AIR TRAILS

A STREET & SMITH PUBLICATION

15c
MAY, 1939

TEST PILOT TEST
★
LATEST RADIO CONTROL
★
FORMATION FLYING

CLAYTON KNIGHT - WILLIAM ENYART
FRANK TINSLEY - ARCH WHITEHOUSE

ENROLL AT CALIFORNIA FLYERS THIS SUMMER
WORK IN AVIATION THIS FALL

Building the DC-3 in the huge southern California Douglas plant

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You learn in one of America's most modern aviation schools, in fact, the only U. S. Government-approved school in Los Angeles which offers all phases of aviation training. California Flyers maintains one of America's largest training fleets. The school has an enviable record for cooperation both in production technique and personnel placement with Southern California's huge aviation industry.

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Aircraft Building (Aircraft sheetmetal) ☐ *Airplane Drafting* ☐
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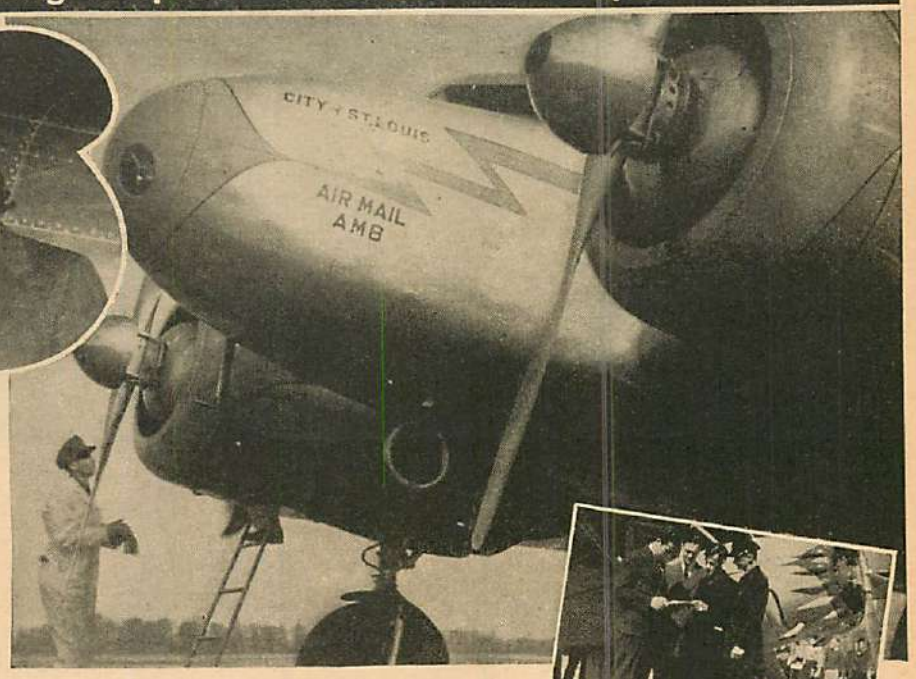
Proof that Parks Training Prepares You for Leadership in Aviation!



Bruce Braun, right, vice-president in charge of operations, Chicago & Southern Air Lines tells Oliver Parks —

"We've Never Been Disappointed in a PARKS Graduate"—

Bruce Braun goes on to say, "Among C&S pilots, co-pilots, district sales managers, dispatchers and maintenance engineers are a number of Parks graduates. They all have lived up to your recommendations."

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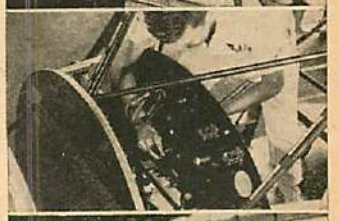

● *In common with all commercial aviation, this is the code of Parks Air College: "No compromise with safety will ever be permitted or excused."*

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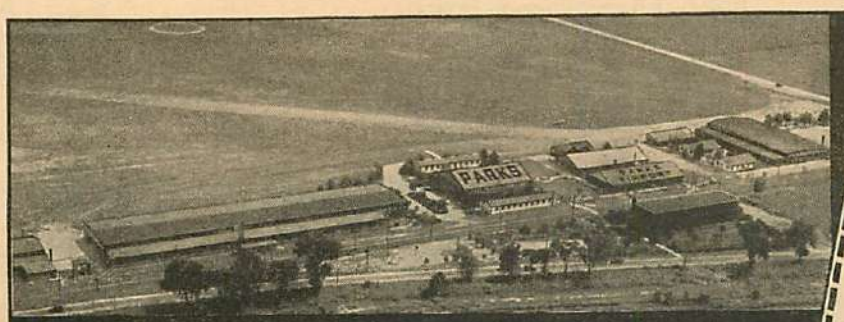

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Please send me details of Parks four major courses in commercial aviation training.

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State.....

Reg. U. S. Pat. Off.

AIR TRAILS

CONTENTS FOR MAY, 1939

VOL. XII, NO. 2

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WITH BALL BEARING PROP SHAFT

Balsa Covered Wing—"Semi-Planked" Fuselage
Wire "Gas Model Type" Landing Gear

No airplane in the history of model building has established such a long line of records equal to that of the "BUCCANEER" Gas Models, holder of both the Senior and Open World's Record under both limited fuel allowance and limited engine run rules. In response to your demands we give you the rubber powered "Buccaneer". Designed for a 4-cylinder Menasco engine to give scale model appearance.

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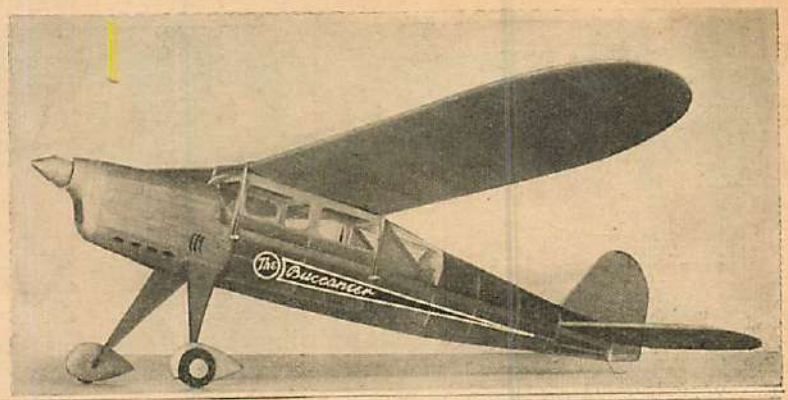

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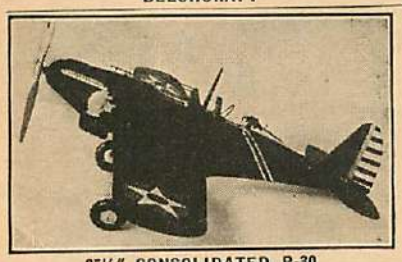

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Metal Spinner
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The model that actually flies itself. When the rubber unwinds, the wheels and "Air Brakes" automatically drop.

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"CAVALIER-STANDARD"

6-Foot Wingspan For 1/5 H.P. Motor

The latest full-size gas model kit on the market, designed to outclimb any other ship. You will like this clean little plane and its breath-taking flights..... **$5.95 P.P.**

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The aristocrat of model airplanes. Absolutely the most complete kit ever offered to model builders. Suitable for radio-control... **$15.00 P.P.**

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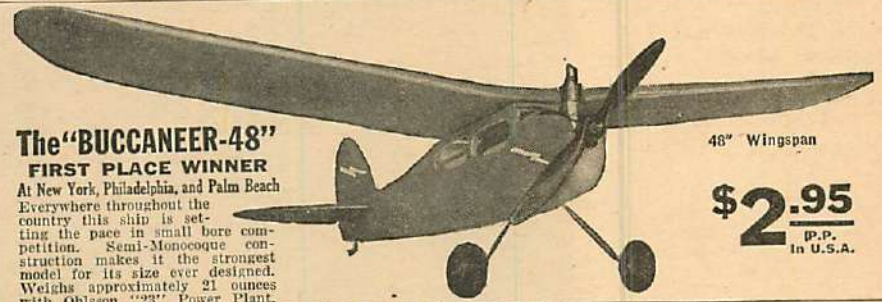

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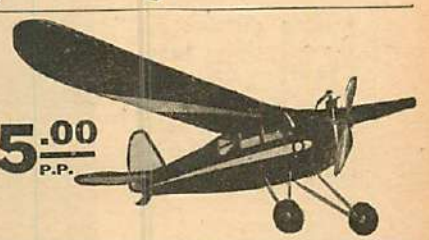

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All the thrills are

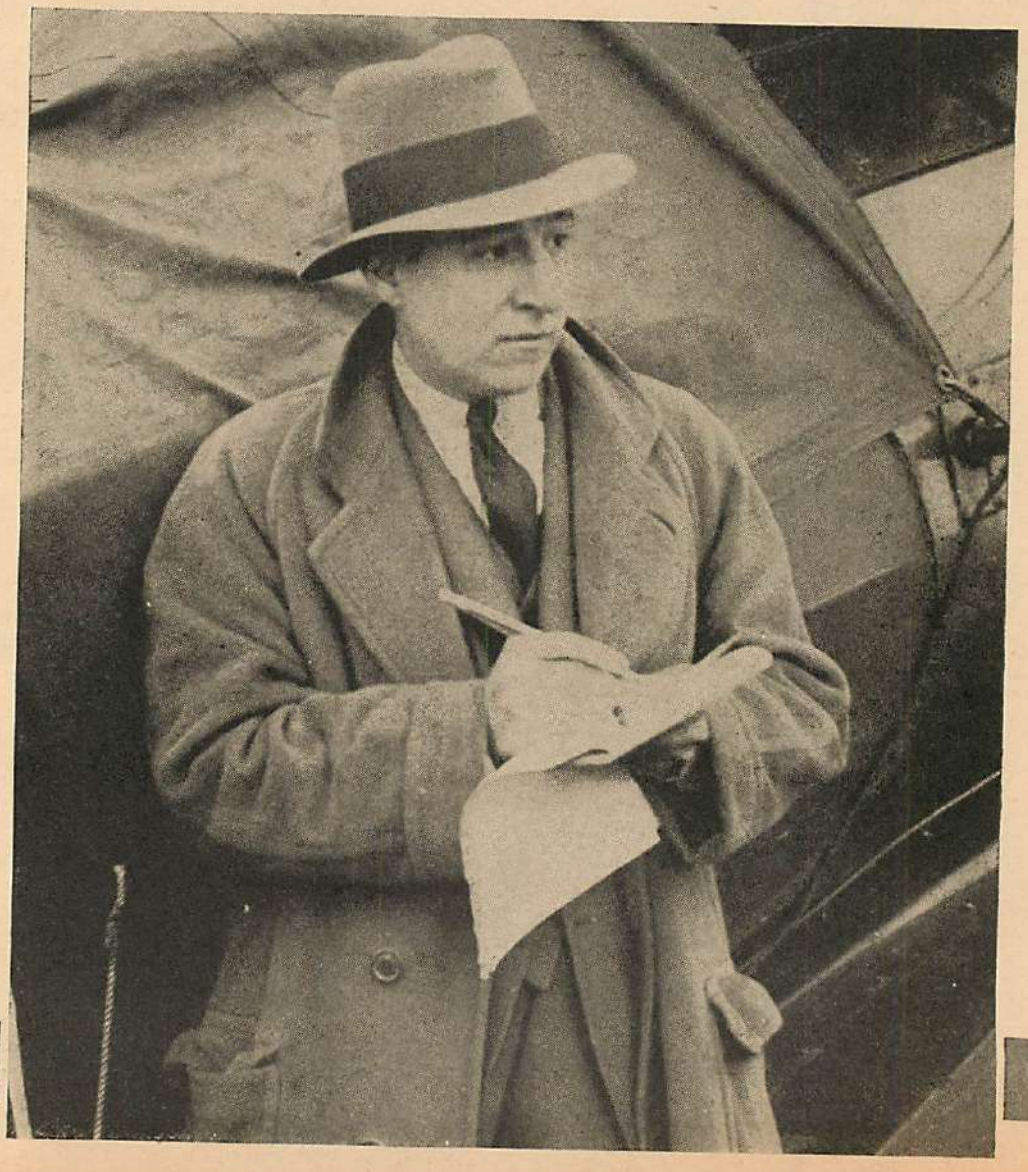
THE WORLD WAR was my first introduction to aviation. Flying fascinated me; it still does. A German explosive bullet ended my War flying career but it also proved that there are many and varied ways of being connected with the giant industry besides piloting a plane.

