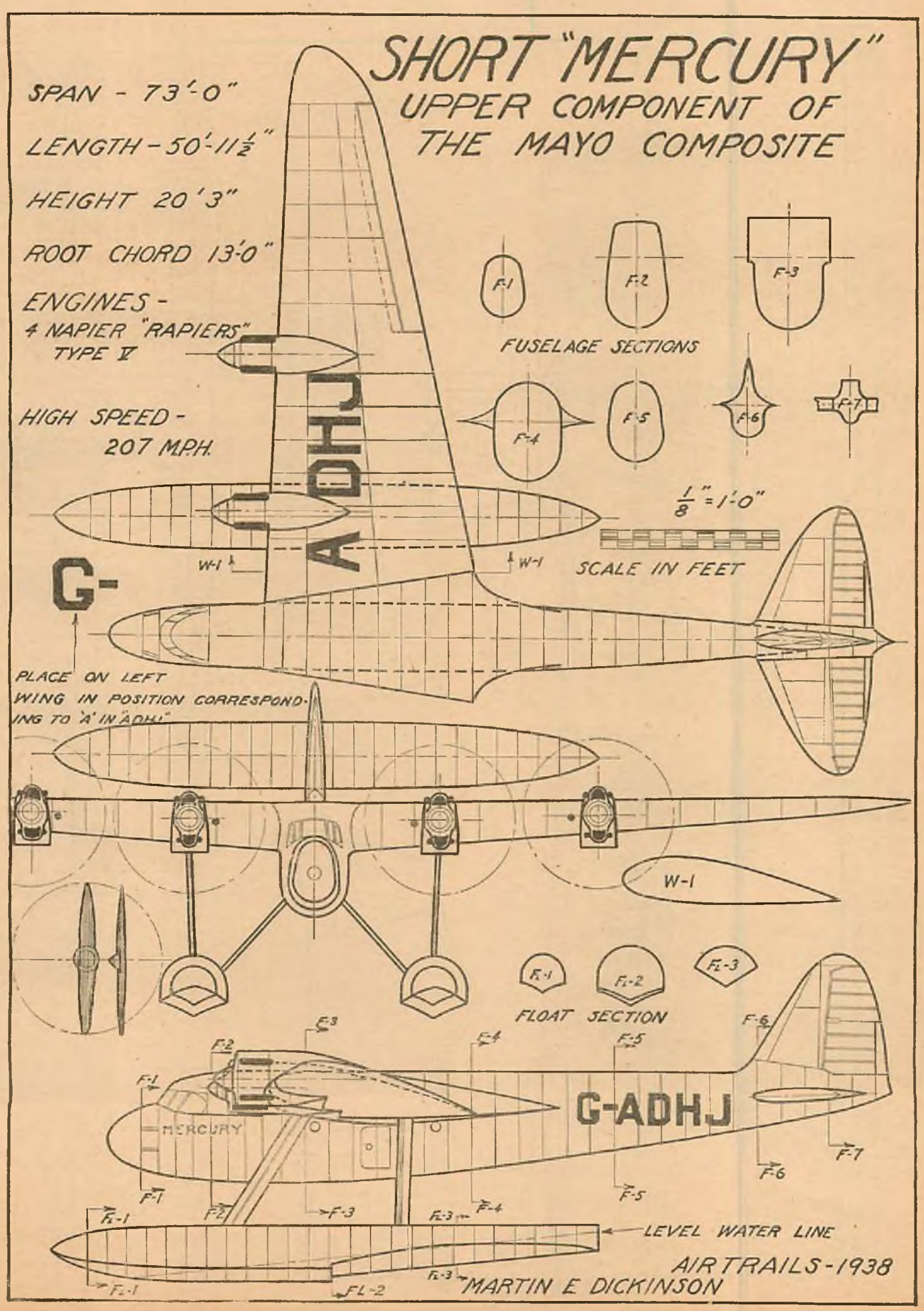
Rudy Kling's Folkerts Special, 1937 winner of the Thompson Trophy, is produced as a flying scale model by the Cleveland Model and Supply Company. For those who prefer to construct ships that resemble their prototypes in the most minute details, Cleveland is a name to conjure with. The "Special" is available in the 1/2" scale (8" span) at $0.65, and in the 3/4" scale (12" span) at $1.95. Both kits are complete, down to the retracting landing gear. Kits are in dry form (no liquids). Right—Richard Korda and his 54-minute contest job, kits of which are now obtainable from the Burd Model Airplane Company.

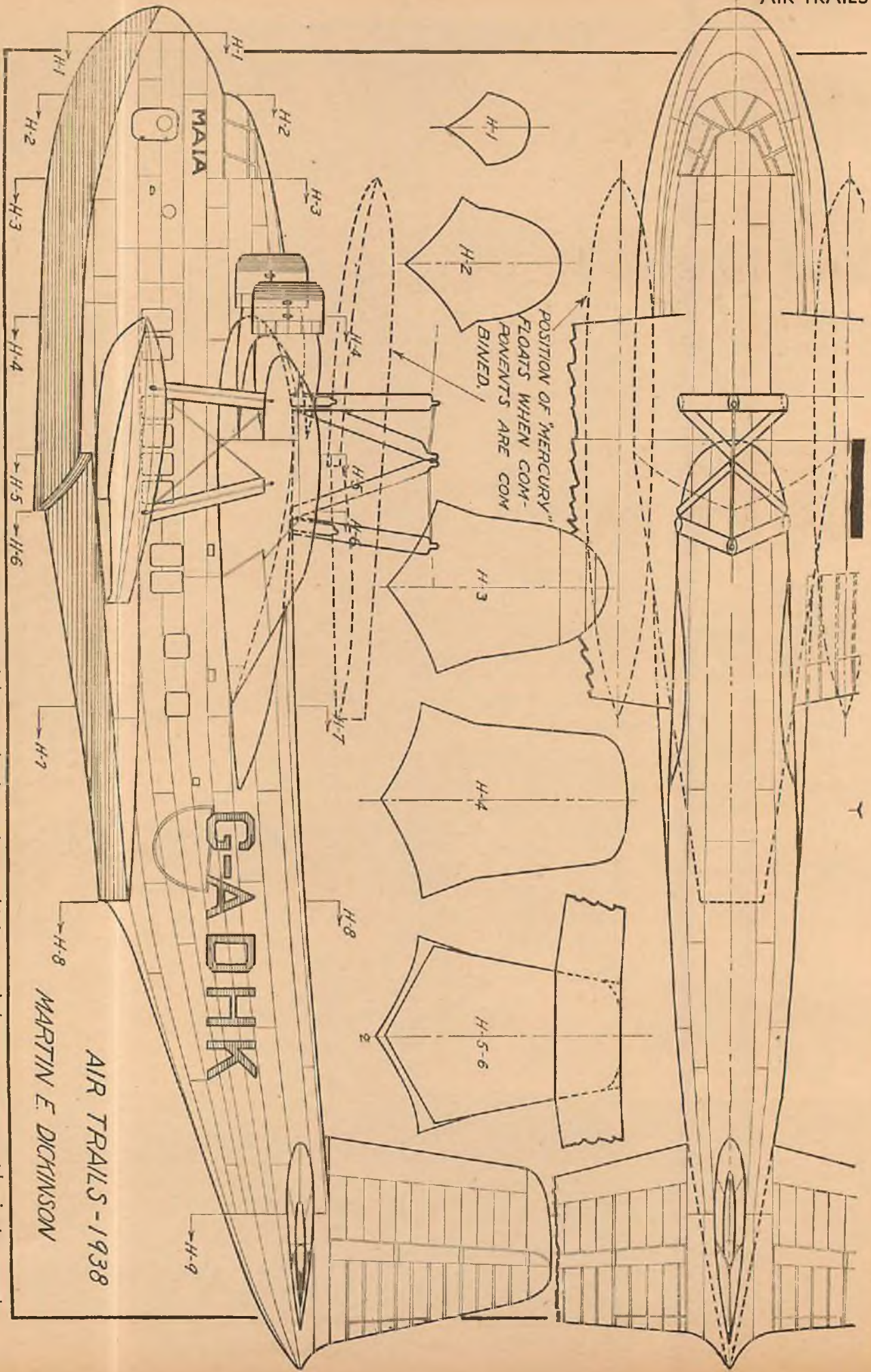
The Model Staff will supply on request any particular information on these products.



The ultimate in performance is inbred in Burd's large 50" designs, of which the Aeronca above is exemplary. The large size provides an extraordinary duration. The low price of $1 should permit any flying-scale enthusiast to purchase many hours of constructional and flying enjoyment. Below—A greatly reduced plan, just a sample of what is to be found in Megow's 10-cent flying-scale model kits. The sound design and the amount of materials merit a price many times that charged. Biplanes are 12" in span; monoplanes 15".

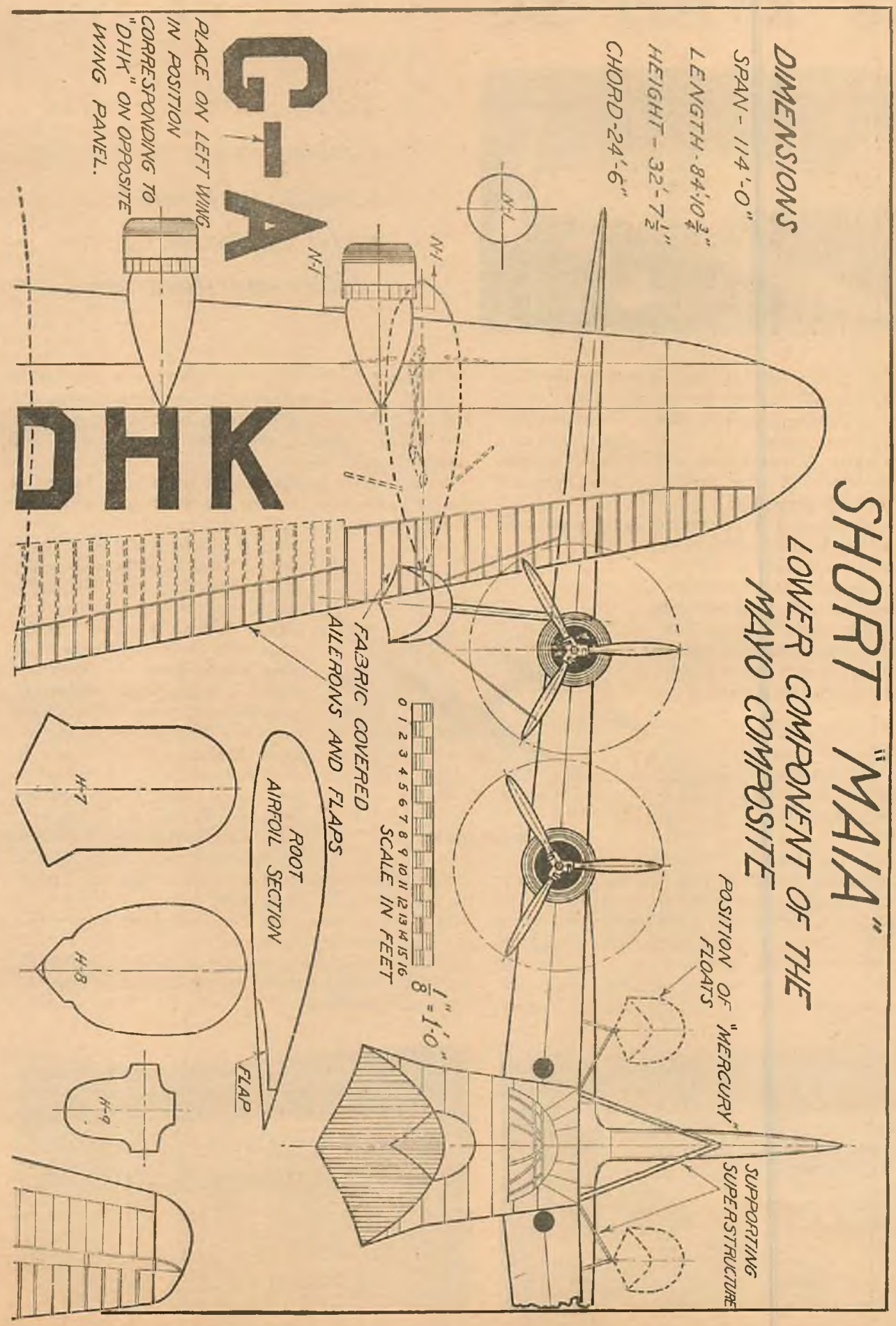



SHORT "MERCURY"
UPPER COMPONENT OF
THE MAYO COMPOSITE
SPAN - 73'-0"
LENGTH - 50'-11½"
HEIGHT 20'3"
ROOT CHORD 13'-0"
ENGINES -
4 NAPIER "RAPIERS"
TYPE V
HIGH SPEED -
207 M.P.H.
F-1
F-2
F-3
FUSELAGE SECTIONS
F-4
F-5
F-6
F-7
1/8" = 1'-0"
SCALE IN FEET
W-1
W-1
G-
A
DHJ
PLACE ON LEFT
WING IN POSITION CORRESPOND-
ING TO 'A' IN "ADHJ"
W-1
FL-1
FL-2
FL-3
FLOAT SECTION
F-3
F-4
F-5
F-6
F-2
F-1
MERCURY
G-ADHJ
F-7
F-6
F-1
F-5
FL-1
F-2
F-3
FL-3
F-4
LEVEL WATER LINE
FL-1
FL-2
FL-3
AIR TRAILS-1938
MARTIN E DICKINSON



Taking off and at lower speeds, the lower component carries the greater part of the gross load. As the speed is increased, the upper component begins to support more and more weight until, finally, it is supporting its own weight. As the speed is increased still more the components tend to separate. An ingenious system of coördinated instruments and release mechanism guarantees the release at the proper moment.

Martin E. Dickinson started last September the preparation of these drawings of the Mayo Composite. At that time, Air Trails had decided that a "rush" compilation of the Composite was not in keeping with the wealth of detail embodied in its design. Sufficient time was given Mr. Dickinson to enable his duplicating every feature of the original. The editors would appreciate hearing from model builders how this particular arrangement was liked and whether or not more plans of this character would be preferred to the lesser-detailed "scoops."



The RYAN S-C

by Alan D. Booton

Real performance with a flying scale model—a lightweight, large size model emphasizing stability and duration.

PRODUCTION has just been started by the Ryan Aeronautical Company on the two models of the new S-C three-place sport plane. The only difference in these two models is the choice of a Warner or a Menasco engine. The performance of the ship is approximately the same with either engine, top speed being 150 m.p.h. and landing speed 45.

The Ryan Company is a pioneer of metal construction in planes, and in the model of the Menasco powered S-C it will be noted that the metal fuselage is simulated, together with other external features. The model is larger than usual and of simple construction, and due to its size, makes longer flights than could be expected otherwise.

The model gliding.

FUSELAGE

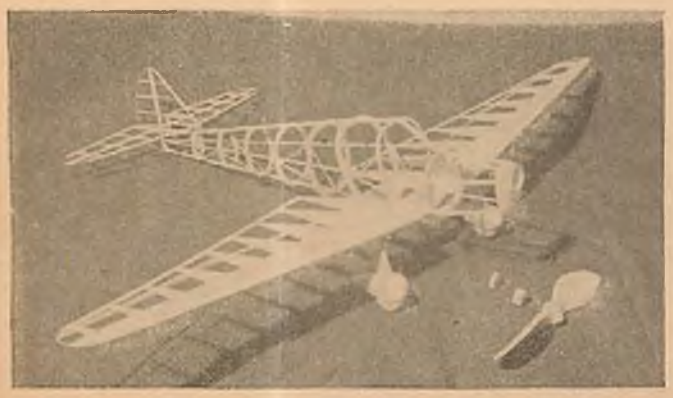
Prepare a 6x8" sheet of $^1/_{16}$" balsa plywood by cementing cross-grain $^1/_{32}$" sheets. Keep this weighed down several hours to dry, then cut out the formers in pairs, except DT, which can be cut from $^1/_{16}$" sheet.