I hope, as does almost every other person who had a real taste of the War, that these United States will never be inveigled into another conflict such as the last one, but I sincerely hope that if such a catastrophe does overtake us and we are forced to fight to preserve our democracy, we will profit from the mistakes we made in that fracas.

Today the world is aëronautically minded. Huge airliners girdle the oceans and continents at speeds that would make Jules Verne blush for shame. Huge bombers, carrying tons of explosives, are destroying cities and killing civilians by the thousands. Nations are rushing madly to build faster and larger ships in ever-increasing numbers, and there is no end in sight. For our own protection we must strive to keep abreast of this undesirable phase of flying, just as we must seek to develop the industrial side.

I am happy that I have been, and am, a part of aviation. I had thought that my part was ended when I discarded my crutches some months after the World War, and then I discovered that as an artist there was a field awaiting me larger than anything I could ever have done as a pilot. Through my work of illustrating for various magazines and books I have kept in intimate contact with the industry. I have watched it grow and expand into the giant it now is.

As the frequent guest of the army, the navy and



Making sketches on the field helps keep Clayton Knight's vivid drawings the very tops in the field of authentic aeronautical illustration.

not for the pilot.

by CLAYTON KNIGHT - Guest Editor

various important manufacturing concerns I have been able to study at first hand the advancement in planes and personnel.

I believe that the average person little realizes the opportunities presented by aviation in addition to piloting. Few people know that for every plane in the air there must be a ground personnel of fifteen. All of us cannot be pilots. With the immense and complicated power plants that now carry the modern airplanes in flight, no pilot is able to service his own plane; expert mechanics are needed. Behind the mechanical forces are the engineers, the designers and manufacturers. Above them are the executives, and scattered in between just about every type of profession imaginable.

No other industry today presents such a field for new ideas. Many of the younger generation, engaged in model building and gliding and soaring, are better informed on things aviation than were most of our engineers at the beginning of the World War. This may well prove our salvation if we ever enter into another conflict. It is on this youth of America that we will have to draw for our pilots, mechanics and others needed to build, service and operate the thousands of combat planes necessary to defend our country.

I recently flew down to the Argentine in a regular commercial plane and I marveled at the mechanical precision with which it was operated. We flew over the ocean, impenetrable jungles and burning plains with equal ease. We flew over the Andes at 26,000 feet, through fog, rain and snow to come to our destination with the certainty of a homing pigeon.

It takes a great deal of time and money to build one of these huge airliners, or their prototype, the bomber of military service. It takes more than a year of training before a pilot is capable of handling one of them. I remembered that during the World War the average life of a combat pilot in the air was forty-eight hours, and the average life of a combat plane in active service was fifty hours. More than ever my trip brought home to me the possibilities of aviation. There are things to be done in aviation that a legless man can do.

Thousands of men are making a good living from aviation who have never been in a plane in their lives. All the thrills are not for the pilot. The mechanics who groom the sky ships take pride in their jobs, for without their skilled help the pilot and ship would be useless. The specialist who designs and builds the airdromes with their thousands of feet of runways must build today in anticipation of tomorrow. The engineer who plans the lighting system that gives a nonglare light to safely guide the landing planes; the radio experts who are constantly striving to perfect their system of communication, to eradicate static and to perfect blind landings—these and hundreds of other positions are open, wide open, and exciting.

My field is painting, but I know that my efforts have not been without some value to aviation, and for that I am thankful. Aviation is an all-embracing business and there is room for most of us, for those who care.

MEET CLAYTON KNIGHT

As Introduced by Tracy Richardson

"On October 5, 1918, I shot down a D.H.9 (British Squadron 206, No. D.560) out of a formation of ten units and forced it to land near Aelbeeke, Belgium. Machine destroyed, pilot wounded, observer unwounded. Signed,

"Auffahrt, Oberlieutenant."

That German flier's report should have ended the War and everything aviation for Clayton Knight, young American pilot attached to the British Observation Squadron 206. It did end his War flying, but it was such happenings as this that impressed themselves so indelibly on his memory and now permit him to portray them with a fidelity possible only to one thoroughly familiar with his subject. This knowledge, tempered with the fires of experience, has placed Clayton Knight at the top of the list as a painter of things aviation.

There has been little idle time in Clayton Knight's life since he was born in Rochester, New York, on March 30, 1891. After completing high school he attended the Rochester Art School. Then he got a job with a lithographic company where they were supposed to teach him art and pay him three dollars per week to start, and they agreed that if he stayed on the job for three years they would pay him a bonus—if he were any good. When his time was up he was earning twelve dollars per week and they paid him his bonus of $350 and offered to raise his salary to fifteen dollars if he would stay and practice the things they had taught him.

With $350 in his pocket? Not Clayton Knight. He tackled the Art Institute of Chicago—because they put out the best catalogue— *(Turn to page 56)*

The new Bell army pursuit ship, powered with a liquid-cooled Allison, gives the pilot something to think about. For one thing, he is sitting over the propeller drive shaft, much as in the Koolhoven 55 pursuit ship. The engine is back in the fuselage, and the automatic cannon fires through the propeller hub itself. Looks as if it should be interesting to see, let alone fly.

★ ★ ★

News from California indicates Stearman-Hammond will soon be back in the aviation game with a new light, low-priced (about $1,800) all-metal pusher, tricycle-geared private plane. The same source of information rumors that it will be of the high-wing, tail-boom type powered with a fifty-horsepower engine of a standard make. It will seem like old times to have a new Stearman-Hammond ship on the market again.

★ ★ ★

We hear that the Boeing Stratoliner is even faster than the YIB-17, which does about 285 miles per hour at correct altitude. The new YIB-17A, with her turbo-superchargers, is one bomber which should deliver the knots, too. We hear figures of 300 and 350 miles per hour at 30,000 feet, which, if true, makes it one of the world's fastest in its class, and gives us reason to look for turbine blowers on a lot of other ships now under construction.

★ ★ ★

Lockheed seems to be going off into a radical field with a new model 27 which is planned as a tail-first, twin-engined transport. This is purely experimental and may never actually appear, but the figures as given are that it has a span of about a hundred feet and will probably be powered with two Twin Cyclones. Preliminary tests seem to predict trouble with the front "wing" or "tail," as you will have it, in stalling. Another "bug" has been that ice formed on this same wing, cracking off and pelting the propellers, which is not too good. Bell, as an aside, also has this same trouble with their Airacuda. It will be interesting to see just how the top-notch engineers of these two companies lick this problem.

★ ★ ★

Vought is presenting a mighty interesting set of twins in the navy's XOS2U-1 and XSO2U-1. The former is a P. & W.-powered midwing with spot-welded dural or possibly Alclad construction, the first time, we believe, such a method has been used. This ship is for either wheels or floats, and is designed particularly as a shipboard catapult model. The XSO2U-1 is very much under cover, however, and we'll have to take another look at it later, when the wraps are off.

★ ★ ★

The new Martin 167 bomber now undergoing tests looks like any other model with the exception of a plexiglass nose and a sharp break in the fuselage belly just aft of the wing for the rear gunner. The span of this model is only sixty feet, and with the slender fuselage it is possible that the predicted speed of 350 miles per hour will be attained.

★ ★ ★

Australia and New Zealand are predicted as strong future markets for the aircraft industry. J. C. Cotton, export sales manager for the Lockheed Aircraft Corp., tells us after a five months' business trip to the land of the kangaroo that "the market for aircraft sales in these two countries offers extensive possibilities." Offering our apologies in advance, may we suggest that possibly the land of the kangaroo will get the jump on other markets in the near future?

★ ★ ★

Air passengers are beginning to get wise to the fact that lower berths are no longer the choice of the seasoned traveler. On the contrary, upper berths have more room, are quieter and generally have a bit of an edge on the lowers. We slept through five landings and take-offs in one a few months ago coming back from the West coast, and we can't sleep on a train even standing still.

★ ★ ★

The Women's National Aeronautical Association of the U. S. A. holds its 1939 National Convention at Salt Lake City, May 26th and 27th, with the purpose of furthering the Amelia Earhart Foundation Fund. This fund, a splendid gesture, will provide study in various aeronautical subjects for deserving individuals selected on the basis of merit from schools throughout the country.

★ ★ ★

California Flyers, with the addition of several new planes, becomes one of the largest civil training squadrons in the country, with a total of fifteen training planes of various types. Up-to-date schools have a job on their hands keeping up with all the latest developments in technique and plant machinery, but have found that this is imperative to acceptance as a modern school.

★ ★ ★

Lockheed has found a new customer in the colonial government of the Netherlands East Indies for their new 212 fighter. This new wagon is a twin-engine all-metal monoplane, with both fixed and flexible guns and bombing facilities. Said customer has signed on the dotted line to the tune of twelve planes and a total of $690,000 worth of planes, spare parts and special equipment.

These particular planes are equipped as military trainers powered with P. & W. engines and have a nonstop cruising radius of nearly five hours.

★ ★ ★

Well, if the great DC-4 has done nothing else for the industry it has certainly given us a lot of interesting and, as usual, groundless rumors, gossip and legends. The latest is that Japan is going to take over DC-4 number two. We hazard a guess that her appropriating of territory has been for the purpose of providing a suitable landing field.

★ ★ ★

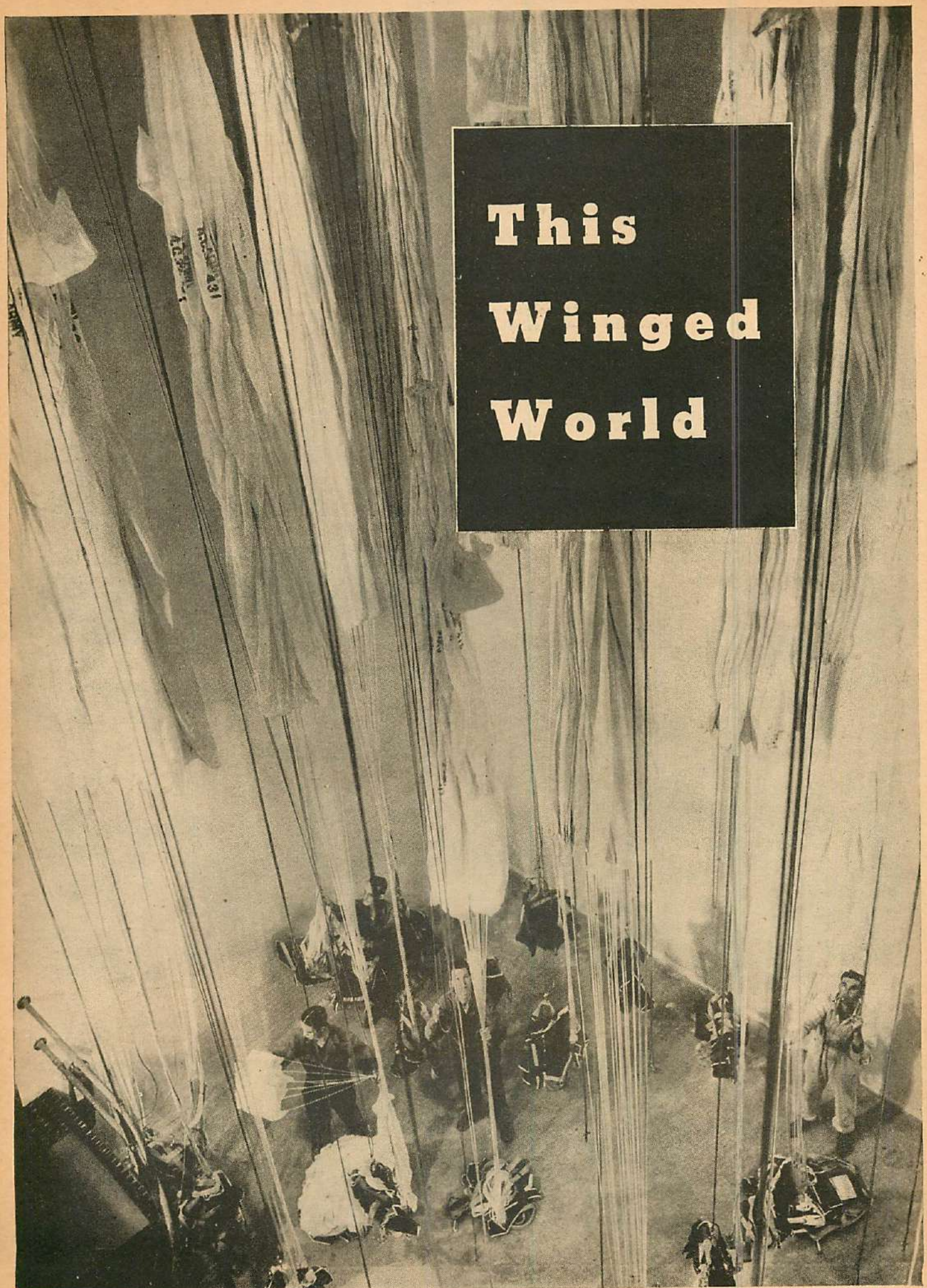
Northrop, in other words the El Segundo branch of Douglas, is turning out many A-17 attack bombers for export, powered with a Wright Cyclone in place of the usual Twin Wasp Junior. Incidentally, one of these new ships sold to Peru is able to reach 35,000 feet with full load, which is really getting up in the world.

★ ★ ★

North American is finishing up her 400 "Harvard" trainers for England. Now why couldn't that name have been "Oxford"? North American is also putting the finishing touches on their new tricycle-landing-geared, twin-engined light bomber supposedly for army competition. This same competition was to have included the ill-fated Douglas bomber that crashed. Another competitor for this juicy contract is the Stearman X-100, which comes in the same category.

(Turn to page 78)

This Winged World



International

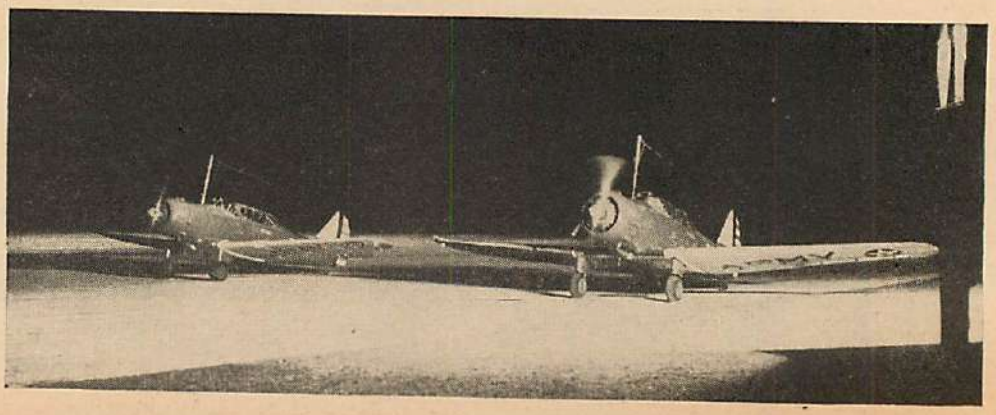
Skyhooks get the air. In the Randolph Field parachute loft the students' 'chutes are aired and inspected every sixty days by a special crew.

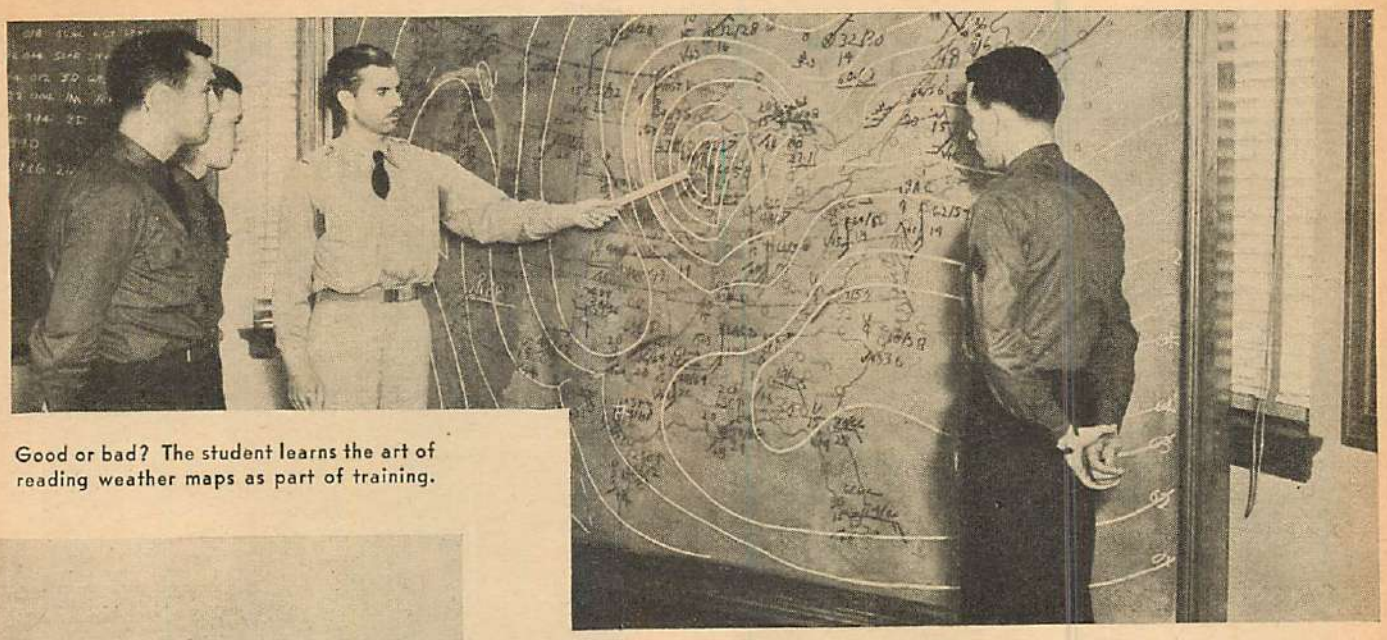
The instructor in the rear cockpit always has the last word, in fact all of them, at Randolph Field. The one-way telephone system enables the instructor to advise the students as to errors.

What you'll do at Randolph

International Photos, compiled by Capt. J. G. Hopkins

Two North American training planes warming up for a night flight for student training in the important subject of night navigation and instrument flying so important to military missions.

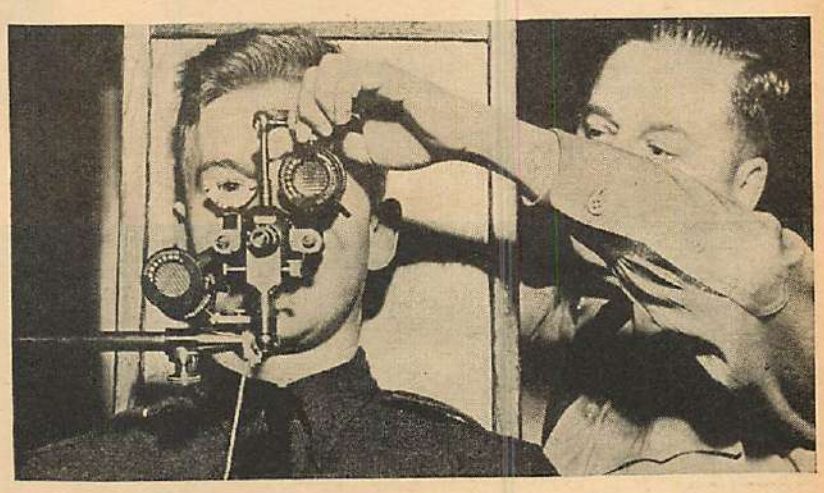




Good or bad? The student learns the art of reading weather maps as part of training.

Randolph Field, the goal of every flying cadet who sets his heart on army flying.

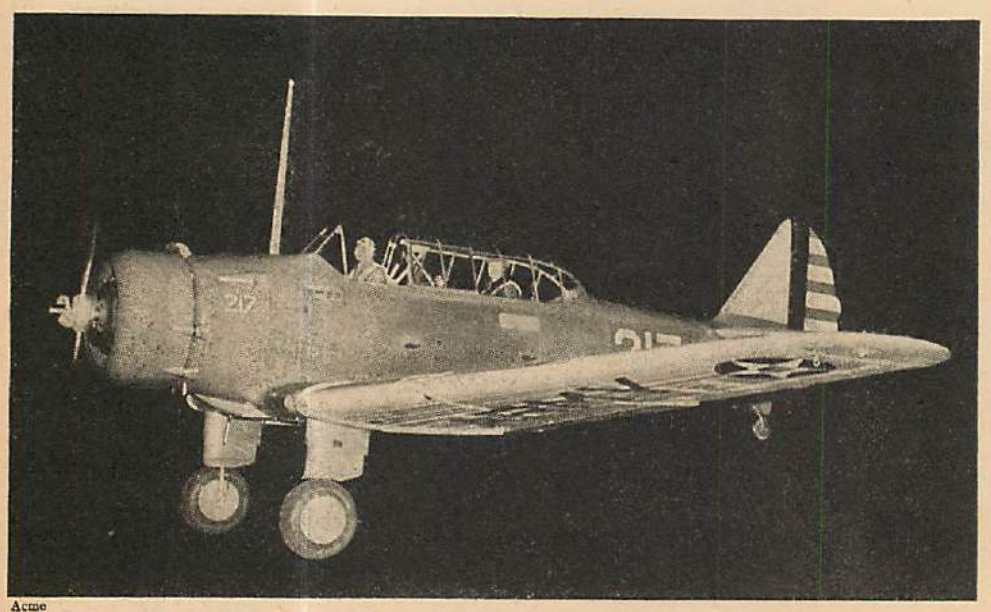
The eyes have it or else—! This all important human organ must check up to rigid requirements and kept at efficiency peak throughout the training.