Pin the top and bottom longerons to the drawing and cement the formers to their respective stations. The drawing shows a continuation of the top longeron to aid in assembly. This is cut away just before covering the fuselage forward of F. Bend a strip of $^3/_{32}$" sq. so that it will lay in the former slots without forcing, then cement it in place. Cement $^1/_{16}$" sq. diagonals between the formers from the bottom longeron to the middle longeron. After this is dry, remove from the drawing and build the other side directly to it in the order the first half was made. Include the rear hangar as F is cemented on.

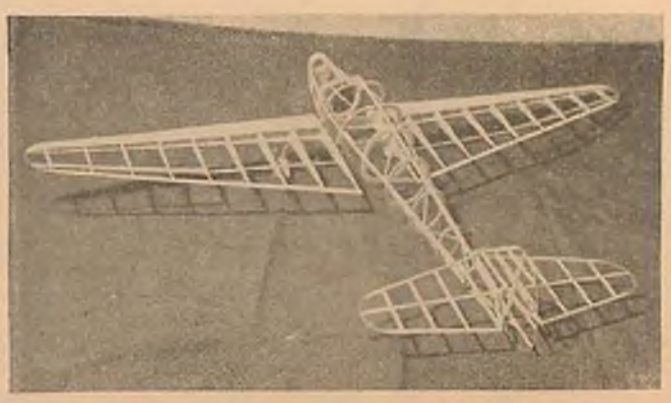
Since there is no bulge in the fuselage to the rear of former F, the sheet covering can be wrapped around the frame like a cone. Cut $^1/_{32}$" sheets diagonally to form an oversize pattern similar to the miniature pattern on sheet 2, in a dry state at first, then when the setup is satisfactory, cement the parts together. When dry, cement the top longeron to the center of pattern. In other words, invert the frame and cement it to the blank. When dry, wrap the cover around the frame and trim away the excess sheet, then cement members that will touch the sheet, and with rubber bands bind the cover to the frame. Cover the frame forward of F with narrow sheets.

Cement plain #1 ribs ($^1/_{16}$") to the stubs of E and F in the position shown by the broken lines of the rib on sheet 2. Cement the fillet sheets on. These must be made by cut-and-try with pieces of paper, but the final appearance will be noted by reviewing the photos.

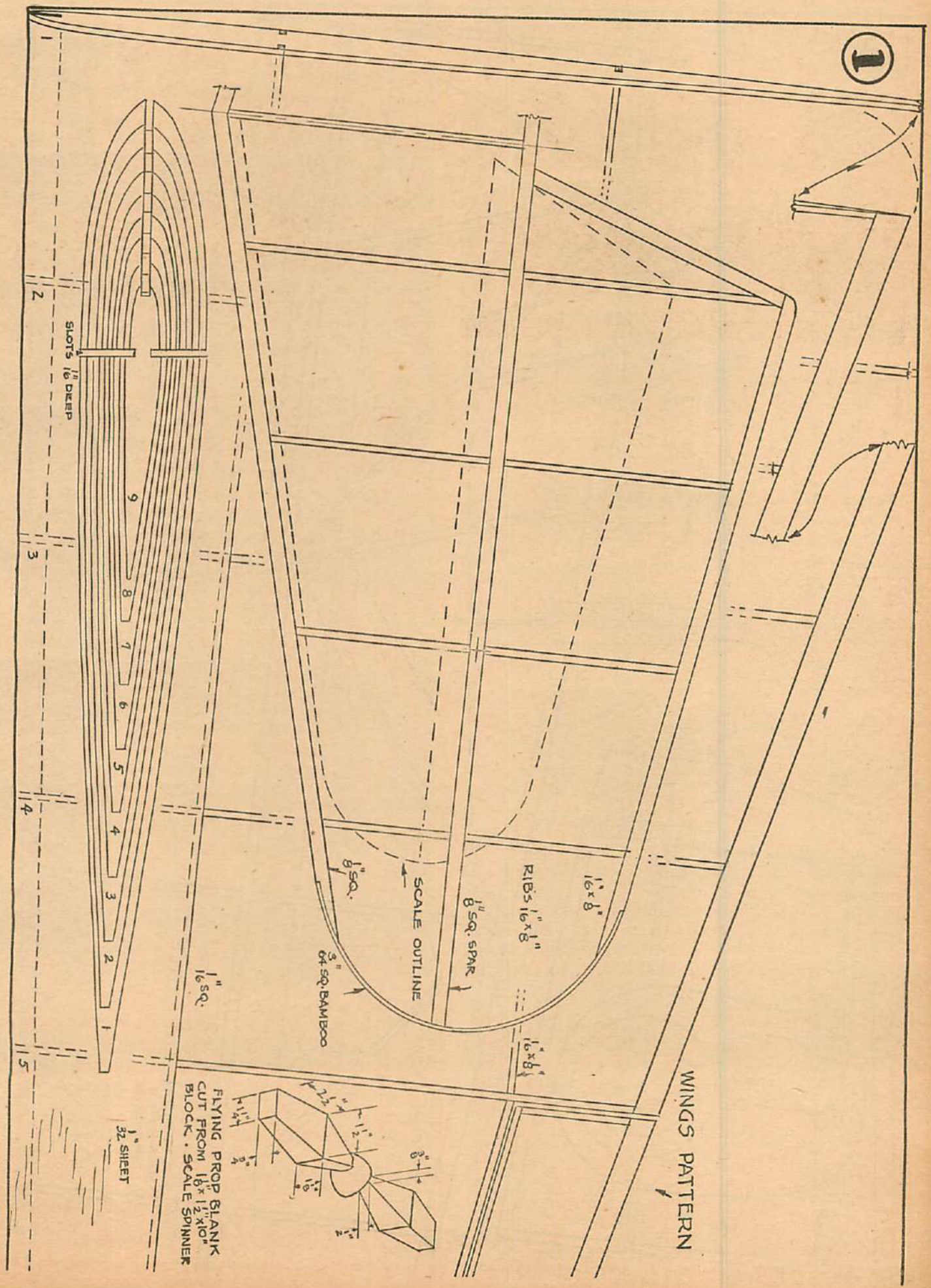
Cut away the temporary top longeron, complete the top of the fuselage front of the cabin and then frame the cabin with bamboo. *(Turn to page 84)*

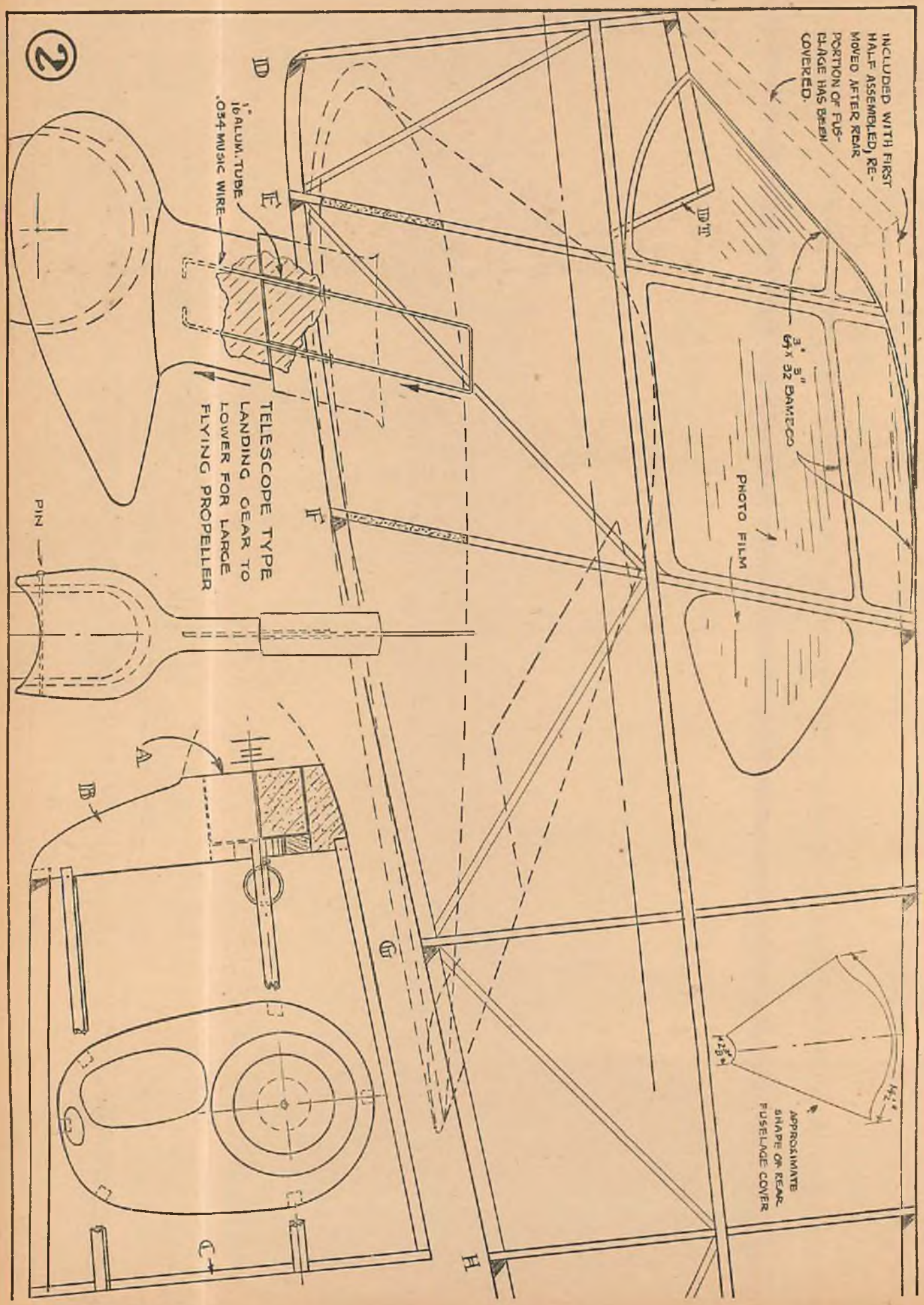


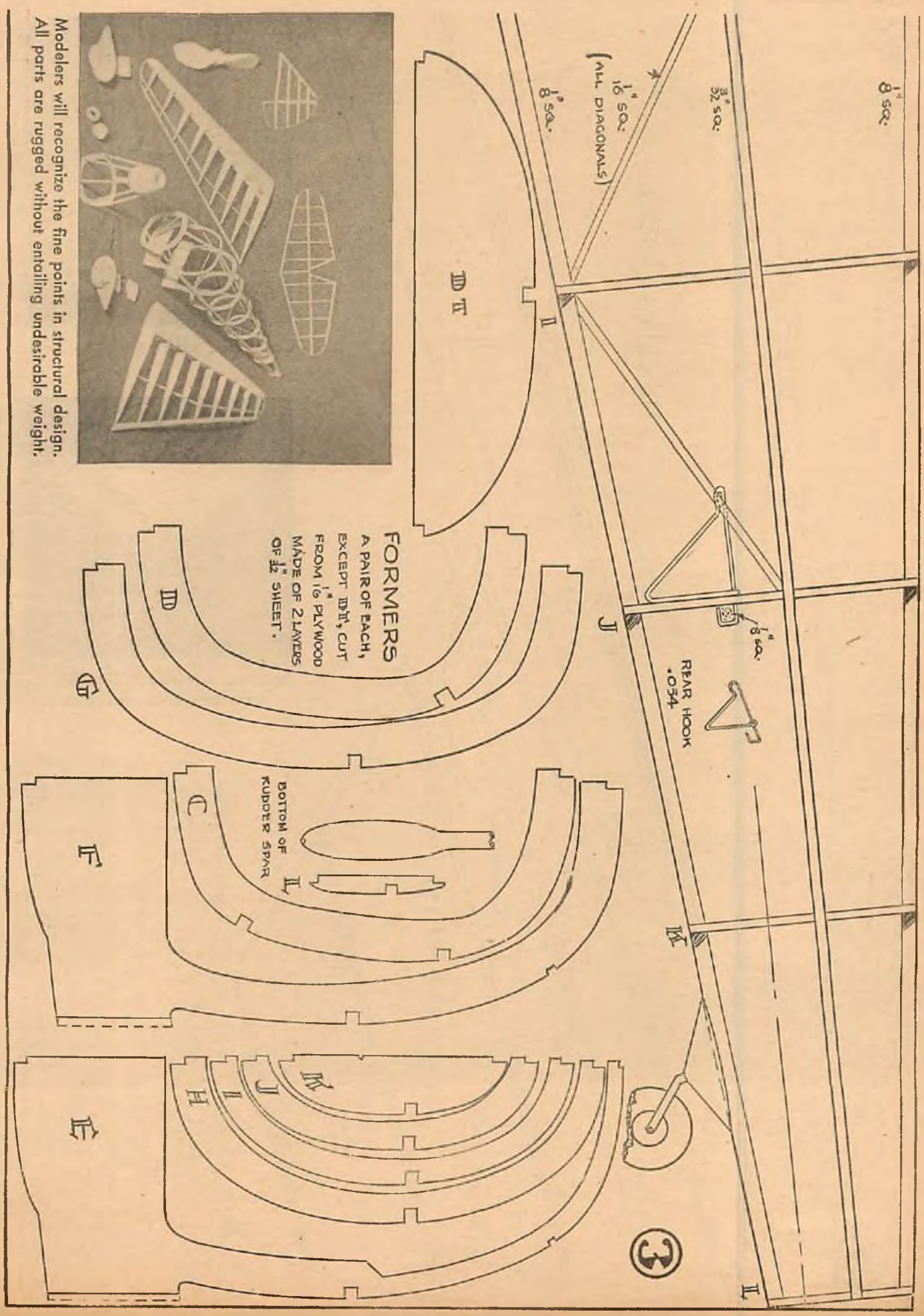
The structure features bulkheads and master stringers. Fuselage is sheet balsa covered.



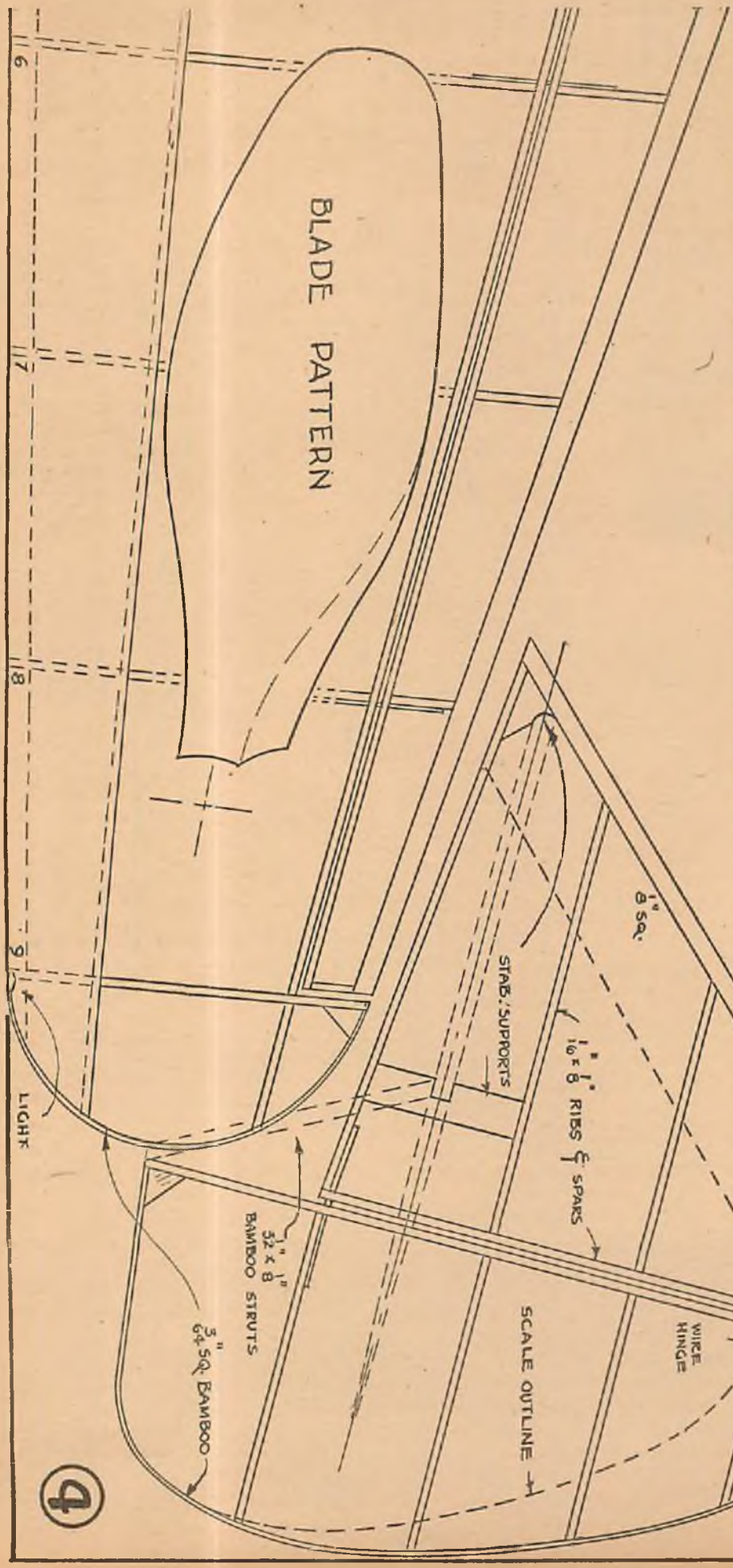
Its large size and inherent stability make this low wing a super performer.