Radio communication, that ever-vital phase of military flying and mission work, is taught with the aid of buzzer and head sets in groups such as this one.

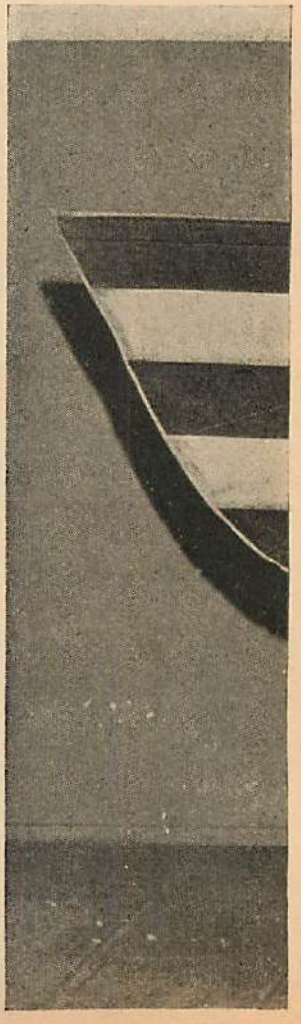
Rudy Arnold
Water watchdog of the seaplane base. "Tiger," who removes driftwood from the New York downtown skyport.

Acme
"Now I lay me—" or its German equivalent might be the thoughts conveyed by this German parachutist's expression.



Acme
Training planes are literally in the spotlight as part of night photo experiments at Randolph Field. This unusual photo was taken with the aid of a photoflash camera in second plane.

Man with wings. Jimmy Goodwin, who designed these wings and leg fin and leaps thus equipped from plane at 10,000 feet, nonchalantly wheeling and soaring till he opens parachute and lands.

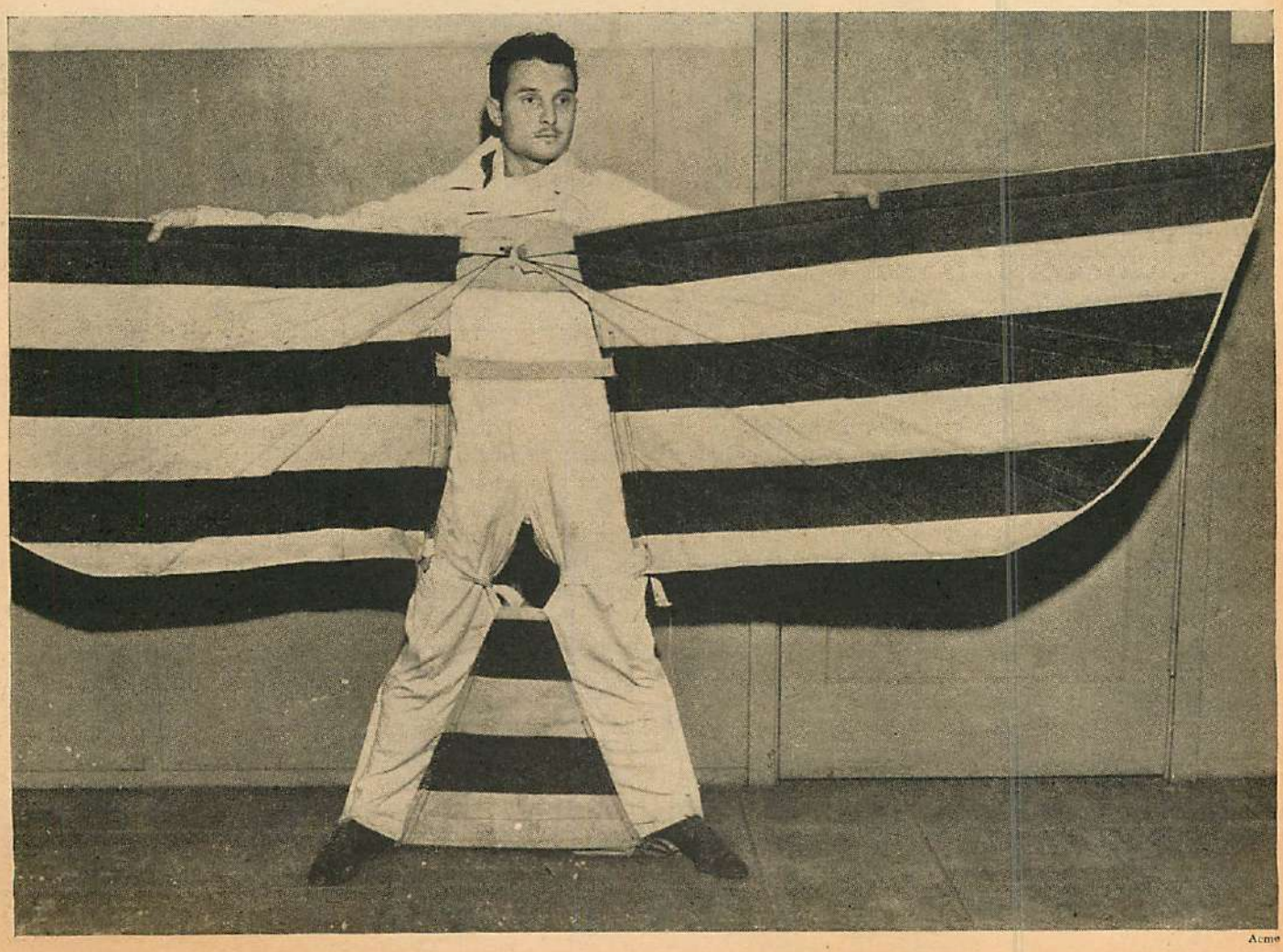


Presenting News Shots of What's Going On in the Air World

Carl Goldberg, famous model airplane designer, takes a look at the Eastern Air Lines demonstration transport.

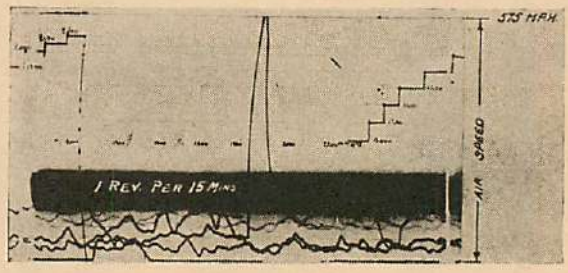
Wide World

What, no Indians? James Donnelly, famous old Indian fighter, takes a ride on a sky pony far above the plains.



Acme

TEST PILOT TEST



Chief Test Pilot H. Lloyd Child climbs into the Curtiss 75A just before its record-breaking 575 m.p.h. terminal-velocity dive. Built for France, the 75A is similar to our P-36A. Right—Photo of the recording airspeed graph showing flight. High peak shows dive.

HIGH up in the sky a tiny dot that is an airplane, hardly visible to the casual eye, the roar of its powerful motor long since dissipated by altitude, hesitates for a moment in its climb, noses over, points its whirling propeller at the earth and races like a comet toward the group of observers on the field below. Though the roar of its motors is lessened by a retarded throttle, it nevertheless begins to make itself heard as the vacuum behind it closes in, and others besides the special group glance up and pause to watch what is commonly considered the most dangerous and certainly is the most spectacular of all test dives, the 9 G.

G is the symbol for gravity and 9 indicates the power to which it is raised. The simple explanation is that during the terminal velocity dive—more often referred to in the trade as the "zero lift" because there is next to no lift exerted on the wings during the dive—when the airplane attains approximately a speed of 500 miles per hour, in the subsequent pull-out, a force is exerted on the plane and the test pilot flying it which is nine times greater than the normal pull of gravity.

A movie camera equipped with special telescopic lens, a timing attachment that automatically registers the time of each section of exposed film, and an inclinometer that tells the angle at which the plane is diving, grinds away, recording every movement and flutter of the speeding ship, just in case something goes wrong and the test pilot might not be able to tell about it.

Another camera is installed in the cockpit of the plane and automatically photographs every movement of the instruments on the instrument board. These films are used as an added record to check against the findings of the test pilot. Cameras are not used on all tests; the navy has done more in this direction than any other

by TRACY RICHARDSON

Untested airplanes are not flown and dived until they fall to pieces. Pilots and planes are too expensive. Here is how it is really done.

purchaser of aircraft. Attempts to follow the diving or spinning plane and photograph it from a following ship have not worked out successfully.

The department of commerce requires that all test pilots wear parachutes, but it is a moot question whether or not a pilot would be able to separate himself from a plane during a terminal velocity dive. It is generally believed that if the plane goes to pieces, or for any other reason the pilot finds it necessary to "abandon ship," he would have to wait until the force exerted by the motor had subsided and the ship was traveling at the speed of normal gravity pull.

Nonflying onlookers who happen to see the dive from a distance hold their breath, waiting for the moment when the plane will shed its wings and the pilot go plummeting to earth. But the special group of experts out on the field, with powerful glasses glued to their eyes, are not worrying about the ship going to pieces. It can happen, and has, but they know that nowadays airplanes are tested gradually up to this climax and that the chances are all against any serious accident. Most accidents that happen to test pilots, paradoxically enough, occur on or near the ground.

There's a reason for this and it isn't just luck. The best of all reasons is that the test pilot knows his job. Back of him are several large organizations with respectable sums of money invested in the plane about to be tested, and they exercise every precaution to see that the test pilot is the best obtainable and that he delivers the best he has. Airplanes destroyed during tests mean loss of life, loss of money, loss of confidence and time.

Experiments in testing naval planes have proved that the 9 G test dive was a much greater strain on both ship and pilot than was necessary, and that just as much information was obtained by a dive of 7½ Gs, and that is now the recognized dive test.

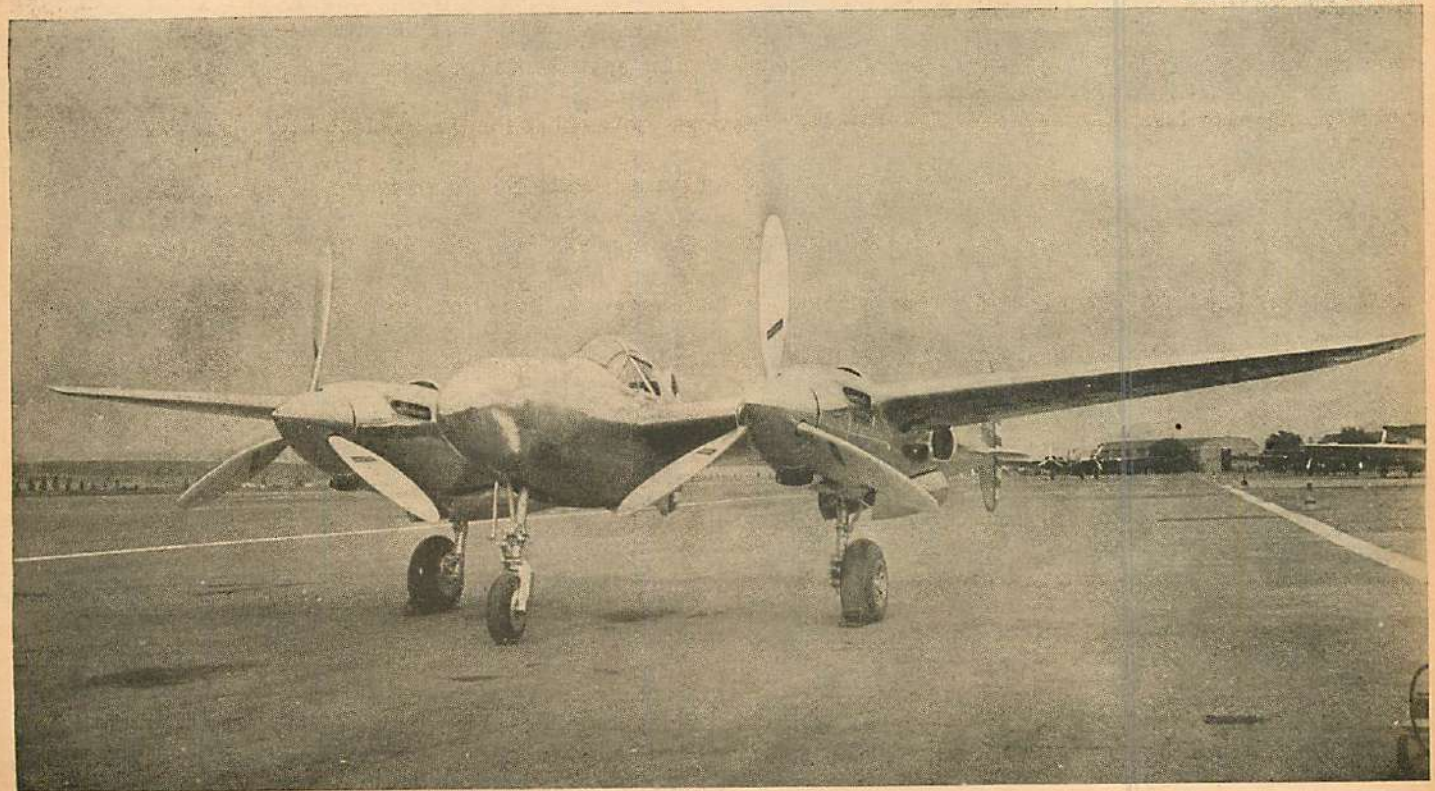
There are 19,782 licensed airplane pilots in the United States today; 32,032 student pilots are under instruction. Of these thousands, 1,126 transport pilots are flying the commercial lines, the most important flying jobs outside the army and navy—and *that's* a matter of opinion—open to pilots.

Of all these fliers there are about a dozen who rate first-class as test pilots, six who are tops, and not one who rates one hundred percent. This does not mean there are no pilots in this country who could not measure up to the highest standard, but to date, for one reason or another, they haven't.

It's a strange profession, this testing of new airplanes. A profession that is not only exciting and dangerous, but monotonous as well. There are long waits between jobs, waits for weather and hours spent in routine inspection and study. It is not a crowded profession, but even so there is hardly enough work to keep them all busy at one time. The rate of pay is high. It varies according to the type of ship to be tested and the requirements of the purchaser. Usually it is a contract price for a completed job, and no one kicks that he does not earn every cent paid him.

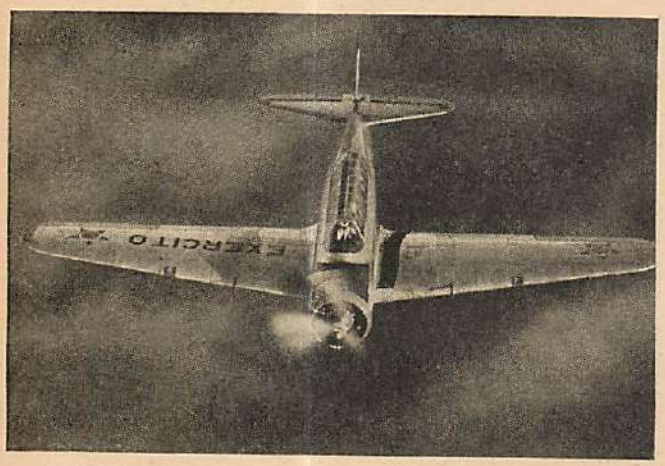
Oddly enough it is the insurance companies who are

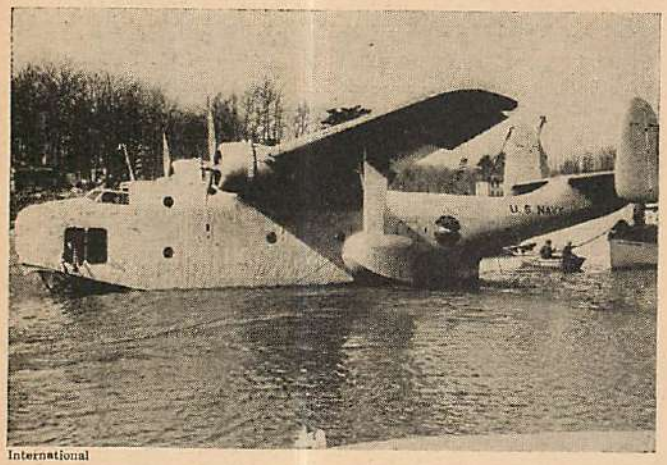
Official Photo, U. S. Army Air Corps.



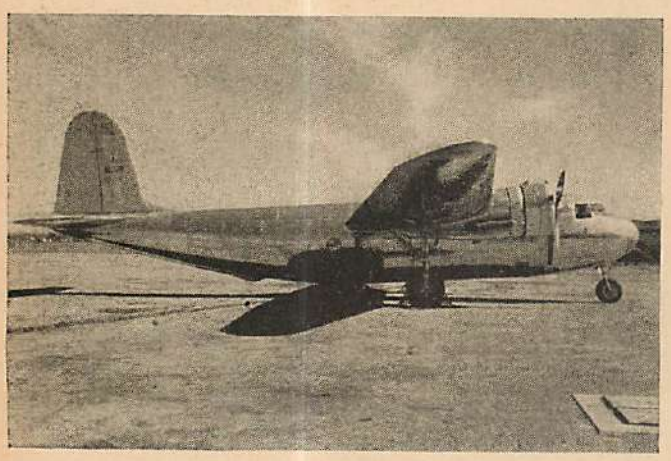
The Lockheed XP-38 created the biggest sensation of the year when it suddenly burst into print by nearly equaling Howard Hughes' record across country. The ship is single-place, powered with two Allisons. The opposed propeller installation is interesting.

TEST PILOT TEST





International



Top—The ultimate in striking power is the Vultee attack-bomber. Vultees are popular as export models. One shown is for Brazil.

Middle—Glenn Martin's latest is this 18-ton, 7-place patrol-bomber. Design was first tested as a man-carrying scale model.

Above—The 16-passenger DC-5, recently flight-tested by Carl Cover, Douglas' senior vice president. Top speed is 248 m.p.h.

the final arbitrators of the fate of a test pilot. If they turn thumbs down on a pilot they will not insure any plane he tests, and so, indirectly, with their system of checking and cross-checking, they are one of the greatest factors for safe flying. The designer, the manufacturer and the test pilot might be willing to take chances, but the insurance people play percentages, and there's no edge to a test job with an unqualified or physically unfit test pilot.

In digging into the life of a test pilot we find that he has to be good morally. The insurance companies are firm believers in the aphorism that liquor, night-club life and such and airplanes do not mix and pay a profit. Likewise by their close supervision they take a lot of the glamour from the romantic stories that have been built up in fiction and the motion pictures.

Contrary to general opinion, airplanes are not taken into the air and flown and dived until they fall to pieces. It would probably be the end of the pilot and nothing material would be gained from the manufacturer's point of view.

The first plane of any new type is always expensive, costing many times the amount of the same plane after it has been proven and gone into production. There are expensive engineering problems to be figured out and months and even years are sometimes spent over the drafting board. Scale models are built and tested until they *think* their figures are perfect; then they build the first plane. New jigs are designed and built for certain parts, but a great deal of the work has to be done by hand. Before the plane ever leaves the ground it has to undergo every known stress test that can be worked out on the ground. The plane is loaded in every conceivable manner, and delicate instruments record the findings. Wings, fuselage, undercarriage, everything is thoroughly tested to see what load the plane will stand before it is ever flown.

From wind-tunnel tests the engineers are able to figure out the performance they can expect from the plane in the air, given certain atmospheric conditions and motor performance. So important have these wind-tunnel findings proven that the government now maintains one at Langley Field large enough to test any completed type of plane used by the government. But all they can do is build the plane and test it to the best of their ability on the ground. Then they must turn it over to the test pilot who takes it aloft to see if their figures are right, to find out whether or not they have an airplane or just another busted dream, no matter how carefully conceived.