1
WINGS PATTERN
1/16 x 1/8
RIBS 1/16 x 1/8
1/8 SQ. SPAR
SCALE OUTLINE
1/8 SQ.
3/64 SQ. BAMBOO
1/16 SQ.
1/16 x 1/8
SLOTS 1/16 DEEP
1/32 SHEET
FLYING PROP BLANK
CUT FROM 1/8 x 1 1/2 x 10"
BLOCK. SCALE SPINNER
1
2
3
4
5
6
7
8
9

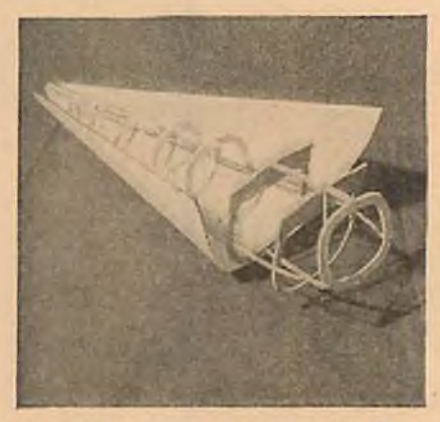

2
INCLUDED WITH FIRST HALF ASSEMBLED, REMOVED AFTER REAR PORTION OF FUSELAGE HAS BEEN COVERED.
3/64" x 3/32" BAMBOO
PHOTO FILM
D
D'
E
F
G
H
A
B
C
1/16" ALUM. TUBE
.034 MUSIC WIRE
TELESCOPE TYPE LANDING GEAR TO LOWER FOR LARGE FLYING PROPELLER
PIN
APPROXIMATE SHAPE OF REAR FUSELAGE COVER



Modelers will recognize the fine points in structural design. All parts are rugged without entailing undesirable weight.



Cabin and wing root-fillet details.



The sheet covering is simplified as explained in the directions.

LIGHT PLANE FLYING CLUBS

(Continued from page 24)

used are properly licensed and that you in no way become involved with any unlicensed entanglement.

For you who are considering flying club training this year, here are a few points that should be considered. I got them from the above-mentioned Jim McBride, who has had the experience, and he should know.

First, make certain that the plane being used for instruction is in good shape. If it is a second-hand ship, its value should be in the neighborhood of $1,000. Such a ship can be bought for approximately $300 down and the balance paid up in twelve payments of $58.33. One such plane would accommodate the requirements of about twelve students, so that their share of the cost would be a down payment of $25 with an additional monthly assessment of about $5. Any repairs, of course, would be carried equally by the twelve members, and this is a very important item that must be thoroughly thrashed out and clarified before you sign up.

Actual flight cost is usually figured on an operation cost basis. For instance, figuring $1.50 an hour for flying a 40 h.p. job (Cub, Taylorcraft or Aeronca) the complete cost of fifty hours of flying would be $158.33 if the time were spread over twelve months; and in addition, the student will still retain his one-twelfth interest in the ship, which will amount to about $75. Actually then, if you can get into a well-run flying club with eleven others who share and share alike, you can get fifty hours of flight training (dual and solo) for something less than $100.

What, then, are the problems?

First, you must find this hypothetical flying club, or organize one yourself. Next you must find a suitable instructor who does not want to make a million dollars out of your venture. He must be a good instructor, and the fact that he holds a transport ticket does not assure you that he can teach. You must demand his references and his instruction history; for good instructors are few and far between.

You should then select your field, your operating base, and the most suitable is one that does not boast of too much traffic. It should be reasonable in rental and convenient for your members. Hangar space should provide reasonable shelter for your ship and convenience for servicing and repairs. These things are very important, not only for the efficient conduct of the club, but for the problem of keeping down expenses. If the hangar can in addition provide suitable classroom space for ground subjects, so much the better.

Personally, I am not quite certain which of these problems provides the greatest stumbling block. It would seem that with the number of licensed pilots available, as compared with the number of licensed ships on the line, there should be some transport pilots who would be willing to add to their finances by taking over these flying club jobs. Besides remuneration, they would be adding to their flying time and gathering experience that cannot be bought anywhere else. We might go so far as to suggest that the civic bodies be urged to find these instructors other jobs to bolster their finances and encourage them to stay in the town and build up the aviation industry in that section.

There are many small towns that have suitable land available for landing fields, and no one can deny the ultimate value of being listed among the communities that have landing fields. If we

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A Pietenpol, Ford A powered, flown by "Tip-Top" Collingsworth, Perrytown, Texas.

believe in aviation, we can readily see how, within a few years, owning a civic landing ground will be as important as being on a Class "A" highway to-day. Your club instructor could be assigned the duties of managing this civic air field. He would have complete charge of it, the clearing, grading and general improvements. He could rent hangar space to commercial firms, cater to transient pilots and improve the field so that it could become an integral and important part of the national airway system. In that way he could fully justify his position, and still carry out his duties as club instructor.

In other words, the flying club can become a very important part of modern aviation as an industry and a worthy cog in the airways system. All this adds up to our recent contention that the light plane is, or can become, the greatest single contribution to the advancement of aviation.

But there's another angle to this instructor business which has been brought to my attention. Every year, the Army Air Corps turns out a certain number of highly skilled pilots. At the present time, from what we can understand, there is a dearth of candidates for the Flight Cadet openings at Randolph Field. On the other hand, a great number of qualified flying officers are released into civil life, to find positions in commercial aviation. A few find these positions, but most of them are forced to return to the more general of civil occupations.

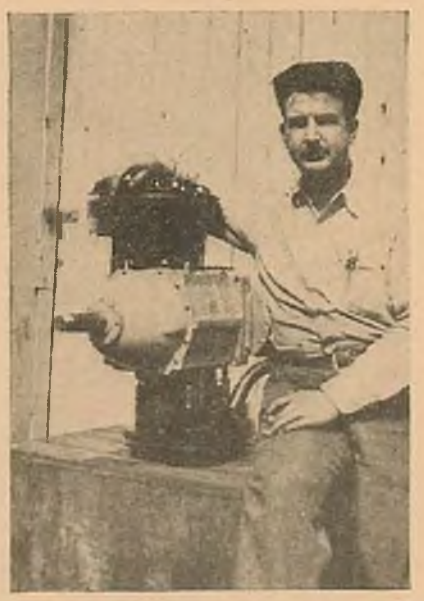
We all know that Army officers are loaned to the various Reserve Officers Training Corps units maintained at many of our colleges and universities. It apparently is a sound idea, and there is no reason why the same idea could not be incorporated into our flying clubs.

Young graduates, completing the Randolph Field and Kelly Field courses, cannot always be assimilated into regular service squadrons. They could be posted to recognized flying clubs as field managers and instructors under army jurisdiction and at army pay.

The results would add up to this:

The club would get the benefit of the finest and most up-to-date system of flight training carried out by a skilled pilot. The field would be properly controlled and run under that system of discipline so necessary to make it a paying proposition. The officer in question would retain his flying status and gather all-important flying time and experience. At the same time he would be in a position to study the students and select those he might deem suitable for reserve commissions and training in the Army Air Service. In that way, the government would always have on hand a valuable list of private pilots whose skill is such that they could be quickly turned into active service military pilots, should a national emergency arise.

This may seem a little idealistic, for light plane flying has never received its share of the breaks, but none of the suggestions offered are beyond the realm of possibility. They have been used and proven elsewhere, and there is no reason why Americanized versions of the same plans cannot be adopted here.



Jack Rose and his new 155-pound, 37-55 h.p., light plane engine now under development.

NEW EQUIPMENT

The year of 1938 will see a great improvement in American light aircraft. Already many of the new models are on the line at the various airports and it is easy to see that we are fast getting away from the skeleton cockpit and made-by-the-mile and sawn-off-by-the-yard wings.

We have been particularly interested in the new Luscombe line. In addition to the well-known Phantom the Luscombe firm of West Trenton, New Jersey, is now offering a Ninety and a Fifty.

The Ninety is powered with the 90 h.p. Warner Scarab Jr. and sells for $3,975. It has a top speed of 136 m.p.h. and lands at 47 without the use of flaps. With the flaps down, it can be set down safely at 40. It has a range of 600 miles, which should suit the most adventuresome.

The lighter Fifty uses the new Continental A-50 engine and has a wing-span of 35 feet, or about three feet more than the Ninety. In the initial flight tests, it showed a top speed of 107 m.p.h. and landed at 37 without flaps.

Fairchild will also be in the field again with two versions of the 24. One will use the inverted Ranger engine and the other will be designed around the Warner Scarab. The Ranger model is particularly pleasing as a high-wing monoplane with spatted wheels.

Two new Aroncas have been seen already. Both are two-place side-by-side models. As is well known by now, the K model is powered by the Aronca E-113-C engine, while the KC model will be fitted with either the Continental A-40-A or the A-40-5, which has dual magnetos.

For those who still go for the converted automobile engine models, we can say that the makers of the new Arrow Aircraft model, which is powered with the Ford V-8 engine of 82 h.p., have announced a new Model G Advance plane for which at this writing an A.T.C. is pending. They have increased the horsepower to 90 and the cruising speed has been raised from 90 to 97 m.p.h.

Clare Bunch reports that the famous Monocoupe line will be continued with but minor changes. The deluxe 90-A powered with the 90 h.p. Lambert cruises at 110 m.p.h. on 4½ gallons of gas.

Rearwin will soon be producing the new Speedster 6000 and the Speedster 6000-M. The 6000 will be powered with the 95 h.p. Cirrus, the 6000-M with the 125 Menasco and an additional model, the 6000-MS, with the 150 Menasco.

Ryan has announced five models for 1938. There will be two Warner and Menasco cabin models and three open cockpit jobs.

Cessna will have a new 1938 Airmaster model based on the C-37 job which will use the 145 Super-Scarab but the performance remains the same, 143 m.p.h. at cruising speed. It has a useful load of 1,000 pounds and a redesigned landing gear.

The new Dart company which bought out the manufacturing rights on the Monocoupe's *Monosport*, is now manufacturing this ship for production.

The Monocoupe 90A.

SUBSTRATOSPHERE SHIP

(Continued from page 37)

pressure valve set in the rear bulkhead assures that the change in cabin pressure shall not be more than 5% of the barometric pressure at altitudes in excess of 15,000 feet. Extensive experiments are under way to determine the air-conditioning quotient most conducive to passenger comfort at altitude. At present it is not intended to permit the cabin interior to become colder than 50° or warmer than 70° F.

Provision is made in the pressure section of the fuselage for a crew of six. The pilot and co-pilot are seated side by side in a control compartment that differs little from that of the standard Electra transport. Immediately behind the pilot's seat is the instrument panel and control table for regulating and conditioning the cabin atmosphere. Within easy reach of the operator who also doubles in brass as radio man, are emergency oxygen tanks fastened to the wall behind the co-pilot's chair. The array of dials and switches facing this busy personage includes a cabin pressure regulator valve, humidity control, oxygen supply with manually and automatically regulated valves, supercharged air supply control, automatic pressure safety valves, emergency relief valves and a bank of indicating instruments showing cabin pressure in ft./altitude, humidity, differential pressure in lbs./in., outside temperatures and cabin air supply flow meter.

An unusually complete two-way radio installation occupies the rear corner of the pressure cabin and is equipped with an outside antenna supported by two short masts protruding from the top of the fuselage. Just forward of the radio set, an emergency door, similar to the one in the pressure bulkhead, provides a quick means of exit from the starboard side of the cabin. Three upholstered seats are placed in the center section of the cabin, for use by pressure observers. Due to the comfortable air conditions maintained in the interior, ordinary clothing may be worn by the crew even at the highest altitudes. Oxygen equipment is intended for emergency use only as the supercharging and ventilating systems insure a normal supply of air under ordinary operating conditions.

The XC-35 was built at the Lockheed Aircraft factory in Burbank, California, early in 1937 and delivered to the Air Corps last August. Since that time it has been undergoing exhaustive tests at the army experimental field at Dayton, Ohio. The ship is powered with two Pratt & Whitney Wasps fitted with exhaust-driven superchargers of the type developed by Air Corps engineers for high-altitude military flying.

The construction of the XC-35 is generally similar to that of her sister Electras with the addition of an extra heavy fuselage skin to combat the pressure differentials of substratosphere altitudes. The wings are of the full cantilever type with a Clark Y-18 section at the roots and a Clark Y-9 section at the tips. They taper in plan 3 to 1 and have an aspect ratio of 6.6. The center section has a single spar passing through the cabin and is built integrally with the fuselage. The outer panels bolt on just outboard of the engine nacelles. They are of single spar dural construction with stringers of channel section laid across the ribs. A stressed inner skin of corrugated dural stiffens the structure and is finished off with an outer skin of smooth dural plate.

The fuselage is of all-metal, full monocoque construction with transverse rings and longitudinal stringers. The space between the inner and outer walls is insulated against sound and temperature changes. The tail unit consists of a cantilever stabilizer fitted with twin cantilever vertical surfaces in line with the engines. Both rudders and elevators are fitted with trailing edge trimming tabs. The latter are statically balanced. The standard Lockheed electrically operated retractable landing gear is provided. On the Electra this has a tread of 13 ft. 7 in. and is equipped with Goodyear air-wheels and hydraulic brakes.

The XC-35 is not intended as a means of demonstrating high performance or to establish any records. The Air Corps looks on it solely as an experimental laboratory in which to test in service the many new items of equipment and engineering practices involved in the high altitude operation of both military and commercial aircraft. To meet the great temperature differences entailed and to successfully combat fog and ice, the flying laboratory is equipped with every known aid to flight. Rubber de-icing boots are fitted to the leading edges of both wings and stabilizers. De-icing spinners and slinger rings protect the constant-speed propellers. Heating and ventilation with supercharged air protects the crew from the rigors of the extreme altitudes. There is little question that the preliminary experiments in practical substratosphere flight now being conducted by army pioneers at Wright Field will soon bear fruit in the form of fast, safe and comfortable passenger service over land and sea for you and me and the ever-increasing army of air-minded travelers to come.

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MODEL MATTERS

(Continued from page 68)

his spirit and everyone seems to be doing his bit to boost the club.

News From Norway

Arne Haug Smith of Oslo, Norway, sent an interesting letter describing model work in his country. He's been modeling about three years. Last year he boosted his rubber model flights up to 2 minutes consistently. He's been even more successful with towline gliders—4 to 5 minutes average with a towline of about 90 feet. One fine day he turned in the exceptional flight of 10:30—which is outstanding, since contest duration in this country is usually less than 2½ minutes. This is no reflection on the ability of the modelers but the result of weather conditions.

Recently Smith built his first gas model. It's a model of the Berkeley Buccaneer. There are only a half-dozen gas models in Norway.

Like all other modelers with contest ambitions, he's been thinking of Paris and the Wakefield contest for 1938. He was unable to finish his entry in time for the 1937 meet.