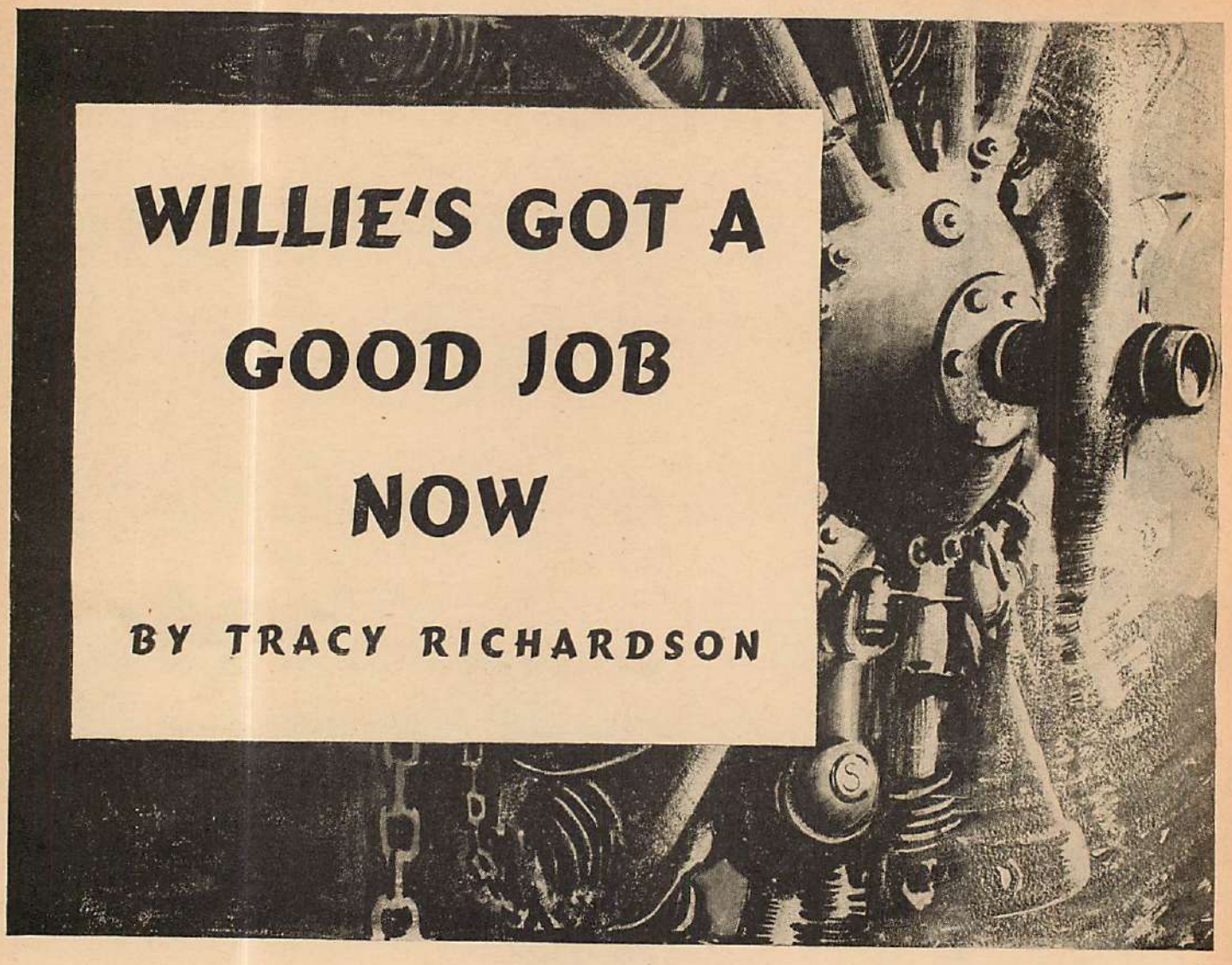
When figuring rates on insuring a test job, the first thing the insurance people take into consideration is the engineering experience and demonstrated ability of the plane's designer. The work of an engineer of proven ability automatically is charged lower insurance rates, while the product of an unknown would be rated proportionately higher.

Their second most important consideration is the requirements of the purchaser. Commercial and military requirements differ widely; so do their insurance rates.

Third consideration in arriving at the insurance rates is the test pilot chosen for the job, and here they really go to town. Every testing job is a "special," with no two alike. Likewise, no two test pilots are cast from the same mold, and some of them have phobias. One top-notcher will not do a 7½ G dive. There's another who rates with the best of them but will *(Turn to page 57)*

A HITLER TRUMP

High above the clouds the pilot poses one of the famous Messerschmitt Bf-109 fighters. The 950 h.p. Daimler-Benz-powered version has flown 379 m.p.h., but has a range of only 373 miles. Entire trailing edge is hinged, the inner portions as camber-changing flaps, the outer sections as ailerons. Handley-Page automatic slots are fitted to the leading edges. The Bf-109 is noted particularly for its high rate of climb, an important factor in intercepting invading bombers. The ship in the photo is camouflaged.



WILLIE'S GOT A GOOD JOB NOW

BY TRACY RICHARDSON

THE softest job in the army, that's mine. All I got to do is stick around and watch Joe Tanner work. And then I go home with him and after we eat I stick around and watch him read or maybe write letters. And then we go to bed, and in the morning we get up and do the same thing all over again. It's nuts, but I like it. We get better grub than even the army chow, and none of the officers' quarters I've ever seen are nicer than Jo Tanner's apartment. Joe's a pretty swell guy himself; that is, when we're alone, but once let him get his hands on his tools and working on one of them big airplane engines teaching a bunch of mugs how to take 'em apart and put 'em together again and he's as screwy as a leatherneck.

This job's got bunk fatigue beat all hollow, and if I could just get Joe Tanner interested in fishing it would be perfect. But Joe don't think of nothing except his motors, and he's always kicking and making a lot of noise because he can't go any higher because he ain't got a college education. But boy, is he a mechanic! Sometimes when the big shots out in the experimental department get stuck they come over to the classroom and ask Joe what it's all about, and sometimes he tells 'em, and then again he goes over to the experimental shop and puts his finger on the cause of their trouble.

I see all these things because it's my job. That job is to take orders from Joe Tanner and keep quiet. The colonel of our regiment told me to do anything Joe told me to. "Corporal Dunn," he says—Willie Dunn, that's me—"you're the champion pistol shot of the army and you don't talk too much. You report to Joe Tanner at the Amalgamated Motors works and take orders from him. You keep your mouth shut, and if he tells you to shoot anyone, you go ahead and shoot him—that's how far you can go, and almost before you know it you'll be a sergeant."

But this Joe Tanner didn't ask me to shoot anyone. He did ask me to show him how to shoot, and when I took the little pistol gun they had given me and made ten bulls at fifty feet in about six seconds he just shook his head and said he guessed it didn't matter whether he could shoot or not. I wasn't proud of that shooting, for it was too slow and the target too close, but then I hadn't had much chance to practice with the new pistol gun, and it was too small for my hand, anyway. Now if I'd just had my regulation .45 I'd have shown him some shooting.

About all I know about motors is what I learned on the farm down in Missouri before I joined the army. Dad had two tractors and a couple of flivver trucks, and I knew how to keep them running, and Joe Tanner says that's enough to make a mechanic out of even a marine, maybe. Anyhow, I stick around the motor school, being shadow to Joe Tanner, and pretty soon I knew the names and uses for every tool he'd ask for. I'd liked to have helped him work on the motors, but he just gives me a sort of crazy grin and tells me to keep my hands clean, and to prove that he was serious about it, one day when he saw me with oil on my hands he made me go wash it off with gasoline and raised Cain with me for being dirty.

And them wise guys that Joe Tanner is teaching to be engine experts so they can go out all over the world and service the motors made by Amalgamated Motors used to laugh at me and call me

Five minutes later Joe Tanner lets out a yell for 'em to stop the motor—but it was too late—everyone ducked for cover—

Joe's stooge. I'd just look at 'em, and every time one of them would ask me a question I'd say "Huh?" or "Naw," and then when we'd get home at night Joe Tanner'd take out a pencil and paper and ask me to repeat every question every one of the students had asked me during the day. At first I wasn't so good at remembering, but when you get a persistent guy like Joe Tanner after you you soon get to remember a lot of things you never thought of before.

That's how I happened to remember that one of the student mechanics had asked me how they were getting along with the new motors they were running on the test blocks in the experimental shop. Those motors were a great secret. They were not much bigger than the TE9s that developed fifteen hundred horsepower, but the new ones were supposed to develop three thousand for a take-off and two thousand for cruising. They were *supposed* to, that was the trouble. They worked out perfectly in the shops, but every time they were put on the test block and run up the bearings burned out like they were made of beeswax.

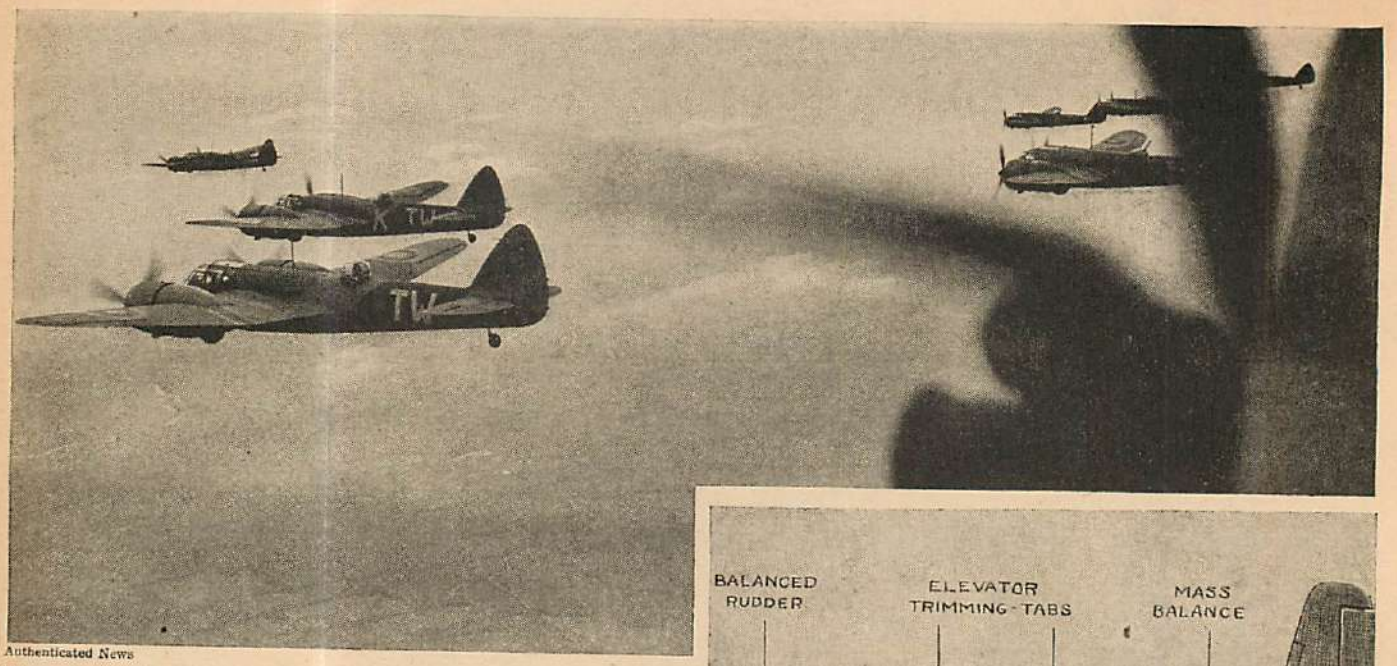
We were working in the classroom one day—that is, Joe Tanner was working and I was keeping my hands clean, when the chief of the experimental bureau came in and told Joe they were going to make a test run and did he want to see it. They didn't want to let me in at first, but Joe told them I was his left hand trying to find out what his right hand was doing, so they laughed and said O. K. So they start up the motor, and five minutes later Joe Tanner lets out a yell for 'em to stop it, but it was too late. The pistons began to kick holes through the sides of the cylinders, and everyone ducked for cover. Joe Tanner told the chief to let him know what he found, for he had to go back and teach some young squirts how to be mechanics.

That's when this student, Johnson, started asking me questions about how they was getting along with the new motors, and I said, "Huh?" and he grinned a dirty grin and said he guessed things were going all right from the looks of things.

Everyone seemed to know something was wrong with the new experimental motors, but no one knew what it was. Rumors were flying around about this and that being wrong. Some of them blamed foreign spies and others claimed to know that something was wrong with the bearing metal. There was dirty work at the crossroads, all right, but there was a lot of guesswork, too. I saw Joe Tanner scratching his head and heard him talking to himself, only he pretended he was talking to me, but I know he didn't know I was in the place. I heard him say, "The cylinders got hot before the bearings burned out."

I just happened to see this Johnson at the time, and I didn't like the look he gave Joe Tanner while Joe's talking to himself. This Johnson's been working for Amalgamated Motors for a long time, and as soon as he completed this course he'd be sent out as an expert to service Amalgamated Motors all over the world, so he must have been all right. I didn't think more about the incident until Joe Tanner started asking questions that night. He sure gave me the the third degree, all right, and when he finished he said, "Willie, if you knew what to look for I think you'd see a lot."

That night some of the company engineers brought reports to Joe Tanner's apartment, and I *(Turn to page 80)*



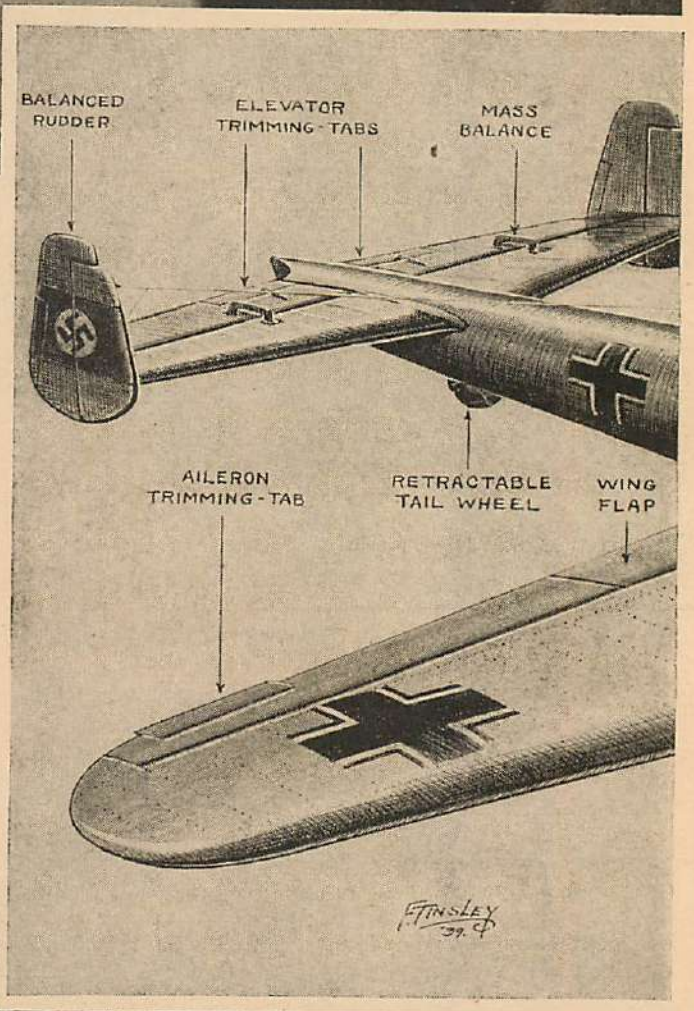
Authenticated News

These British Bristol Blenheims are claimed to be fastest in their class. The latest version does 295 m.p.h.; range 1,125 miles.

medium bombers

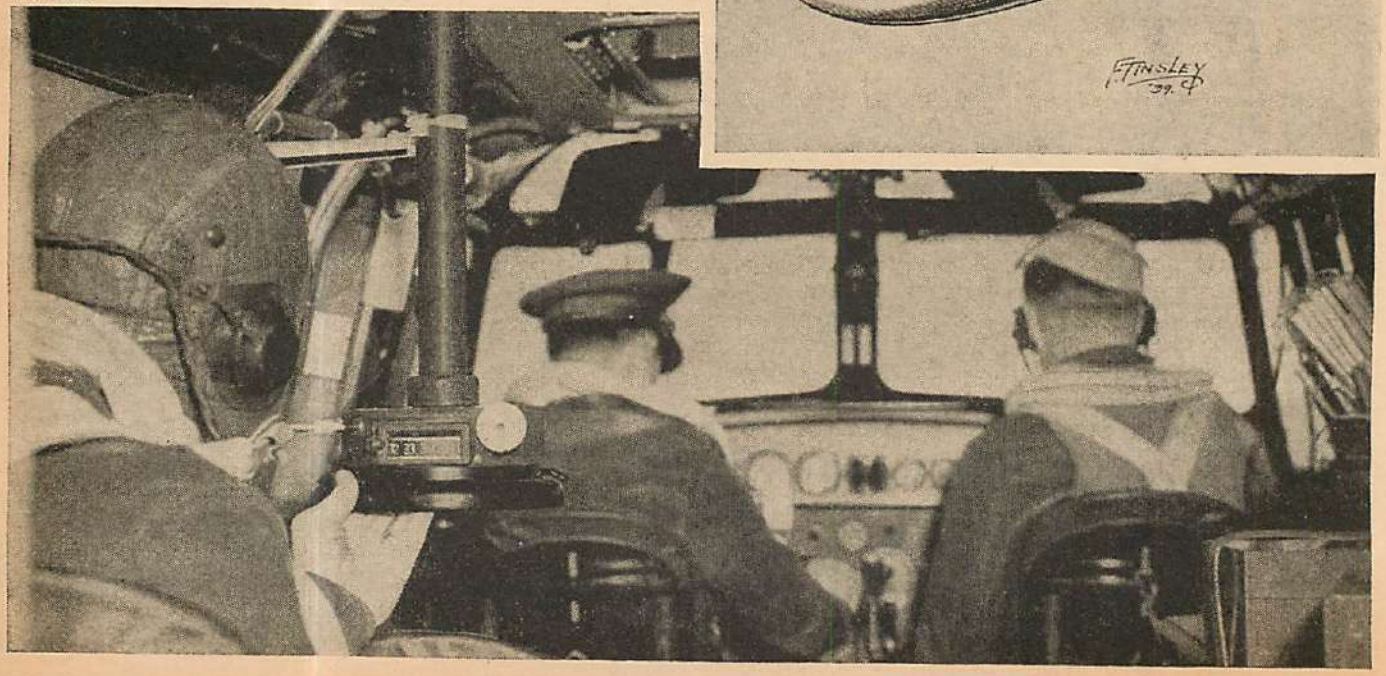
THE WORLD REARMS - Part II

About the swift deadly ships that are the backbone of an air force.



Inside a Douglas bomber. Navigator is turning control for rotating loop antenna outside fuselage. The army has ordered 250.

Rudy Arnold



by FRANK TINSLEY

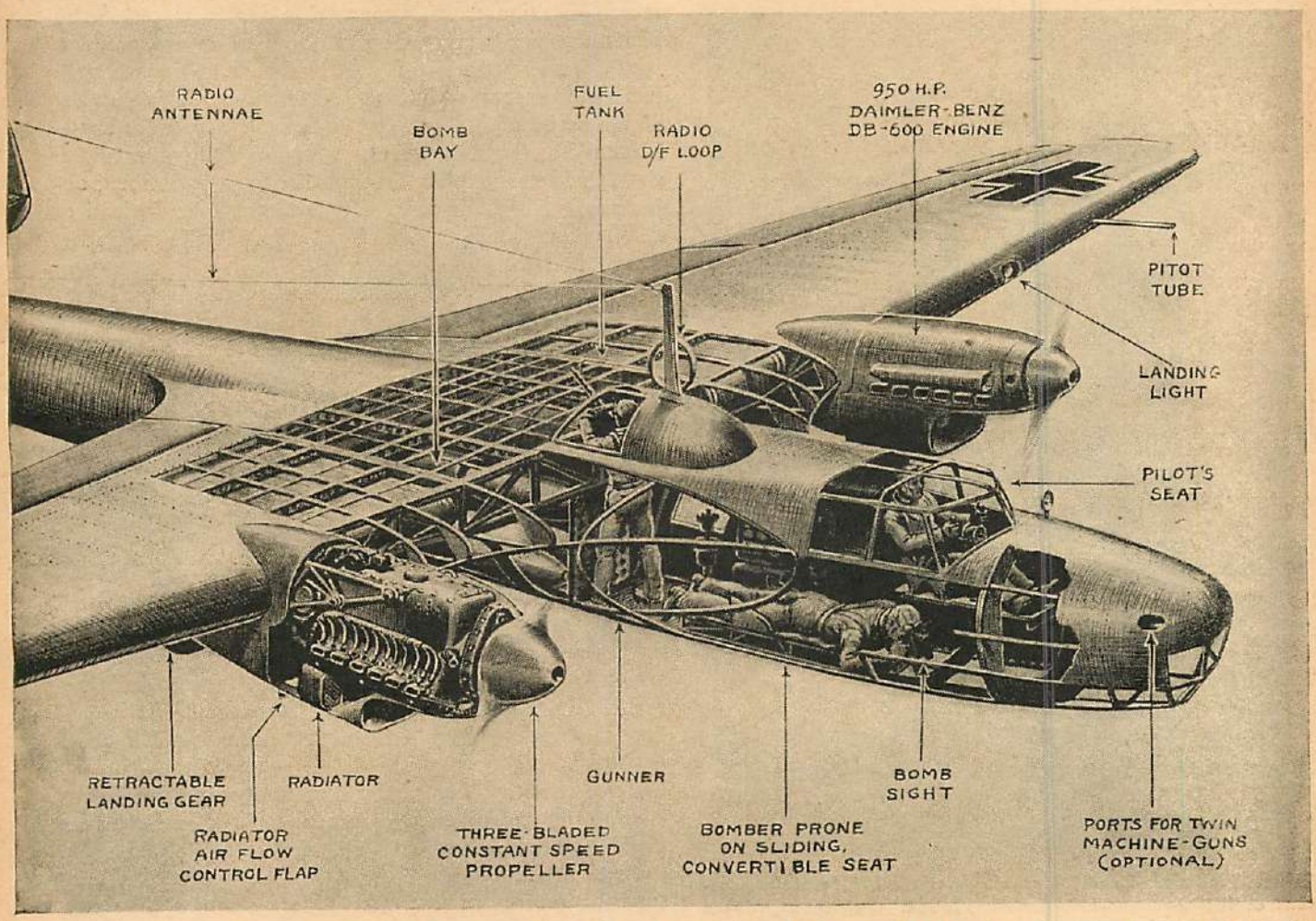
The medium-size bomber can be fairly called the infantryman of the sky. Like the humble foot soldier in the mud below, the bomber slogs back and forth through the clouds carrying out the humdrum, daily missions that go to make up the bulk of aërial operations.

Even as the infantry, bearing the proud title "Queen of Battles," is called the heart of an army, so the medium bomber is the backbone and strength of military aviation. It holds the post of honor and danger in the center of the aërial firing line, midway between the light, single-engine attack bomber and the heavy, multi-engine flying dreadnaught. The medium type has evolved into a more or less standardized design of high performance and great efficiency. It is usually a bimotored, cantilever monoplane, flown by a crew of from three to five men and is capable of carrying in the neighborhood of a ton of bombs at high speed for a distance of nearly 2,000 miles.