Smith is well informed on model activities in all countries. Although he's only 17, he's been reading English for the past four years and has kept pace with developments through magazines carrying model information. He'd certainly be glad to hear from American modelers themselves. His address is: Villavei 13 Lille Froen, Vinderen, Oslo, Norway.

Fitchburg, Mass., Club

The Landing Field is the name of the weekly club paper of the Wachusett Model Aero Club, Fitchburg, Mass. Walter Pierce, editor, turns out mighty interesting news of the club activities, personal activities of members, answers to model questions, and three-view drawings of models and large airplanes. The W. M. A. C. holds forth in its clubroom in the Fitchburg Y. M. C. A. Anyone interested in joining or receiving a weekly copy of *The Landing Field* is invited to contact Walter Pierce, Y. M. C. A., Fitchburg, Mass.

J. A. L. Activities

Junior Aviation League, Boston, Mass. Captain Jack Knight of United Air Lines was Guest Speaker at the February club meeting. He has flown more than two million air miles, farther than any other pilot in the world. From him, J. A. L.'ers learned the inside story of airline operation and what developments can be expected in the future.

Five new Boston records were set at the Irvington Street Armory during an indoor contest the early part of February. Veteran Bruno Marchi's weekly classes in the technique of adjusting models began to bear fruit—younger J. A. L.'ers turned out in grand style and did some good flying. New Boston records set at this meet are:

Stanwich, (sr.) Stick ROW Cl. B	3:58.5
R. Brown (jr.) Stick ROW Cl. A	5:58.4
R. Brown (jr.) Fuselage ROW Cl. B	2:52.6
G. Elberfield (sr.) Ornithopter	:45.9

Wilbur Tyler took home the challenge trophy as a result of his making the longest flight of the day—stick HL Cl.C 11:02.2.

Stix, Baer, and Fuller Club

Stix, Baer, and Fuller Model Club of St. Louis, Missouri, has arranged a full schedule of events that will keep members busy through the spring and summer. Model-building classes are held every Saturday morning for beginners, who receive instruction from the experienced builders. Club champion Dick Courtial has arranged a series of discussions for these classes, and topics include every phase of modeling that proves troublesome. Throughout April, regular indoor flying sessions will be held every Saturday afternoon in the Merchants' Exchange Auditorium. During May and June, these meetings will move outdoors to the Old Flying Field, Forest Park. This competitive flying will be in preparation for the two big club contests: National Elimination Contest (June 23-25) to select the representatives for the National Meet in Detroit; and the Mississippi Valley Tournament (August 13 and 14).

New Jersey Activities

The Linden Model Aircraft Club of Linden, New Jersey, has received N. A. A. sanction for the first New Jersey State Gas Model Meet tentatively set for June 25. The meet will be directed by Frank M. Krysiak and will be held at Hadley Airport, New Brunswick.

Six or seven model organizations of Union County, New Jersey, are forming the Union County Model Airplane Association. The purpose is to stimulate activity by inter-club contests and meetings with an exchange of ideas. Clubs joining the Association are: Hillside Model Aircraft Club, Plainfield Queen City Gas Model Club, Elizabeth Model Airplane Club, Linden Model Aircraft Club, and several other neighboring organizations.

The Paterson (N. J.) Society of Model Aeronautical Engineers holds meetings every Saturday night at the Y. M. C. A. Any one interested in modeling is invited to contact this active group of modelers.

THE SPEE DEE

(Continued from page 66)

the ribs and tips to them in the accepted manner. After the parts are dry, unpin all but the center section and crack the spars at the point shown and raise the tips one inch, then recement the cracked places.

The tail surfaces are the same shape as the outer portion of the wing and the tips are alike. The difference lies in the plain stock ribs. Build the stabilizer as a unit.

The propeller design is an important factor. Follow the given design carefully and be sure to balance and polish before using. The freewheeling is very simple and should need no explanation, other than it is a boon to a long glide.

The landing gear is bent from #10 music wire to the dimensions shown. The wheels should have bushings cemented in them.

Use any color scheme desired but apply it carefully. Cover the wing with six pieces of tissue and the top of the fuselage one panel at a time.

Now assemble the model completely. Cement the tail surfaces in place and power the model with three *strands* of ⅛" flat rubber, allowing for about 2" of slack. Lubricate the motor before winding. Strap the wing on with two small rubber bands and place a ⅛" incidence block under the leading edge. The model is now ready for trials. Wind the motor by hand until the model will barely take off. Gradually increase the number of turns when adjusting improves the flights.

If the model climbs too fast and stalls, move the wing back or lessen the incidence and vice-versa. If the model falls off one wing, extend that side of the wing farther unless the wing is warped. Continue to adjust the model until it will climb in a tight spiral almost straight up for a hundred feet and then level out. Memorize the best adjustments and mark them where possible. The model should last until it is literally worn out.

MATERIAL LIST

Miscellaneous	Blocks
2 dm. tube cement	1 1x1⅛x7"
½ oz. clear dope	1 ¾x1x1¾"
½ sheet tissue	
1 bamboo strip	**Strips**
1½" #4 music wire	3 $\frac{1}{16}$x⅛x18"
12" #10 music wire	4 $\frac{1}{16}$x$\frac{1}{16}$x⅛"
2 wheel bushings	
4 ⅛" washers	
00 sandpaper	**Sheet**
1" sq. celluloid	1 $\frac{1}{16}$x2x9"
¾" $\frac{1}{16}$" alum. tube	1 $\frac{1}{32}$x2x9"

AIR PROGRESS

(Continued from page 4)

test was made off the Short plant at Rochester, England, when the two planes took off together, maintained telephonic communication until a height of 700 feet was reached. Then simultaneously the two pilots pulled levers releasing the device which had clamped them together. Both made successful landings afterward.

Secretary Roper has authorized Northwest Airlines, Inc., to resume operations following a thorough inspection of the company's equipment. On February 5 the Bureau of Air Commerce ordered the suspension of all passenger service operations of the company after the crash of a Lockheed-14 in Montana, when ten persons lost their lives.

The initial flight of the British Armstrong-Whitworth *Ensign*, a giant four-engined transport land plane, was made on January 24.

According to reports, and from photographs of models, the new Douglas 40-passenger D.C.4 will be equipped with a tricycle landing gear. An Italian Savoia-Marchetti S.74, a high-wing transport powered with four Alfa-Romeo 126 r.c. 34 (Pegasus-type) engines, has set a new mark for planes over 1,000 km. carrying a load of ten tons, when it attained an average speed of 322.089 km/hr. (about 200 m.p.h.)

AIR FORCES

Probably the most sensational news in the military field this month was the announcement of the amazing speed disclosed by the British Hawker Hurricane. Flying at night, Squadron Leader J. W. Gillan flew one of these new British single-seater fighters from Edinburgh to Northolt Aerodrome, just west of London, at an average speed of 408.75 miles per hour. The distance of 327 miles was covered in 48 minutes. A tail wind assisted the flight somewhat, but the Hurricane was not flown "all-out."

Repeated requests for more candidates for aviation training continue to be announced by the Army Air Corps. This year's March class has been increased from 150 to 344 cadet flyers. The recruiting section has waived the written examination for entrance and will accept suitable proof of the educational credits in addition to certified physical fitness.

For heroism shown during a night flight on December 24, 1936, Lieutenant Benjamin S. Kelsey of Waterbury, Conn., has been awarded the Distinguished Flying Cross. While flying between Mitchel Field and Wright Field, his plane's left motor failed and at the same time the left wing burst into flames. Although nearly blinded by the glare, he landed safely and extinguished the flames.

According to Leighton W. Rogers, president of the Aeronautical Chamber of Commerce, in a report on a survey of the aeronautical industry, the United States will be able to double its output within a year should a national emergency arise. During 1937 $100,000,000 business was carried out, $57,000,000 of which was spent for military planes and $43,000,000 for commercial equipment. It is believed that the business volume in 1938 will reach $158,000,000, of

BEST VALUES in RUBBER-POWERED SUPPLIES

18" BALSA
1/16x1/16 100. 5c
1/16x1/8 35 for 5c
1/16x3/16 18. 5c
1/16x1/4 15 for 5c
1/16x1/2 5 for 5c
3/32x3/32 30. 5c
1/8x1/8 30 for 5c
1/8x3/16 12 for 5c
1/8x1/4 10 for 5c
3/16x3/16 8. 5c
1/4x1/4 6 for 5c
1/4x1/2 3 for 5c
1/2x1/2 2 for 5c
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1/8x2 6 for 10c
3/16x2 3 for 9c
1/4x2 3 for 10c
5" sheets or 36" lengths, double above prices; add 10c packing charge for 36" lengths.
18" PLANKS
1x1 5c; 1/2x2 6c
1x1 1/2 8c; 1x2 10c
1x3 15c; 2x2 18c
2x3 23c; 2x6 39c
3x3 40c; 3x6 75c
MACHINE-CUT BALSA PROPS
5" 4c; 6" 5c; 7" 6c; 8" 7c; 10" 8c; 12" 10c. 15" 15c
PROPELLER BLOCKS
1/2x1/2x3 8—5c
1/2x3/4x6 6—5c
3/4x1 x 7 4—5c
3/4x1 x 8 3—5c
3/4x1 1/2x10 2—5c
3/4x1 1/2x12 2c ea.
1 x1 1/2x12 4c ea.
1 x1 1/2x15 6c ea.
NOSE BLOCKS
1x2x1 .....1c
2x2x1 .....2c
2x2 1/2x1 .....3c
3x3x1 .....5c
3x3x2 .....8c
3x3x3 .....10c
INSIGNIA
21 and stripes 5c
PROP. SHAFTS REAR HOOKS
doz. 8c

THRUST BEARINGS
Small ..doz. 10c
Large ..doz. 15c
DOWELS
1/16x6 ..doz. 5c
1/8x18 ...2 for 3c
3/16x1 1/2..2 for 5c
RUBBER
.045 .....5 ft. 5c
1/10 sq..20 ft. 5c
1/4 flat..18 ft. 5c
Skein 40c
WIRE
0-8-10-12-14
6 ft. 3c
WOOD VENEER PAPER
20x30 ..1 for 10c
BAMBOO PAPER
5c per sheet
CELLULOID
6x8 .....5c
12 1/2x16 .....18c
WING AND TAIL LIGHTS
12" 10c; 15" 15c; 21" 20c.
CAMEL'S HAIR BRUSHES
Small 3c; Lge. 5c
Extra large...8c
NOSE PLUGS
1/2" .....doz. 8c
CLEAR DOPE OR BANANA OIL
1 oz. 5c 2 oz. 7c
4 oz. 13c 1 pt. 45c
Thinner same price as clear dope
COLORED DOPE
White, yellow, orange, blue, red, green, olive drab, black, silver, gold.
1 oz. .08 2 oz. .10
4 oz. .18 1 pt. .65
COLORLESS CEMENT
1 oz. .05 2 oz. .08
4 oz. .13 1 pt. .35
TISSUE, AA
All col., doz. 19c
Silver ....ea. 5c
Superfine, wh. 5c
SANDPAPER
5 sheets.....5c
ALUM. TUBING
1/16, 3/32, 1/8 ft. 7c
3/16 or 1/4 ft. 10c

BAMBOO
1/16 sq x12, 30, 5c
1/16x1/4x15, dz. 10c
WHEELS per pr.

Brch	Blsa	Celu
1/2	.01	.03
3/4	.02	.04 .05
1	.03	.06 .07
1 3/8	.04	.08 .10
1 7/8	.07	.10 .10
3	.20	.15 .30

SHEET ALUMINUM
.0003x3 1/2 ft. 1c
.005 in. 6x6 5c
.010 in. 6x6 6c
DUMMY RAD. ENGINE (Cellu.)
1 1/2" d. 10c; 2" d. 20c; 3" d. 25c.
ENGINE AND COWL (Cellu.)
1 1/2" dia. ...15c
2" dia. 20c
3" dia. 25c
ALUM. COWLINGS
1 1/2" 15c 2" 18c
3" 25c 2 1/2" 22c
Specify whether anti-drag or closed
BOMBS
3/4" 4c 1 1/4" 7c
2" 12c
GUNS WITH RING MOUNT
1 1/4" 10c 1 3/4" 15c
PURSUIT MACH. GUNS
3/4", 1 1/4" or 1 3/4" each 5c
BUSHINGS
1/16 ....1 for 1c
WOND. WATER SPRAYER 20c
MODEL PINS
1/2" or 1" pkg. 5c
WASHERS
1 doz. 1/4 or 1/2 1c

How to Order
Add 15c to orders under $1.50. Orders over $1.50 add 10% of order. 1 or 2 36" lengths add 10c extra.

"Flying High all over the U. S." **HEATHE'S NEW AND MIGHTY**

Miss EMPIRE STATE

MASTER SET $5.00 COMPLETE without motor
Plus 50c postage with all parts as specified.

DeLUXE SET $9.95 COMPLETE without motor
Plus 75c postage with all parts as specified plus: Carved Prop, Cut-out Ribs, two —1/2 pts. of colored Dope, 4 yds. Silk Tips and Jacks, 3 1/2" Air Wheels, Landing Gear Brackets, Gas Filter Funnel, Turned Aluminum Prop Spinner.

WINGSPAN—7 feet 9 inches. WEIGHT—3 3/4 lbs. complete with motor and gas.
Power Miss EMPIRE STATE with any standard miniature engine for the thrill of powered flight.

It's got everything you look for in a Gas Model Plane! A better plane for less money. It is the result of seven years development in the building of model planes. Proved in championship competition, Miss EMPIRE STATE is your assurance of championship performance. Simple to build—fun to fly—sturdy in construction—will give you a lot of real satisfaction!

THIS SENSATIONAL SET FEATURES: All Balsa Construction—Monospar Wing—Recessed Ribs—Ready-made Tubular Battery Case—Illustrated Instructions for Installing Flight Timer—Variable Angle of Incidence—Diagram for Installing Ignition System—Diagram for Installing Engine—Balsa Wood Fuselage Framework—Landing Gear Struts 1/8" Wire—Adjustable Rudder—Cement—Dope—Bamboo Paper—High Thrust Line—Pattern for both halves of wing—Shock Absorbing Landing Gear—Detachable Wing and Tail Assembly—Removable Engine Cowl—Full size copyrighted Plans and Instructions, Hard-wood wheels—New Skid Slide Safety Motor Mount. Prop Blank—Knife Switch—Nuts and Bolts—Screws—Everything complete and over!

SENSATIONAL MOTOR VALUES

BROWN, JR. MOTOR

$10.00

SPECIFICATIONS
Each model contains the following improved parts: **SPARK PLUG:** Newly designed with concentrated spark. **CRANKCASE:** Newly designed, extra strength die cast aluminum silicon alloy with high speed bronze bearing. **TIMER:** Improved tension spring with tungsten contact points. **FUEL TANK:** New type, two piece, detachable for cleaning. **SPARK COIL:** Water proof, oil proof, gas proof.
Each model has the original specifications, viz: 7/8" Bore, 1" Stroke, Approximately 1/5 Horsepower, 1,200 to 10,000 R.P.M.

ADDED FEATURES:

MODEL—B $21.50
Cadmium plated to give lustrous finish. **Piston:** Hardened steel, ground and lapped to fit. **CARBURETOR:** Micrometer type needle valve control. Packed completely mounted ready to run. Tested & guaranteed.

MODEL—CV $17.00
Cadmium plated to give lustrous finish. **Piston:** Aluminum alloy with 2 special rings. **CARBURETOR:** Simplified pin type control. Packed completely mounted ready to run. Tested & guaranteed.

SYNCRO ACE $15.00
TROJAN, Jr. $18.50
BUNCH WARRIOR MOTOR, complete ..$12.00
OHLSSON $10.50
CHUM "Chum" $17.75
HUSKY, Jr. $12.50
GWIN AERO KIT $11.35
MIGHTY MIDGET KIT $9.85

BROWN MODEL—D $10.00
PISTON: Aluminum Alloy with 2 special rings. **CARBURETOR:** Pin type simplified control. **CRANKSHAFT:** Specially designed counter-balanced Z-metal. Packed complete ready for mounting, tested & guaranteed.

BROWN MARINE MODEL—M $15.00
Cadmium plated to give lustrous finish. **PISTON:** Aluminum alloy with 2 special rings. **CRANKSHAFT:** Specially designed counter-balanced Z-metal. **CONNECTING ROD:** Forged aluminum alloy. **FLYWHEEL:** Specially designed Z-metal. **CARBURETOR:** Micrometer type needle valve control. Packed complete ready for mounting in boat. Tested & guaranteed.

HEATHE MODEL AIRPLANE COMPANY
260-B-5 Troy Ave. Brooklyn, N. Y.

which $98,000,000 will be spent for military aircraft.

Loyalist Spain is now producing an average of one to one and one-half planes a day for military use, according to an official announcement. Most models are adaptations of American craft powered with Hispano-Suiza engines. Many are revised versions of the famous "Chato" fighting biplane, which seems to have been so successful against the Italian Fiats and German Heinkels.

Fifteen new naval flying boats will be added to the Guam defenses before June, according to an announcement from a reliable source. Pilots of Squadron VP-18 are said to be expecting orders to leave the Pearl Harbor fleet air base for a one-year tour of duty at Guam. At present the squadron has a personnel of ten officers, ten aviation cadets and approximately a hundred men.

The new British Vickers Wellington medium bomber has at last reached the production line and the first of the series has been flown. It has been much cleaned up as compared to the original and powered with two Bristol Pegasus engines equipped with two-speed superchargers, and is said to show remarkable speed. Probably well over 200 m.p.h.

The Fokker Le Faucheur, the G-1 fighter-attack ship, has been tested by the Finnish Air Force. With a top weight of 8,800 lbs. it took off in 270 yards. Diving from 10,000 feet, it attained a speed of 385 m.p.h. and came out safely, although the nose fairing around the nose nacelle, which carries the crew and armament, caved in under the pressure.

New aerial weapons, mass machine-gun fire, explosives which were dropped to earth by means of small parachutes and bombs containing new and more deadly chemicals, were recently tested out by the three wings of the General Headquarters Air Force at Shreveport, La., a short time ago. High-speed fighters, flying fortresses and new attack ships took part in the display, which was arranged for the Air Corps tactical school.

It is believed that a military version of the French Caudron racer will be placed on exhibition at one of the coming European air shows within the next few months.

An attempt to strengthen the anti-aircraft defenses of western New York state will be made by reserve officers who are seeking authorization for National Guard anti-aircraft regiments which will be stationed at Rochester, Buffalo and Lackawanna.

MISCELLANEOUS

The American Burnelli UB-14, which is being exhibited in Europe by Clyde Pangborn and Captain Rex Stocken, has won much praise in England. The ship was recently put through its paces at Hatfield and kindly comments on its take-off, climb, slow landing and quick pull-up were heard on all sides.

Owing to the rush in military planes and the building of defense equipment, the British light-plane pilot has to turn to foreign firms for his craft. No British aviation firm will promise a delivery before 1940, so stocked up are they on military orders or orders for parts and equipment. Many American machines are being sold over there now in spite of the high duty on imported types. There are nearly 5,000 "A" pilots in Great Britain at the present time, and only about 668 private planes available for them to fly.

TWA recently announced the winners of their annual newspaper aviation trophies. Devon Francis, national aviation editor of the Associated Press, was awarded a silver trophy and $250. Reginald M. Cleveland, aviation editor of the New York *Times* during 1937, received the second award, and C. B. Allen of the New York *Herald-Tribune*, was awarded honorable mention.

All light-plane manufacturers have agreed to attempt to draw up standard rules for second-hand planes, in an effort to stabilize the market and provide some authoritative appraisal system such as is used by the automobile industry. Fixed trade-in prices will be set on different types according to location, and a standardized system of charges for "extras" on planes will be brought up.

Japan is starting a new air program which will provide 10,000 pilots, navigators and mechanics within a year. This move is said to be aimed at the Soviet Union's armament expenditure and their massing of military and aviation strength in the Far East.

THE RYAN S-C

(Continued from page 74)

The Menasco cowling is made the way the fuselage was. First carve B and slice it in half.

WINGS

The wing frames are made in the usual manner. A tapered strip, 1/4" under the trailing edge of rib 1 to 1/16" under the trailing edge rib 9, will maintain the relative incidence of all ribs during assembly. Also cement the top leading edge cover on while the frame is pinned down. The rear spars and ailerons are slotted for and installed after the frames are taken up.

TAIL SURFACES

The tail surface frames are assembled with regular stock, as noted on the drawings. The horizontal tail rests on supports between the first and second ribs. The hinges are soft iron wire. The horizontal tail should have at least 3° positive incidence, although the setting shown is zero.

LANDING GEAR

The drawing of the landing gear is self-explanatory. The wire guides slip in 1/16" alum. tube sections cemented in the top portion of the strut, to enable the use of a 10" or longer prop. Sections can be made to fit over the wires and fill in when the gear is down. Dress snaps will hold them together. During assembly the landing gear struts cement under the second wing ribs with the back wires resting against the bottom spars. Slots are cut in the sheet for the wire to pass through. Assemble the tail wheel and cement it on.

PROPELLERS

A scale prop design is provided. Blank the flying prop block as shown by the miniature sketch on sheet 1 and after carving, use the blank shape on sheet 4 for the final outline. The spinner is carved integral with the prop. For this size model, attach your pet freewheeling to increase the endurance.

FINISHING THE MODEL

Cement all the parts to the fuselage in their respective places. Cover the cabin with cleaned photo film and the remainder of the model with silver tissue, even the wooden parts. Paint the wheels and nose holes black and add a license number to the wings.

FLYING THE MODEL

The motor is made of four loops of 1/8" flat rubber, lubricated, and about 2" of slack. Leave the rear "S" hook open enough to engage the rear hanger, then drop the rear end of the motor down into the fuselage and "fish" until the hook catches. The model is likely to be slightly nose heavy, so add heavy rubber bands to the cowl on the first test to prevent any tendency to stall. After the proper adjustments have been made, treat the motor as that of a contest model and long graceful flights will be the reward.

LIST OF MATERIALS

Blocks

1 1 1/8x1 1/2x10"
1 1/4x1 1/2x7"
1 3/4x1 5/8x2 1/2"
2 1x1 1/4x3 1/2"
2 5/8x1 1/2x1 1/2"
2 5/16x2x1 1/4"

Sheets

15 1/32x2x18"
3 1/16x2x18"
1 1/8x2x18"

Strips

10 1/16 sq. x18"
5 1/16x1/8x18"
4 3/32 sq. x18"
6 1/18 sq. x18"

Miscellaneous

1 oz. cement
2 oz. dope
2 sheets silver tissue
4 clean photo film (116)
4" 1/16" alum. tubing
24" #14 music wire
washer assortment
1 dram black dope.

Make Mine Light

(Continued from page 13)

this training that the future of aviation depends. There must be a sound and practical way somewhere.

The aviation club idea, in itself, is one of the best mediums we can suggest. In the first place, the club plan creates a certain bond of friendship, loyalty and esprit de corps that can hardly be developed in the commercial school. Men who have banded together and pooled their resources have automatically built up a business—a business of learning to fly.

We know the usual routine of this sort of thing. A group of interested men, say ten or more, get together and underwrite the cost of the down payment on a light plane. They also rent hangar space, the use of an airport and hire a licensed instructor. Most of the servicing, etc., is done by teamwork and the rest of the expense month by month is carried pro rata and paid accordingly. One by one, in a prearranged order, they take their lessons and dual instruction and eventually all learn to fly. The usual procedure, then, is to turn in the original school plane and purchase another—a more expensive and speedier ship. If additional memberships warrant it, they buy a new light plane and continue with the second batch until another group has passed its tests. It is the cooperative movement applied to aviation, and from all accounts is one of the best arrangements for those with limited means, but unlimited energy and club ideals.

The club idea should be encouraged further and get government and industrial assistance. By this, I do not mean a subsidy in the blatant sense of the word, but sincere and reasonable financial assistance as it is carried on abroad.

We cannot shut our eyes to the fact that the aviation industry is not entirely self-supporting. Our air lines get munificent assistance from the government in the way of mail contracts, and few air lines today could keep on without this assistance. We don't like the word "subsidy," but the principle is there just the same. Why can't the same principle be applied to our flying clubs?

Let us assume, for instance, that you can get twenty men who are physically capable of learning to fly. Let us also presume that they want to fly. All that is holding them up is the necessary funds. We can see that in a national emergency these men, who today are unable to fly, will be snatched up at once and shoved through a very hurried and very sketchy course of flight training—just as many of us were in the unhappy days of 1914-18.

Wouldn't it be saner if these same men could be carefully and properly trained in their own club? Couldn't there be a Bureau of Air Commerce which would have the right to forward a certain amount of money to be used in the purchase of a suitable light plane?

What could be wrong with a number of army or navy instructors—many of whom are turned loose every year to make way for men graduating from the service flying schools—being given part-time or full-time jobs as instructors in these self-same flying schools? Then our club would have the best of equipment and instruction to start with.

But all this is not on the free list. Our members should agree to pay a certain amount each month to carry a share of the costs of the flying time involved. The amount should come somewhere near about half of what it costs the present-day club member.

There should be other tie-ups, of course, to justify the government interest. Besides being taught to fly, the members would—or should be required to—absorb a certain amount of other knowledge that would be useful should the government find it necessary to call on these ambitious young men. You can call this a form of regimentation if you wish. You can accuse me of fostering a form of compulsory military service if you like. But you must face facts.

Practically every other major and minor power in the world is running a system similar to the one I am outlining.

They teach them to fly, and they do a good job of it. They see that they get safe ships and proper instruction. They see that the instruction includes a primary, at least, schedule of military or naval subjects like military map reading, machine-gun mechanism, the theory of bomb dropping and bomb mechanism. They take short courses in aerial navigation, meteorology and instrument flying.

I see no reason why any man who is willing to accept a certain amount of government assistance to get his ticket should not, in turn, be willing to pay for it with a certain amount of his time taking a few necessary semi-military subjects along with his dual and solo.

It is not hard to perceive how well the plan would work out *should* an emergency arise. It is easy to see how a man who has had training in light plane flying, machine-gun theory and possibly aerial camera work, would soon fit into the complex system of the national air defense. It would not be necessary for him to sign to serve in case of war, should he accept this government-subsidy plan, but one can hardly see how he could very well refuse should the occasion arise.

There's part of my idea. To be frank, it is not originally my idea, but what has jelled in my own mind after studying the various systems in vogue in other countries. There is another angle to it that *is* my own idea. Assuming that the more light plane pilots there are, the greater will be the demand for light planes, let us assess the manufacturers with a small share of this burden.

It would be very simple to establish a Pilot Fund Bureau in the Bureau of Air Commerce, which could collect a set fee from every manufacturer on every plane in this category he sells. The more planes he disposes of, the

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more he would rightfully pay toward training the men who are to eventually fly his planes.

This money would be paid directly into the Pilot Fund Bureau and as fast as each club turns out a qualified amateur pilot, a certain amount—for the sake of argument let us say $100.00—would be paid into the flying club treasury. Thus, if your flying club was successful in turning out ten qualified amateur pilots in the period of one year, the Pilot Fund Bureau would pay your club $1,000, which would probably take care of the depreciation on the ship in that length of time.

What would be the result?

First, the government would have on hand ten qualified pilots who would be available in an emergency for a quick military training course.

Second, the manufacturers would be assured of an outlet for their products.

Third, the industry as a whole would benefit, because there would be less crashes as the result of poorly trained amateur pilots.

Fourth, it would provide a worthy outlet for obsolete service training planes and give skilled instructors, who otherwise might be thrown on the civilian world, a chance to keep their hands in and also enable them to make a fair and pleasant living out of the training system.

Fifth, the industry itself, for an outlay of $1,000, is in a position where it sees the best possible leads for the sale of possibly ten light planes to these newly trained pilots.

There are other and less important results, of course, and, by the same cry, possibly several points of objection to the idea in general. I have only sketched in the program and present it for what it is worth. No plan of this scope could be put into order without considerable and lengthy discussion. There are loopholes in it, I know, but none so grave as to be beyond all possible chance of plugging up.

Whatever is done in this particular case, we must all work with the thought in mind that *anything* done to assist the light plane industry is a boost toward greater aviation.

You can't laugh off the light plane.

THE HERO

(Continued from page 15)

We got a hurry-up call to fly a guy up to Jacksonville. It seemed that a certain dowager was going to a certain social binge and had to have certain jewels to wear. The hitch was that she was in Jax and the jewels were in Miami. The bird we were to fly up was a special messenger carrying the rocks.

I told him okay, to come right out. Willie happened to be the only pilot around, so he got elected. Then Willie got a phone call—from Veronica. He hung up beaming.

"Veronica," he said, "is going to Jax to that social party. She wants to make a reservation. I told her I'd take her. Okay?"

"The more the better," I said. "I wish we could fill up the crate."

Well, we did. Within five minutes a guy phones for two Jacksonville reservations. That filled the ship.

While we were waiting around, I told Willie about the jewel shipment. "Keep your rod handy," I said. "Just in case."

If he heard me, he didn't show it. A taxi pulled in right then and Veronica popped out. She was carrying a large leather suitcase affair. Willie went galloping over and took the case from her.

"Please be very careful of it, Will-ie," she said. "My most precious possessions are inside. If I should ever lose them. . . ."

I could almost see Willie's chest expand. "I will guard your possessions with my life, Veronica," he said woodenly.

Pretty soon the jewel messenger showed up and then the two other fares. I eyed these two guys. They were well-dressed, looked Miami Beach and seemed okay.

We got them all parked in the ship with Veronica in the seat right beside Willie. Her suitcase was at her feet.

Oh, sure, I'd read of plenty of hold-ups in planes. But I wasn't worried.

Willie took the load off and headed north. And what happened after that I got second-hand. But it went something like this.

They had almost reached Pompano. Willie and Veronica were rubbing shoulders and I guess she was telling him what a brave man he was when one of these Miami Beach guys jumped out of his seat and jammed a gun in Willie's neck!

The gunman told Willie to set the ship down pronto at a deserted flying field just ahead. The other guy was holding a roscoe on the jewel messenger.

Willie took the situation in and he knew there wasn't much he could do about it. So he started letting down. The rocks were insured and it'd be better to land before any rough stuff started. He didn't want Veronica to get hurt.

But Veronica was in a panic. She picked up her luggage and held it tightly to her. Of course, the gunman became interested.

"What you got there?" he asked her. "Hand it over!"

Veronica screamed. "Will-ie! Don't let him take it!"

That dug the spurs into Willie. He rammed the stick forward.

Before the gunmen could savvy what went on, they were being tossed around the cabin like a couple of peas in a pod.

Willie didn't fool. He plugged one mug through the shoulder and put the other out colder than an ice cube. By the time he struggled back to his seat, the crate was down to two thousand.

But Willie pulled her out of it and headed back for home.

I heard the mill and came outside.

The ship had barely come up on the concrete when Veronica piled out of the cabin. She started to tell me everything in one jumbled sentence. Willie came after her, holding tightly to Veronica's precious suitcase.

I got the story and got the cops. After a couple of telegrams we learned that the dowager hadn't ordered the jewels sent up. It had just been a smart stunt on the part of these two yeggs.

Well, everything was hunky-dory. And Willie was a hero again.

After the smoke had cleared away, Willie and Veronica were in my office. Willie was sitting in a chair, still hugging Veronica's suitcase and grinning.

"Oh, you were wonderful, Will-ie," Veronica said. "But for you my luggage would have been stolen. My whole fortune. You are so, so brave."

Willie pinked up as usual. He just stared at Veronica.

"Veronica," Willie said. "For you, I would do anything. Veronica—ah—I don't make much money but——"

She looked up. "I have money, Will-ie," she said. "All I want is you. I make much money in my profession. Now that you have saved my valuables, we have nothing to worry us."

She took the suitcase from Willie and undid the straps. She threw back the lid. Inside was a wire-meshed arrangement.

Willie suddenly came to his feet, pale as a ghost, staring.

"I will show you my loves," Veronica said. "My precious darlings you so bravely saved." She opened the top of the wire mesh and reached inside. And with a glistening green coil wound around her arm, she turned to face Willie. "See, I am a snake charmer," she said.

Willie let out one strangled gasp—and was gone.

Through the window I saw him tear across the apron to the cabin job and leap inside. He whipped the ship around and gunned it down the field and into the air as if the devil were at his heels.

That's the last I ever saw of Willie Stevens. The next day I got a wire. It read: LEFT YOUR PLANE AT NEWARK AM SAILING IMMEDIATELY FOR IRELAND GOD BLESS ST. PATRICK WILLIE.

THE ARMY NEVER SLEEPS

(Continued from page 20)

name for the same thing. It is probably returning with a group of enlisted men who have completed courses in the Air Corps Technical Schools at Chanute Field or Denver. In addition to the ferrying of personnel between the various Air Corps stations, the Barksdale transports are very busy during several months of the year keeping the six squadrons supplied with equipment and provisions while they are away on maneuvers. There are GHQ Air Force maneuvers, wing maneuvers, and group maneuvers in addition to various tactical exercises and demonstrations. Then each squadron must spend a week each year in gunnery camp on the Gulf coast while the pilots of the pursuit planes and the rear-seat gunners of the attack planes practice shooting at aerial targets. For this kind of work one plane tows a sleeve target, which looks like a large wind sock, up and down along the shore line while another plane fires at it toward the open sea.

But the target ranges east of the field can accommodate almost everything else, as we can see when we turn our attention to the attack group. No, those strange-looking bi-motored planes in a line facing the field are not visiting bombers; they're the new Curtiss A-18s. Just a few of them were constructed on the first order and the Barksdale pilots are trying them out and getting familiar with them.

Notice that the A-18s take off in a very wide formation and that they don't fly as closely as the other planes at Barksdale. The little fuselage, almost hidden between the two big motors on each side, carries only one pilot, and he has plenty of work to do. The defensive gunner in the rear cockpit cannot help, so the pilot must operate everything that goes on a modern bi-motored plane, in addition to flying formation, maneuvering close to the ground, firing his machine guns and releasing his bombs during an attack. It's a lot of work for one man, but the Barksdale pilots manage it somehow. Let's watch this machine-gun attack.

Notice how low they approach—almost hidden by the trees. Several hundred feet from the target they open fire and hold their fingers down on the electrical triggers until the curtain of fire ahead of them has passed across the whole target. They do not dive at the target, but shoot straight ahead as they fly along, thus subjecting the whole area in front of them to a moving hail of bullets. A squadron of attack planes can fire so many rounds in such a short space of time that attack pilots are trained not so much to hit a small target as to cover a large one. When a flight of nine attack planes cuts loose on a target area with thirty-six guns firing a hundred or so rounds each in a few seconds, well—you can't hear the roar of the engines.

The scorers on the big attack gunnery range are protected by dugouts that look like fortifications for real combat. The range officer and the scoring crew stand inside this dugout while bullets spatter against the wooden panels outside, and they emerge to count the hits only when they are sure all the planes have passed. The pilots are informed by radio and signaled by flags when the range is ready for more firing. This attack firing is an even more impressive experience than the type of gunnery practiced by pursuit, for when the ground is dry you can see the dust kicked up by your bullets striking far ahead; and when tracer bullets are used you see them as glowing streaks shooting from your plane to the target.

Now that the attack planes which resemble light bombers have flown over the horizon, we can turn our attention to the half-a-hundred Northrop A17-As which at the present time are the real strength of the Third Wing. And we are about to see one of the most beautiful sights anywhere—the take-off, in formation, of one of the twenty-seven plane attack squadrons operating as a single unit. The squadron is divided into three flights of nine planes each and these flights taxi out on the field and take off one after another. By the time "C" flight is leaving the ground, "A" flight has already passed the boundary of the field and the leader begins to raise his wheels by means of the engine-driven pump. The other pilots follow suit and all the wheels fold up into the wings. After leaving the ground every pilot in each flight goes through the same process of raising his wheels, shifting his propeller to high pitch, closing the flaps around his engine cowling that had to be kept open to prevent overheating on the ground, sliding the glass hood over his cockpit to keep out the draft, easing back on his throttle and watching his manifold-pressure gauge to avoid straining the supercharged engine, adjusting his elevator and rudder balances, checking his oil and fuel pressure to see that the engine is functioning properly—and continuing to fly formation all the while. So don't be surprised if the formation is not too tight at the very beginning.

"A" flight, often led by the squadron commander, makes a ninety-degree turn to the left, while "B" and "C" flights cut across to catch up and take their places in the formation. There are now nine groups of three planes each lined

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up in a long echelon to the left of the leader, and since it is an attack formation they are all at approximately the same level. When the lead element turns as much as ninety degrees the others cross over to the opposite side in order to fly the same distance. And as they settle down for straight flight on the course, notice that the element leaders shift again to the side toward the sun, so that they will be less troubled by glare as they look down the line toward the leader.

Very likely these planes have started on a simulated attack mission. They will fly a couple of hundred miles or so over a prescribed route and will attack some target exactly at a specified time, just as they would in war except that now the machine guns and bomb racks are not loaded. As they approach the target, usually a section of highway, a bridge, or a small airport, they will drop very low and come upon it suddenly at an altitude of less than a hundred feet. By this time the flights will be following each other and spaced so that by the time one flight has fired its machine guns, dropped its bombs and pulled away, the next element will be ready to cover the target with its own fire.

Speaking of bombing practice, that's exactly what that Northrop is doing which keeps flying back and forth at an altitude of several hundred feet near the eastern boundary of the field. And if the pilot is new in the attack group he is probably sweating, for accurate bombing of that type is not easy. Since attack planes fly too low for the operation of bomb sights, their pilots must learn how to estimate the distance a bomb will travel after it is released. Furthermore, the target is in range only when it is hidden by the nose of the plane so that the pilot can't see it. That's why you see this fellow tilting and skidding his plane during his approach—he is trying to keep the target in sight as long as possible. But he is probably more accurate than you think. After each bomb is dropped a "range officer" on the ground informs him by radio where it fell, and if he has missed he can correct his estimates and try to do better with the next one.

There is another Northrop beginning the same type of back-and-forth flying a little nearer to us and at a much lower altitude. It seems to be dropping little parachutes, but each parachute carries a small dummy bomb, and the pilot is developing his accuracy at this type of bombing, which is also peculiar to attack maneuvers. The object of the parachute is not to let the bomb down easy, but to slow up its descent and allow the plane to get away before the explosion. Using the ordinary type bomb, an attack plane must fly at an altitude of at least five hundred feet in order to escape the fragments blown upward. The parachute bomb will allow planes to fly low enough for the use of guns and bombs at the same time. As yet, no parachute bombs have been dropped at Barksdale, but there has been a great deal of practice with the dummy variety. You have only to watch that fellow to see how accurate they are. Notice also that the pilot can look back and watch his bomb as it strikes, so that he doesn't need any information by radio.

The low cloud of white smoke that has appeared suddenly, southeast of the field, is not an airplane on fire. See that Northrop speeding away from the cloud, with a thinning streak of white coming from beneath each wing? The pilot has just opened a couple of smoke tanks, and the liquid they contained, usually called "FS," has been vaporized by the speed of the plane into enough white gas or "smoke" to cover several acres.

The pilot who released the smoke is also engaged in target practice, but he must wait several minutes to find out whether he has made a hit. You see, he must not only "obscure" a certain area, but he must do it at a certain time he has already specified by radio. He was required to release his smoke at a considerable distance from the target area, upwind, and to estimate the distance and the wind velocity well enough to predict the exact time at which the target will be covered. This is extremely difficult, but the time element is quite important. Smoke is used principally for the purpose of blanketing enemy antiaircraft batteries while friendly bombers are approaching for an attack. So the smoke-layer must be able to place his artificial fog so that it will cover the batteries at the exact time when the bombers are scheduled to arrive.

Standing on the same spot at Barksdale, we have seen in a few hours some examples of almost every type of military flying. Much of it will continue throughout the day, as will the arrival and departure of visiting planes which we have scarcely noticed. And sometimes not even darkness halts practice in the use of various weapons. Night attacks are usually performed with the aid of flares similar to those which all Army planes carry for use in case of a night forced landing. When tracer bullets are used at night they can be seen for miles and the shooting of an attack squadron appears as a fountain of fire moving along the horizon.

But the ordinary, routine night flying at Barksdale is a beautiful sight in itself. It's interesting to watch a single plane coming in then, but to see a whole squadron strung out into a long row of red and green lights that glide in and settle on the field all at one time is something else entirely. Brilliant floodlights at each end of the landing area have taken some of the mystery out of night approaches, but night landings in formation are still difficult enough to keep any pilot's mind from wandering.

Incidentally, there was a collision on the field a few nights ago, though not between airplanes. It resulted from the wandering habits of Louisiana mules. A pilot landing in the dark was surprised when he was somewhat jolted and his airplane somewhat dented by a couple of mules that were stubborn enough to graze in the one wrong spot in hundreds of acres of flying field. But it's no wonder the farmers call them "hard tails" in this part of the country, for the mules moved away rapidly under their own power. The airplane had to be repaired.

Due to its facilities and its midway location, Barksdale is visited often by military planes of every type. The big bombers of the First and Second Wings often make this their only refueling point in flying from coast to coast. Navy planes pass through Barksdale on their journeys between the Florida and California bases. Groups of cadets from Kelly and Randolph make periodic visits in connection with their cross-country training, while the big Bellanca and Douglas freighters from the San Antonio Air Depot arrive and depart almost daily to pick up worn engines in exchange for new or overhauled ones.

Planes may arrive or depart at any hour of the day, particularly on week-ends, when Barksdale pilots take an airman's holiday and get in their cross-country training by flying to various points, such as Atlanta, Brownsville and Kansas City.

So flying of one kind or another is almost continuous, halted only by storms and fogs. After darkness has forced the pursuit pilots to cease their gunnery practice, the attack and pursuit squadrons begin their night work. They return from their various missions in a few hours and usually by eleven o'clock the great hangar doors have been lowered to enclose the planes until another dawn and another day's work for one of the world's busiest tactical units. But the big beacon on the water tower continues to sweep the sky with the characteristic split beam that indicates an Army field, and a guard is always handy near the floodlight switch to accommodate any visiting plane that may appear unannounced. And even when all traffic seems to have ceased, even in the small hours of morning, flying isn't over. For at two a. m. the weather observation plane is rolled out and warmed up and a sleepy pilot appears who takes it up to fifteen thousand feet and down again before daylight. The Air Force never sleeps.

109 MILES WITHOUT A MOTOR

(Continued from page 31)

Hill I was told that Peter Riedel had landed in the same vicinity 45 minutes ahead of me. We must have flown the same course.

With the help of some boys who were milling around my ship I located Riedel's sailplane, but he himself was not there. Returning to town I entered a restaurant to have something to eat, and there found Riedel having his dinner. He was quite surprised to see me. We sat and discussed our flight and found that our reactions were very similar.

Due to the holiday traffic my crew did not arrive until after midnight. We disassembled the ship, loaded it on the trailer and were back at Harris Hill, Elmira, at 8 a.m.

THE MITE

(Continued from page 62)

attractive, they'll stand considerable punishment. Use 1/8" hardwood plywood with 1/4" diameter dowels for the hubs. Drill the hubs to receive the landing gear axles.

FLYING

Make sure that all surfaces are perfectly straight. Should a warp develop, it can be removed by giving the wing or tail a coat of dope thinner and twisting the wing against the warp, holding the wing in this position until the dope has dried. The model should balance slightly tail-heavy. The motor is slightly offset against torque. This adjustment will result in a straight level glide after the motor has cut. This straight line flight is desirable for short test hops. But if you want to risk your model for a little thermal soaring, give the rudder a slight turn for a circular glide.

MOTOR OPERATION

Ignition is even more important in small motors than in large ones. The breaker points should be carefully adjusted until smooth operation is obtained. Oil and gas mixture should be varied until you're satisfied that your motor is turning up smoothly. Engine manufacturers usually include definite instructions regarding fuel mixture.

Mounting the motor is especially important from the standpoint of reducing vibration. Small motors are especially sensitive to vibration. Unless it is reduced to a minimum, operation will be rough and uncertain.

LIST OF MATERIALS

Fuselage

8 3/16x3/16x36" longerons, braces, etc.
1 1½x2¾x⅛" front bulkhead, three-ply hardwood
1 3/16x2x10½" wing mounts
3 ⅛x1½x12" front and rear of fuselage, flooring, rudder.
1 1x1½x2" front lower-cowling
1 1/32" diam.x9" wire bottom-rudder outline
1 ⅛x1½x6" battery tray
2 ¼x⅜x3¼" motor mounts, hardwood
2 1/16" diam.x18" wire landing gear
1 ¼" diam.x6" doweling landing gear and wheel hubs
1 ⅛x2x4" plywood for wheels

Wing

2 ¼x¼x24" leading edge
2 ⅛x½x24" trailing edge
2 ⅛x¾x24" spars, hard straight-grained balsa
2 1x1x6" wing tips
4 1/16x1x24" ribs
1 1/16x1x6" hardwood plywood

Elevator

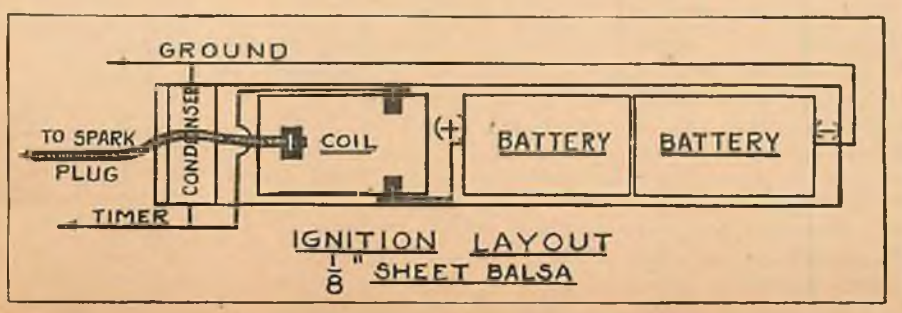
4 ⅛x½x9" elevator outline
1 ⅛x1x6" tips
2 ⅛x¼x12" ribs

Rudder

1 ⅛x½x12" outline
1 ⅛x¼x15" ribs
1 ⅛x1x2½" tips

Additional Items

1 sheet bamboo paper
½ pint dope
3 ounces cement



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GLIDING

(Continued from page 33)

ment in this country, and announced that the Glider Construction Manual will be out in a month or so. He strongly urges all those with rebuilt or privately designed gliders to write for it, addressing the Bureau at Washington, D. C., and thereby facilitate licensing. Because of a fifty per cent increase in the department's staff of inspectors, the licensing of gliders can be accomplished more quickly than formerly.

Ray Beret, versed in aircraft insurance, gave the audience some figures on glider insurance, showing that the cost was not prohibitive. It is planned to have all ships covered for liability and property damage at the next contest, the cost being about $16.00 per ship.

The Director of Aviation for the State of Tennessee announced that his home State is planning to spend some money on developing gliding and soaring sites.

At 12:30 an official luncheon was held at the hotel. It was attended by General Arnold, Assistant Head of the Army Air Corps, Captain Richardson, of the U. S. N., Representative Moss, Congressman Meade, Fred Fagg, Director of the Bureau of Air Commerce, Dr. Lewis, head of the research department of the National Advisory Committee for Aeronautics, and William Enyart of the N. A. A.

After the luncheon everybody was taken to Bolling Field, the Army Air Corps base at Washington, where Lew Barringer gave a demonstration of sailplane flying in a Goeppingen Wolf before the heads of the Army and Navy. Although the ceiling was only 400 feet, Lew made several excellent flights.

At 4:30 a conference on sailplane construction was held at the hotel, with Dr. Jacobs of the NACA presiding, and with Dr. Lewis and Dr. White present. The object of this meeting was to acquaint the NACA, which does all research work on aircraft construction, with the problems of glider and sailplane design.

At 8 o'clock that evening all participants were taken to the Smithsonian Institute, where an interesting lecture was given on the history of flight.

"NACELLING" THE PRIMARY

Due to limited financial resources, many clubs that have only a primary cannot afford to purchase secondary ships and thus advance to the next stage of gliding. The primary is not maneuverable and has a poor gliding angle, since aerodynamically it is far from being "clean," and its short wing span and heavy weight (span to weight ratio) give it a high sinking speed; these characteristics make soaring almost impossible.

Yet two of these faults can be cured to a certain extent. Maneuverability can be improved and the gliding angle stretched, without major structural changes. A primary's lack of maneuverability comes from the fact that the pilot's position in front and out in the open disturbs the smoothness of air flow over the tail surfaces, preventing them from operating properly. Furthermore, the pilot imposes a drag on the ship and acts as an air brake, thus causing a poor gliding angle. All these defects can and have been dealt with by "nacelling" the front portion of the primary from nose to the stern end of skid—that is, streamlining the pilot into an enclosure.

The whole nacelle need not be heavy, just strong enough so that the pilot can safely lean on the cockpit edge while getting in and out. Material may be metal tubing or wood for bulkheads and stringers, with fabric for covering. The nacelle's form does not have to follow strictly aerodynamical lines—flat sides are easier to construct and quite satisfactory. The enclosure should be deep enough so that the pilot's shoulders are exposed, and should taper from the front cabane mast down to the rear end of the skid.

Nacelled primaries have been soared for several hours, and are extensively used by glider schools to give training in soaring. Of course, you can't expect the same performance as from a Franklin, but the addition of such a hood is a vast improvement on the simple stick model.

CLUB NEWS

Parker Leonard, of Osterville, Mass., recently soared his newly acquired Goeppingen Wolf sailplane for over two hours over the sand dunes of Cornhill, the birthplace of American gliding.

Because of the great number of entrants at the last National Soaring contest at Elmira, N. Y., and the difficulty of accommodating a still greater number for this year's meet, it has been definitely decided to hold two separate national events this year. One will be held at Elmira from June 25th to July 11th, and the other at Frankfort, Mich., from August 29th to September 7th. The Frankfort event will be known as the American Open Soaring Contest. The Ninth National Soaring Contest at Elmira will be a competition between top-flight soaring pilots of this country, and flights below the Silver "C" requirements will not be encouraged, while at the Frankfort meet all are welcome to compete. The SSA will transfer to Frankfort all prizes that reward the performances of groups, utility gliders and junior pilots. The prize regulations will be drawn up so as to set a handicap on sailplanes.

At a recent annual election of directors of the SSA the following men were elected to serve six years replacing the six members automatically retired at the end of 1937: William Enyart, Secretary, Contest Board, NAA, Washington, D. C., "C" pilot; Milton Stoughton, aeronautical engineer, Jackson Heights, N. Y., "C" pilot; Arthur B. Schultz, President, Detroit Glider Council, Detroit, Mich., Silver "C" pilot; Arthur L. Lawrence, Instructor, Greenvale School, Norton, N. Y., "C" pilot; Chester J. Decker, President, North Jersey Soaring Association, Glen Rock, N. J., Silver "C" pilot; Joseph Funk, Secretary, Akron Glider Council, Akron, O., "C" pilot.

C. B. Colby, editor of Air Trails, attended the meeting of The Chicagoland Glider Council held at the Stock Yard Inn in connection with the International Air Show. After an informal dinner three reels of gliding and soaring movies provided by the SSA were shown, augmented by several short reels taken of activities at Sleeping Bear Soaring Site.

Representatives from the following glider clubs were present:

Gage Park Glider Club, Chicago, Ill.
Glen Ellyn Glider Club, Glen Ellyn, Ill.
Grey Gull Glider Club, Chicago, Ill.
Purdue Glider Club, West Lafayette, Ind.
Prairieland Glider Club, Chicago Ill.
Soaring Flight Assn., Chicago, Ill.
Soaring & Gliding Club of Chicago, Chicago, Ill.
South Bend Glider Club, South Bend, Ind.
Tri-State Glider Club, Angola, Ind.
U. of Michigan Glider Club, Ann Arbor, Mich.

The council's first board of directors serving throughout 1937 were reelected for 1938. This board is composed of Joe Steinhauser, Joseph Smith, Wayne Thomis, all of Chicago, and two members of the South Bend Glider Club—Guy C. Weber and Clemens W. Luebker.

All present at the meeting were enthused with the news of the Soaring Society's plans for the American Open Soaring Contest at Frankfort, Michigan. Plans were discussed for introducing more student pilots to the art of slope soaring along Lake Michigan's sand dunes and bluffs. The Purdue Glider Club completed several months ago a two-place utility glider which they intend to test out for its soaring qualities at Benton Harbor's bluffs. Several clubs plan to join the Purdue group at Benton Harbor.

Our editor, by the way, has obtained his "B" license. C. B.'s gliding experience dates back to 1930, when he was with the Bowlus-Hirth Glider School. Jack O'Meara taught him to fly.

AVIGATION

(Continued from page 29)

To summarize what has gone before, there are two kinds of errors to be found in every airplane compass: (1) that due to variation, which is caused by the fact that the north point of the compass points to the magnetic north pole instead of the true pole (in south latitudes, of course, the same applies to the south point of the compass relative to the south pole); and (2) that due to deviation, which is the error induced in the compass by the magnetic effect of the plane itself.

COMPASS CORRECTION

No. 1 Ship No. 6

	Bearing For Magnetic	Steer By This Compass	Cor.
N	0	2	+2
	30	33	+3
	60	64	+4
E	90	90	0
	120	120	0
	150	148	-2
S	180	179	-1
	210	208	-2
	240	240	0
W	270	270	0
	300	301	+1
	330	332	+2
N	360	2	+2

Fig. 1

In navigation there are three terms used for convenience in dealing with compass courses: They are (1) the true course, which means the actual geographical direction on the map from one point to the next, as from New York to Boston, or from Chicago to San Francisco, (2) the magnetic course, which means the true course plus or minus the error due to variation, and (3) the compass course, which is the reading the plane's compass shows due to the influence of variation and deviation combined.

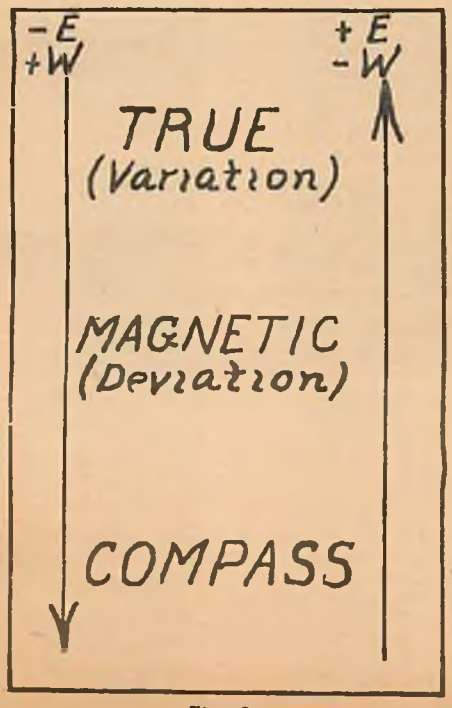

Fig. 2

From what has been said then, it is obvious that if we wish to get into our plane and fly from one city to the next, we must first correct our course for variation and deviation or else we will go astray.

For convenience in mastering this subject of compass errors, we will only consider the north point of our compass and the north magnetic pole, forgetting the south point of the compass and the south pole.

All compass errors are either easterly or westerly in direction, which means that instead of the compass pointing true north it is attracted a little to the east or to the west, as the case may be.

In learning to apply the compass errors it is best to have some handy diagram as a reference. The writer offers the following one and suggests that the student memorize it: (See Figure 2).

It means just this: If you know the true course and wish to find the magnetic course, you must subtract easterly errors due to variation and add westerly errors due to variation. (Notice the signs on the figures above the left arrow). If you want to go still further and find out what the compass course is, you must still subtract easterly errors and add westerly errors, which are due this time to deviation. Notice now, that on the return, as shown by the arrow on the right side, the signs on the letters above that arrow have reversed.

Now work out the following examples, using Figure 2 as a reference:

The true course between Smithville and Big Lake is 100°. The variation is 5° east. What is the magnetic course?

Answer: 100° True
(—) 5° E. (variation)
95° Magnetic

Going further, if the deviation in the above problem is 10° E, what is the compass course?

Answer: 95° Magnetic
(—) 10° E. (deviation)
85° Compass

Here are some more:
True course 150°, variation 6° east,

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3/32x3/32 30. 5c
1/8x1/8 30 for 5c
1/8x3/16 12 for 5c
1/8x1/4 10 for 5c
1/8x3/16 8. 5c
1/4x1/4 6 for 5c
1/4x1/2 3 for 5c
1/4x1 2 for 5c
1/64x2 4 for 10c
1/32x2 8 for 10c
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2x3 25c; 2x6 39c
3x3 40c; 3x6 75c
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Plastic Balsa
For cowlings, streamlining, repairing, etc. Large can 25c
TISSUE, AA
All col., doz. 19c
Silver ...ea. 5c
Superfine, wh. 5c
WHEELS per pr.
Birch Bisa Celu
½" .01 .03
¾" .02 .04 .05
1" .03 .05 .07
1⅛" .04 .08 .10
1⅞" .07 .10 .16
3" .15 .15 .30
NOSE BLOCKS
1x2x1 .....1c
2x2x1 .....3c
2x2½x1 .....3c
3x3x1 .....5c
3x3x2 .....8c
3x3x3 .....10c
SHEET ALUM.
.0004x5x11½
2 sheets 3c

.005 in. 6x6 5c
.010 in. 6x6 6c
.015 6 x 6 8c
1/32 6 x 6 15c
CLEAR DOPE OR THINNER
5c per oz.; large bottle, 8c; ½ pt. 30c; 1 pt. 45c
COLORED DOPE
6c per oz.; large bottle, 10c; ½ pt. 35c; pt. 60c
CLEARCEMENT
5c per oz.; large bottle, 8c; ½ pt. 35c; 1 pt. 55c
PROPELLERS
Balsa Paul-O- Wina
Mach.Cut
5" 4c 10c
6" 5c 15c
7" 6c 20c
8" 7c 25c
9" 8c 30c
10" 8c 35c
12" 10c 45c
14" 14c 55c
15" 15c 60c
INSIGNIA
24 and strings 5c
DOWELS
1/16x6 ..doz. 5c
⅛x18 ..2 for 8c
3/16x½ ..2 for 5c
WIRE
6-8-10-12-14
.....2 ft. 1c
WOOD VENEER PAPER
20x30 ..1 for 10c
RUBBER
.045 ...25 ft. 5c
1/16 sq., 15 ft. 5c
⅛ flat ..15 ft. 5c
Skein 50c
3/16 flat 12 ft. 5c
BROWN RUB.
⅛ flat 12 ft. 5c
Skein 75c
RUBBER LUBRICANT
Large bottle 10c
PROP. BLOCKS
½x ⅝x 5 6—5c
½x ¾x 6 6—5c
⅝x1 x 7 4—5c
⅝x1 x 8 3—5c
¾x1¼x10 3c ea.
¾x1¼x12 3c ea.
1 x1½x12 4c ea.
1 x1½x15 7c ea.
BUSHINGS
1/16 .....4 for 1c
REED
1/32-1/16 2 for 1c
3/32-⅛ ..1 ft. 1c

WOND. WATER SPRAYER 15c
WING AND TAIL LIGHTS
12" 10c; 15" 15c
21" 30c
CELLULOID
6x8 .....5c
1½x16 ....18c
PROP. SHAFTS, REAR HOOKS
doz. 8c
CAMEL'S HAIR BRUSHES
Small 3c; Lge. 5c
Extra large...8c
NOSE PLUGS
½" ....12 for 8c
DUMMY RAD. ENGINE (Celu.)
1½" d. 15c; 2" d. 20c; 3" d. 30c
ENGINE AND COWL (Celu.)
1½" dia. 15c
2" dia. 20c
3" dia. 25c
CELLULOID PANTS, per pair
½" to 1" ..18c
1⅛" to 1⅞" ..33c
ALUM. TUBING
1/16, 3/32, ⅛ .....ft. 7c
3/16 or ¼, ft. 10c
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½" or 1" pkg. 5c
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1 doz. ⅛ or ¼ 1c
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2 blades 3 blades
½"...5c ... .08
2½"..10c ... .15
3½"..15c ... .20
4½"..20c ... .25
ALUM. COWLINGS
1½" 15c 2" 18c
3" 25c
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BOMBS
¾"..4c 1¼"..7c
1½"..10c
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1¼" 10c 1½" 15c
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deviation 10° east. What is the compass course?

Answer: 150° True
(—) 6° E. (variation)
144° Magnetic
(—) 10° E. (deviation)
134° Compass

True course 200°, variation 15° east, deviation 10° west. What is the compass course?

Answer: 200° True
(—) 15° E. (variation)
185° Magnetic
(+) 10° W. (deviation)
195° Compass

Compass course 175°, deviation 7° west, variation 10° east. What is the true course? (Look out for this one. Notice you're beginning with the *compass* course, so go up the right-hand arrow).

Answer: 175° Compass
(—) 7° W. (deviation)
168° Magnetic
(+) 10° E. (variation)
178° True

The student must not become confused with the term "magnetic course." It is used in navigation merely to denote the fact that variation only has been applied to the true course, or deviation only has been applied to the compass course. To be sure, the plane's compass operates upon the principle of magnetism and is called a magnetic compass, but its reading should not be confused with the term "magnetic course" as used in navigation.

The next instrument used in avigation (in this article the terms avigation and navigation are used synonymously) with which the student must become familiar, is the airspeed meter. While the errors inherent in this instrument are not as involved as in the case of the compass, still there are two very important points to be remembered. First, the operation of the airspeed meter depends not only upon the motion of the airplane through the air, but also upon density of the air in which it is operating. Everyone knows

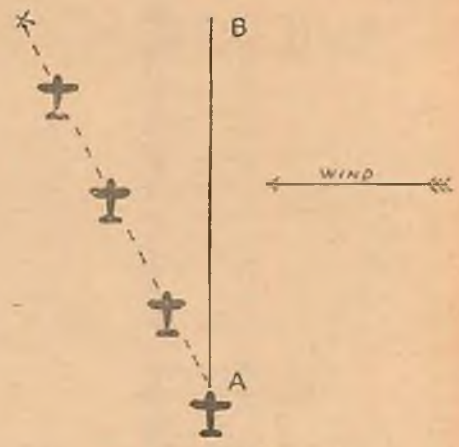

Fig. 3

that the air becomes less dense as altitude is gained. This fact causes the airspeed meter to read less than it should when the plane is flying above sea level. In other words, if the plane is 4000 feet above sea level and the airspeed meter dial registers a speed of 100 miles per hour, the plane is actually making an added, 2%×100×4=8 miles per hour, or a total speed of 108 miles per hour through the air. Thus to obtain the actual air speed, add 2% of the air speed indicated by the airspeed meter dial, for each 1000 feet of altitude. This is an important point to remember as it may cause the pilot to overrun his course if he neglects to allow for it.

Example: If a plane is flying at 8000 feet above sea level and the airspeed meter registers 120 miles per hour, what is the actual speed of the plane through the air?

Answer: 120+(.02×120×8)=139.2 miles per hour.

Notice in the foregoing discussion the term "airspeed" has always been employed. It brings up the second important point to be remembered. Airspeed, or speed of the plane *through the air*, is not necessarily the same thing as speed made good over the ground. For instance, the plane may be making 100 miles per hour through the air, but if a 100-mile-an-hour wind is blowing directly against its nose, the plane will get nowhere at all. If as an exaggerated example, the plane just mentioned were to take off from New York for Boston and meet with a 100-mile head wind, it could fly in the direction of Boston until it had run out of gasoline, without ever leaving the vicinity of New York.

The problem of wind, ground speed

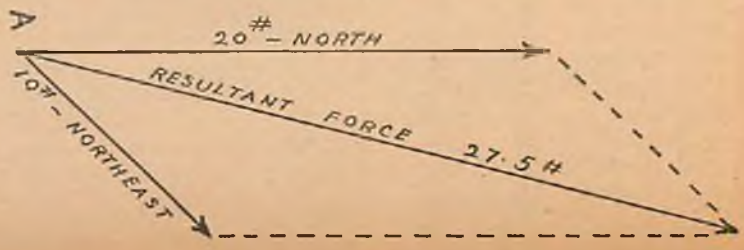

Fig. 4

and airspeed will be dealt with more fully later on. For the time being it will be sufficient to remember that airspeed is not the same thing as ground speed.

ALTIMETER

The altimeter is nothing more nor less than a barometer. A barometer, as everyone knows, is an instrument used to indicate the pressure of the air. The pressure of the air becomes less as we leave the earth. The scale on the altimeter is so arranged that it reads higher as the pressure brought to bear on the instrument becomes less.

There are two very important points to be taken into account in dealing with the altimeter also. One is the fact that its operation is based upon standard atmospheric conditions. In other words suppose an altimeter to be on the ground at a sea level airport and set at zero while the pressure of the air was standard, or 29.92 inches. The altimeter would read zero as long as the atmospheric pressure at that place remained unchanged. If, however, the pressure of the surrounding air should rise, the altimeter would read a corresponding amount below zero, and if the pressure should fall, the altimeter would read something above zero.

The danger involved in this should immediately become apparent to the student. Suppose, for instance, that after a pilot at a certain airport had set his altimeter at zero and taken off for a flight, the atmospheric pressure at that airport should fall; upon his return the plane's altimeter would indicate the plane still to have altitude even after it had landed. Imagine that pilot's embarrassment had this fall in barometric pressure been accompanied by rain and fog!

Another point to be remembered is that the altimeter does not necessarily indicate the height above the ground, but rather the height the plane is above the place which it has just left.

MAPS

A great variety of maps or charts are employed in avigation, each possessing certain characteristics which make it suitable for a particular need. For land avigation the most popular at the present time are the Sectional Aeronautical charts issued by the Department of Commerce. These charts, based on the Lambert conformal conic projection, divide the United States into eighty-seven sections. They are laid out with a view not only to giving the pilot information necessary for cross-country avigation, but also toward being of a size suitable for handling in an airplane.

VECTOR AVIGATION

We now come to the phase in this course which will require appreciable application on the part of the student. It is effort that will be well rewarded, however, when actual avigation is begun, because it comprises the major portion of dead reckoning. Dead reckoning, it will be remembered, is the process of avigating the airplane when visual contact with known objects on the ground is not possible.

If it is desired to fly between points A and B in Figure 3, and a wind such as is indicated by the small arrow is blowing perpendicular to the course between the two points, then the plane cannot simply head in the direction of the line AB, because if it did, it would at the end of its run arrive at some other point X, instead of B.

This leads us to what is commonly referred to in physics as the parallelogram of forces. All forces can be represented in magnitude and direction by straight lines. For instance, if a force of twenty pounds pressure is pushing on an object A in a northerly direction, and one of ten pounds pressure is pushing on it in a northeasterly direction, we can find the resultant force against the object by merely laying the problem out graphically. See Figure 4.

In the figure, an arrow of ten units has been used to represent the force of 10 pounds acting in a northeasterly direction and one of twenty units to represent the force of 20 pounds acting in a northerly direction. To find the resultant force acting on the object A, it is only necessary to complete the parallelogram, as shown by the dotted lines, and draw the diagonal across it.

The same general procedure can be used to find the resultant path of an airplane when its heading and airspeed, and the force and direction of the wind are known.

First, however, it will be necessary to have an understanding of a few terms.

Airspeed is the speed of the airplane through the air.

Figs. 5 and 6

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1/16x⅛ 35 for 5c
1/16x3/16 18. 5c
1/16x¼ 15 for 5c
1/16x½ 5 for 5c
3/32x3/32 30. 5c
⅛x⅛ 30 for 5c
⅛x3/16 12 for 5c
⅛x¼ 10 for 5c
3/16x3/16 8. 5c
¼x¼ 6 for 5c
¼x½ 3 for 5c
¼x½ 2 for 5c
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1/16x2 5 for 5c
3/32x2 4 for 5c
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¼x2 2 for 5c
½x2 1 for 5c
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2x2x1 .....2c
2x2½x1 .....3c
3x3x1 .....5c
3x3x2 .....8c
3x3x3 .....10c
Alum. Tubing 1/16", 3/16", ¼" ....10c ft.
Rubber Motors 1/16 sq. 20 ft. 5c
⅛ flat 20 ft. 5c
Sheet Aluminum .003 ...sq. ft. 10c
TISSUE, AA
All col., doz. 19c
Silver ...ea. 5c
Superfine, wh. 5c
PROPELLER BLOCKS
½x ¾x 5 8—5c
½x ¾x 6 6—5c
½x ¾x 6 0—5c

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⅝x1¼x10 2—5c
¾x1¼x12 3c ea.
1 x1½x12 6c ea.
1 x1½x15 7c ea.
DOPE Clear
1 oz. 5c ½ pt. 25c
2 oz. 10c
Colored
1 oz. 5c ½ pt. 30c
2 oz. 10c
11 in. BAMBOO
1/10x¼ 6 for 5c
Shredded 40—5c
ALUM. LEAF
2 Sheets for 1c
WIRE
6 ft. 3c
THINNER
Best, 1 oz. ...5c
REED
1/32, 1/16" 3 ft. 1c
⅛ in. ...3 ft. 2c
PROP. SHAFTS
2 .....for 1c
PAUL-O-WINA
5" 10c. Add 5c per in. up to 10 in.

Machine Props. 5 in. .....4c (Add 1c per in. up to 16 in.)
THRUST BEARINGS 1c
BUSHINGS Doz. 3c
ALUMINUM WHEELS
1" pr. 6c
1⅜" pr. 11c
1⅝" pr. 14c
NOSE PLUGS
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small ... 5c doz.
CEMENT
1 oz. 5c
½ pt. 25c
Model Pins pkg. 5c
Brushes No. 6 5c
INSIGNIAS—French, American, English, German
1½" ....4 for 3c
2" 1c
1 sheet of 24, 5c
Dummy Radial Engines
1½" Diam. ..14c
2½" Diam. ..18c
5" Diam. ..23c
Sheet Celluloid
2x6..2c 6x8..4c
12x18 .....15c
Wood Veneer
20x30" ..1 for 9c
2 for 17c
WHEELS per pr.
Brch Blsa Celu
½ .01 .03
¾ .02 .04 .05
1 .03 .05 .07
1½ .04 .08 .10
1¾ .07 .10 .18
3 .15 .30
18" Balsa Planks
1x1 ...1 for 4c
1x2 ...1 for 9c
2x2 ...1 for 15c
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Ground speed is the speed of the airplane over the ground.

Heading is the direction the plane's nose is pointing; it is shown by the compass reading.

Track is the direction over the ground in which the plane actually travels. (Notice this is not necessarily the same as the heading).

Wind force is the number of miles per hour the wind is blowing.

Wind direction is the direction from (not toward) which the wind is blowing.

Suppose now, we wish to fly between towns M & O, the direction of O from M being 90°, and the towns 120 miles apart. The plane's airspeed is 100 miles per hour and there is a 10-mile-an-hour wind blowing from the northeast (45°). How do we find what course the plane should steer in order to get to its destination and also what will be its ground speed? See Figure 5.

First lay the points M and O out on a paper using any convenient scale, 20 miles to the inch for example, as the distance between them; draw a line between the points. Now using the same scale (20 miles to the inch) draw an arrow extending from point M in a direction *away* from the direction the wind is blowing; in this case away from northeast. Now take a pair of dividers set to five inches, to represent the plane's airspeed of 100 miles per hour, and with one point of the dividers at the head of the arrow (at point R) describe an arc cutting the line MO as at X. Join R and X. This line, RX, represents the heading and airspeed.

Measure the distance between M and X; this represents the track and ground speed which in this particular problem is 90° and 92.5 (approximately) miles per hour, respectively.

Let us now analyze what we have just done. To begin with, we knew the direction we wished to have the plane go, or the track we desired to have it cover; this was 90°. There was a wind blowing, which not only tended to set the plane off its course, but also to hold it back somewhat. This wind was represented by the arrow, MR. We swung an arc equal to the airspeed of the plane, from the point R until it cut the line MO, which in this case was at point X. The line joining the points R and X not only represented the plane's airspeed, but also the heading by compass that the plane would have to steer in order to overcome the effect of the wind and arrive at point O. Do not be confused by the fact that the line RX, if continued, would cross MO. It must be remembered that the line RX merely represents the plane's *heading* (which in this problem turns out to be 86°) and its *airspeed*. The plane actually is always on the line MO, never on the line RX. In exactly one hour the plane will be at point X. The time it will take the plane to cover the remaining distance to O can be determined by first measuring that distance XO, converting it by means of the scale (20 miles to the inch) into miles, then multiplying the number of miles by 60 and dividing by the ground speed. In actual solution of this we find: XO = $1\frac{3}{8}$ inches; $1\frac{3}{8}$"x20 (the scale) = 27.5 miles. $\frac{60 \times 27.5}{92.5}$ = 18 minutes (approximately), the time it will take the plane to go from X to O. The total time, then, required for the trip from M to O is 1 hour and 18 minutes.

Let us now assume a somewhat different case, one in which the wind helps the plane along, as well as setting it off its course. In Fig. 6, A and B represent two towns 100 miles apart; the direction of B from A is 90° true; the wind is blowing from the northwest at the rate of 15 miles per hour; the plane's airspeed is 100 miles per hour. What course must the plane steer in order to arrive at B and how long will it take the plane to get there?

In each of the problems under discussion, the student may employ the

compass rose printed on the aeronautical chart, a mooring board diagram, or an ordinary protractor in obtaining relative directions. For accuracy in measuring distances and representing values, he should use as large a scale as convenience will permit. Ten miles to the inch is suggested as being handy for most problems of this type. A scale of 20 miles to the inch is being used to illustrate the problems under discussion in order to restrict the size of the diagrams to the printed page.

To get back to the solution of the problem at hand, we first lay out a line in the direction of 90° from A toward B, using a chart rose or an ordinary protractor to obtain the relative direction. The line AB we make five inches long to represent (scale 20 mi. = 1 inch) a distance of 100 miles. By use of chart rose or protractor, the 15-mile-per-hour wind, represented by the ¾ inch line AP, was laid out from the point A in a direction away from the northwest. Now with dividers set at 5 inches, to represent the plane's airspeed of 100 miles per hour, an arc was swung from the point P, cutting the line AB (extended) at X. The line PX represents the plane's heading and airspeed, the line AB represents the plane's track and the line AX represents the plane's speed over the ground, which in this case is 20x5½ inches, or 110 miles per hour.

It will be noticed that in this problem, the point X falls beyond the plane's destination B. The distance AX representing 1 hour's run, indicates that it will take the plane less than one hour to get to B. To find out the time it will take the plane to get to B, which we already know to be 100 miles from A, simply use the formula:

$$\frac{60 \text{ minutes}}{110 \text{ (ground speed)}} \times 100 \text{ miles}$$

$$\text{(distance)} = \frac{600}{11} = 54.5 \text{ mins. Hence}$$

in order for the plane to get from A to B, it must head in the direction PX, or 84° from A for a time interval of 54½ minutes.

The problem is much simplified in cases where the wind is either directly on the plane's nose or its tail. Here it is only necessary to add or subtract the full value of the wind velocity to the plane's airspeed, in order to obtain the ground speed. Obviously, too, the plane is not set laterally off its course, the only effect of the wind being to make the plane arrive at its destination sooner or later as the case may be.

Let us now take up a problem involving all of the processes discussed thus far. As a gauge of how well the student has absorbed what has gone before, it is suggested that he work the following problem completely through without first consulting the text.

A plane wishes to fly from Jonesville to Gold City, a distance of 200 miles. The true course is 150°; the variation in that locality is 5° east; the deviation on the general heading of 150° is 7° west. The pilot wishes to fly at 7000 feet above sea level in order to clear a range of mountains; at this altitude his airspeed meter reads 90 miles per hour. The wind at 7000 feet is north, 25 miles per hour. What are: (1) Track and ground speed? (2) Heading by compass and airspeed? (3) Time required to fly to Gold City?

Hint: Work out the graphical solution, using the true course, then convert to compass course. It is suggested for accuracy's sake, that the student use a scale of 10 miles = 1 inch.

Solution: Corrected airspeed = 90 + (.02 × 90 × 7) = 102.5 miles per hour. Using this airspeed to start the graphical solution we find the track to be 150° true, and the ground speed 124 (approximately) miles per hour. The heading is found to be 144° true. The time to arrive at Gold City is 200 ÷ 124 = 1 hour 37 minutes. There is yet one step left, that of converting the true heading to the heading by compass:

144° True
(−) 5° E. (variation)

139° Magnetic
(+) 7° W. (deviation)

146° Compass

(To be continued next month)

Air Adventurers

(Continued from page 39)

college. Or, he must be able to present a certificate signed by the registrar of a recognized university showing he has completed satisfactorily one half or more of the necessary credits leading to a degree which normally requires four years of work, and that he shall possess a mathematical education which, as for a minimum, shall cover a complete treatise as set forth in Wentworth's College Algebra, Wentworth's Plane and Solid Geometry, plane trigonometry, as set forth in Wentworth's new Plane and Spherical Trigonometry, and Milliken and Gales' Practical Physics, or in other similar recognized standard textbooks of equivalent scope."

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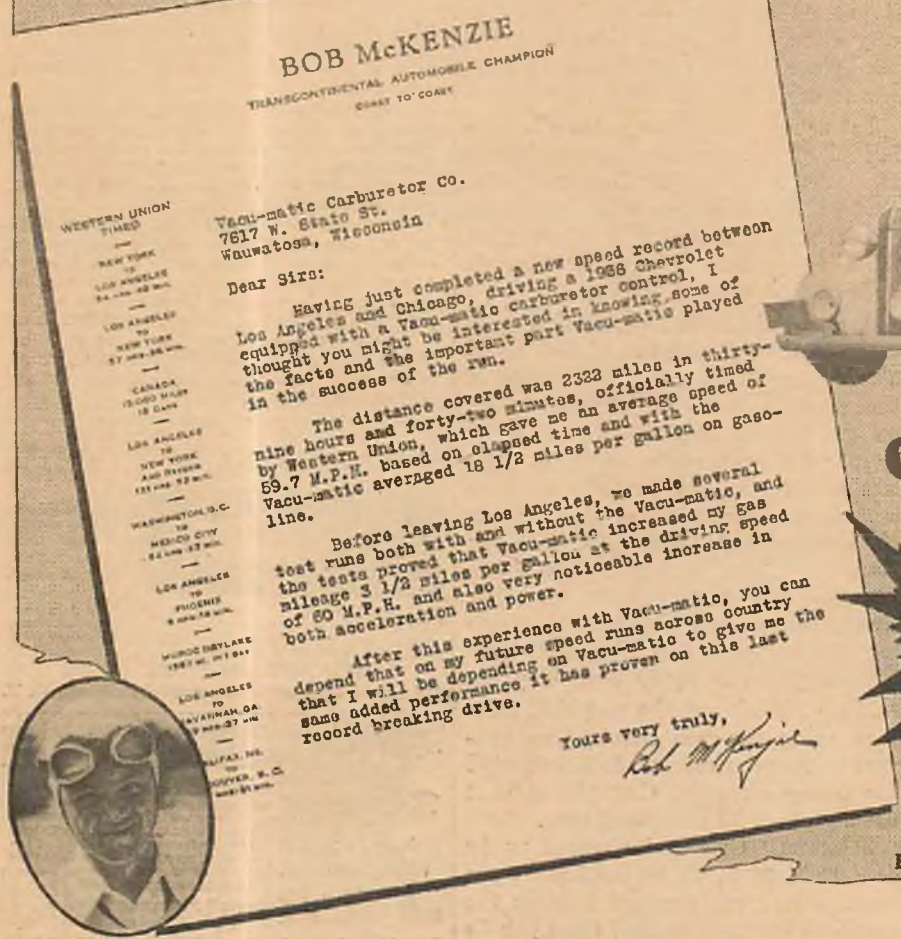

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