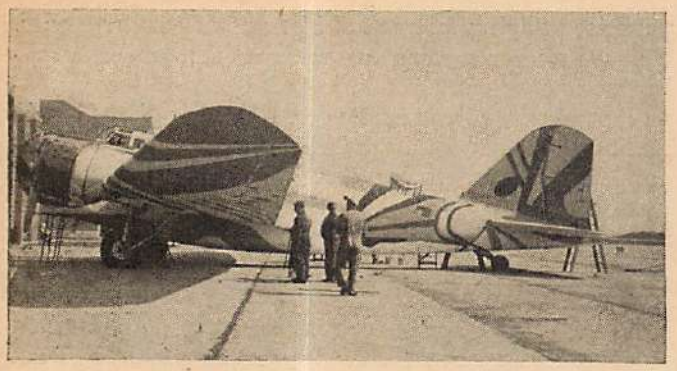
Like battalions of infantry, the medium bomber squadrons outnumber the light and heavy groups ten to one. In certain air forces, notably the Italian, no really heavy bombing planes are used at all. In most of the others, the preponderance of expert opinion leans toward the medium type. A similar policy is said to have been adopted by our own G. H. Q. air force and would seem to foreshadow the eventual abandonment of the highly publicized "flying fortresses" in favor of smaller planes. This is based on a common-sense aversion toward carrying too many eggs (no pun intended) in too few expensive baskets. The medium-sized bomber is relatively much cheaper and easier to build. Moreover, our transport factories are tooled and organized for the rapid production of planes of this size, a matter of no small importance in view of our rearmament plans.

The mention of rearmament, with its corollary of mass building, brings up a pertinent question. How do we stand with regard to the efficiency of our present medium types as compared to the other great air powers? I am afraid the answer must be "just so-so." On the basis of speed, Germany, England and Italy have the edge on us, on the basis of load we have a slight edge on England, break about even with Germany and France and are probably behind Italy. On the basis of range, we are well ahead of France and Germany, shade England and are again beaten by Il Duce's ships. Add to this the fact that all the foreign ships upon which this comparison is based are powered with from 100 to 240 less horses than our American types. Not so good, eh?

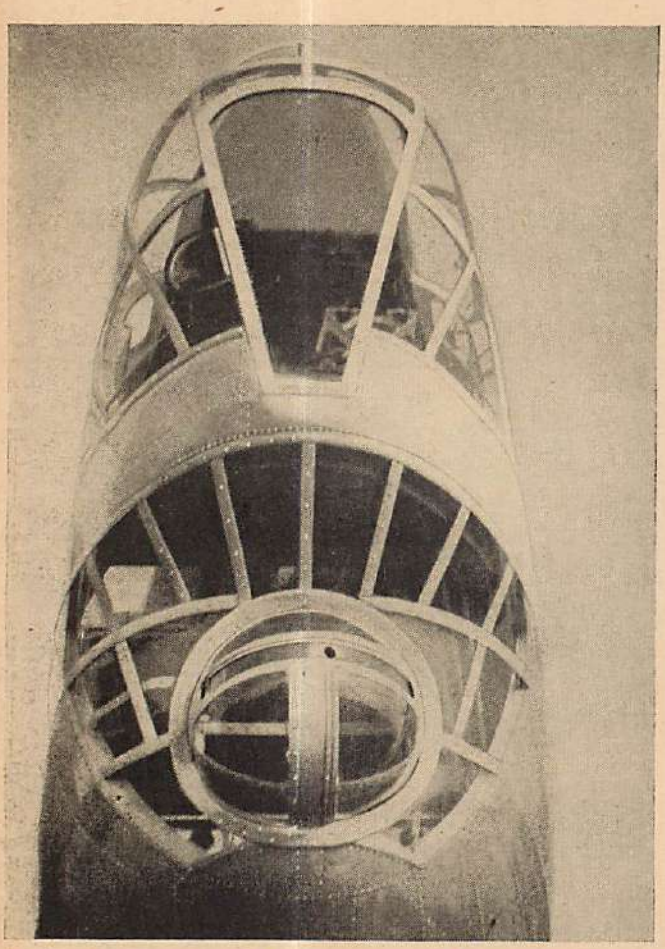
Probably the best known and most efficient of England's medium bombers is the Bristol Blenheim. This speedy, low-wing monoplane is powered with a pair of Bristol Mercury air-cooled radials, each developing 930 horsepower for take-off. It hits a top speed of 285 miles per hour and is probably the fastest medium



The Dornier D-17 "Flying Pencil," as shown here, does 260 m.p.h. Newer models are said to boost the top speed to over 300 m.p.h.



An army Douglas B-18 bedecked in camouflage. The peculiar rear gun turret is designed to retract in flight flush with the fuselage top. The B-18s and B-18As are most numerous of our bombers.



This startling close-up of the nose of a new B-18A reveals the details of the novel machine-gun installation. Service experience with the older B-18s probably dictated the new nose design.

The French Amiot compares favorably with anything in its class. The commercial equivalent flown by Rossi did 295 m.p.h. at 13,120 feet. Span is 82 feet. Military version is improved.

medium bombers

bomber *now* in service in any quantity. It carries a useful load of 4,621 pounds and is armed with two machine guns. It can reach 27,280 feet altitude and has a range of 1,125 miles. A new model now being produced is fitted with a redesigned nose said to improve bombing facilities. This "long-nosed" version raises the maxium speed to 295 miles per hour and has extra fuel tanks in the wings which extend its range to 1,900 miles.

France is starting quantity production on a number of fast, new, beautifully streamlined medium bombers. Prominent among them are the Potez 63, which has such high performance that it doubles in brass as a fighter, the L. E. O. 46 and the Amiot 350, a development of Rossi's record-breaking, long-distance ship that was capable of 295 miles per hour. One of the best of the medium bombers now in service is the Bloch 131. Powered with two 880-horsepower Gnome-Rhone engines, this ship has a high speed of 248.4 miles per hour. Its range is low—930 miles. This, however, is undoubtedly due to the short distances involved in probable French bombing objectives. A ceiling of 27,880 feet and a bomb load of 2,200 pounds make the Bloch 131 a formidable contender. Three machine guns are carried.

Adolph Hitler's powerful new air force is well provided with bombers of the medium class. There are three standard-service models at the present time. The Heinkel 111, powered with two 950-horsepower DB-600 liquid-cooled engines, was developed from a commercial model. So was the Junkers 86K, a long-range design fitted with a pair of Jumo Diesels. The Dornier 17, nicknamed the "Flying Pencil," has been in service for over two years. The original Do. 17 was equipped with B. M. W. engines of 750 horsepower. The present machines (see cut-away drawing accompanying this article) are powered with the 950-horsepower inverted DB-600 and give relatively higher performance. The figures generally accepted for this model are: maximum speed 260 miles per hour; ceiling 29,500 feet; maximum range 1,550 miles; bomb load 2,200 pounds. It is said that the newest version does approximately 315 miles per hour.

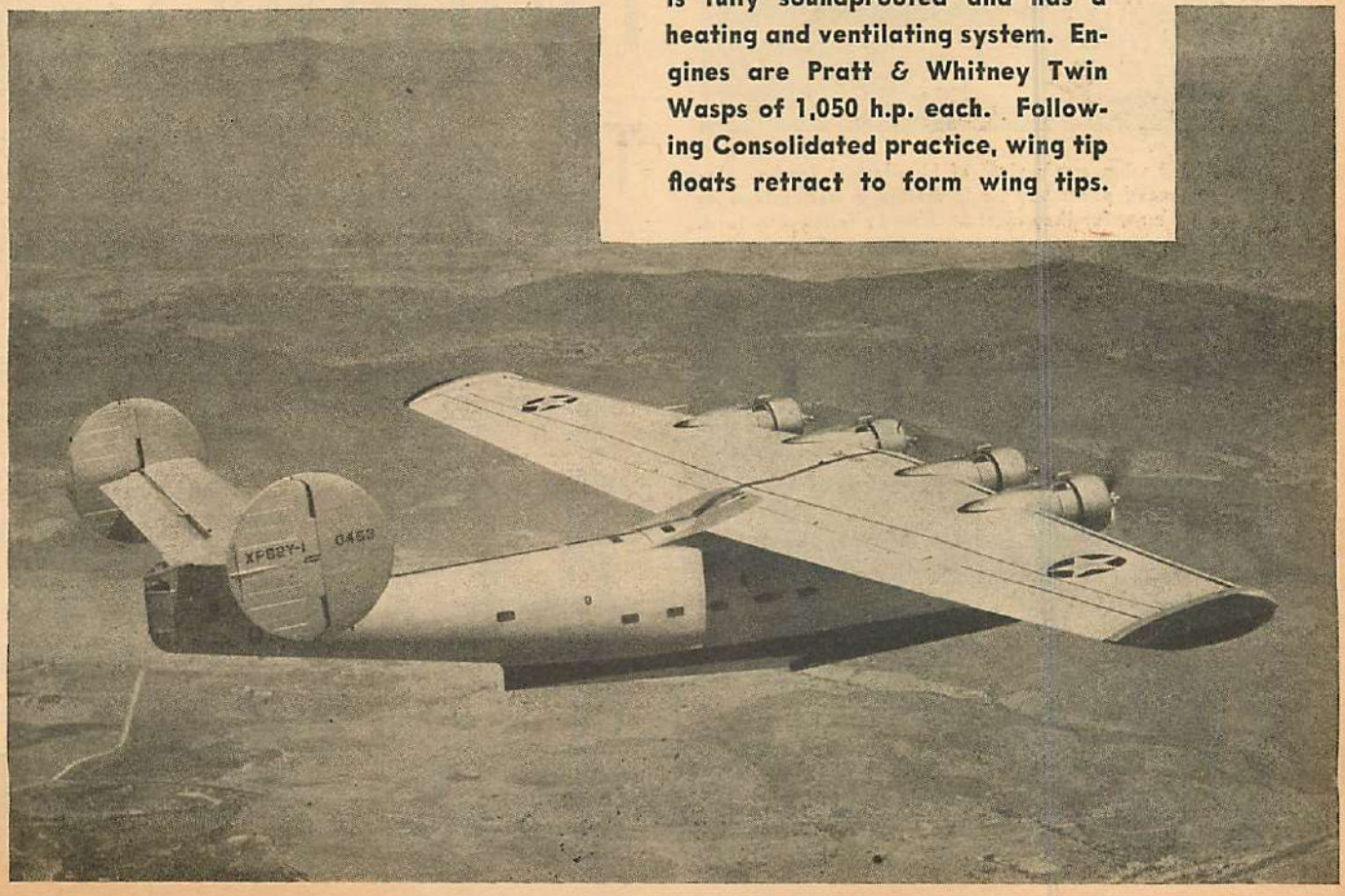
Since the founding of the huge aeronautical research laboratories at Guidonia, great forward strides have been made in Italian aircraft design. Loyalist pilots in Spain seem to agree that the Fascist fighting types have been superior to those of the Nazis. More recently, the attention of Italian designers has been focused upon bombing types with equally good results. The newer Savoia-Marchetti and Breda twin-engine medium bombers are fast, clean and efficient. The latest model of the Caproni 135 is typical of the modern trend. It is an internally braced, center-wing monoplane powered with two Fiat A-80 double-row radials of 1,000 horsepower each. The top speed is said to be in the neighborhood of 290 miles per hour. The Ca. 135 has a ceiling of 26,240 feet and a range of 2,175 miles. It is armed with three machine guns and carries a useful load of 6,325 pounds.

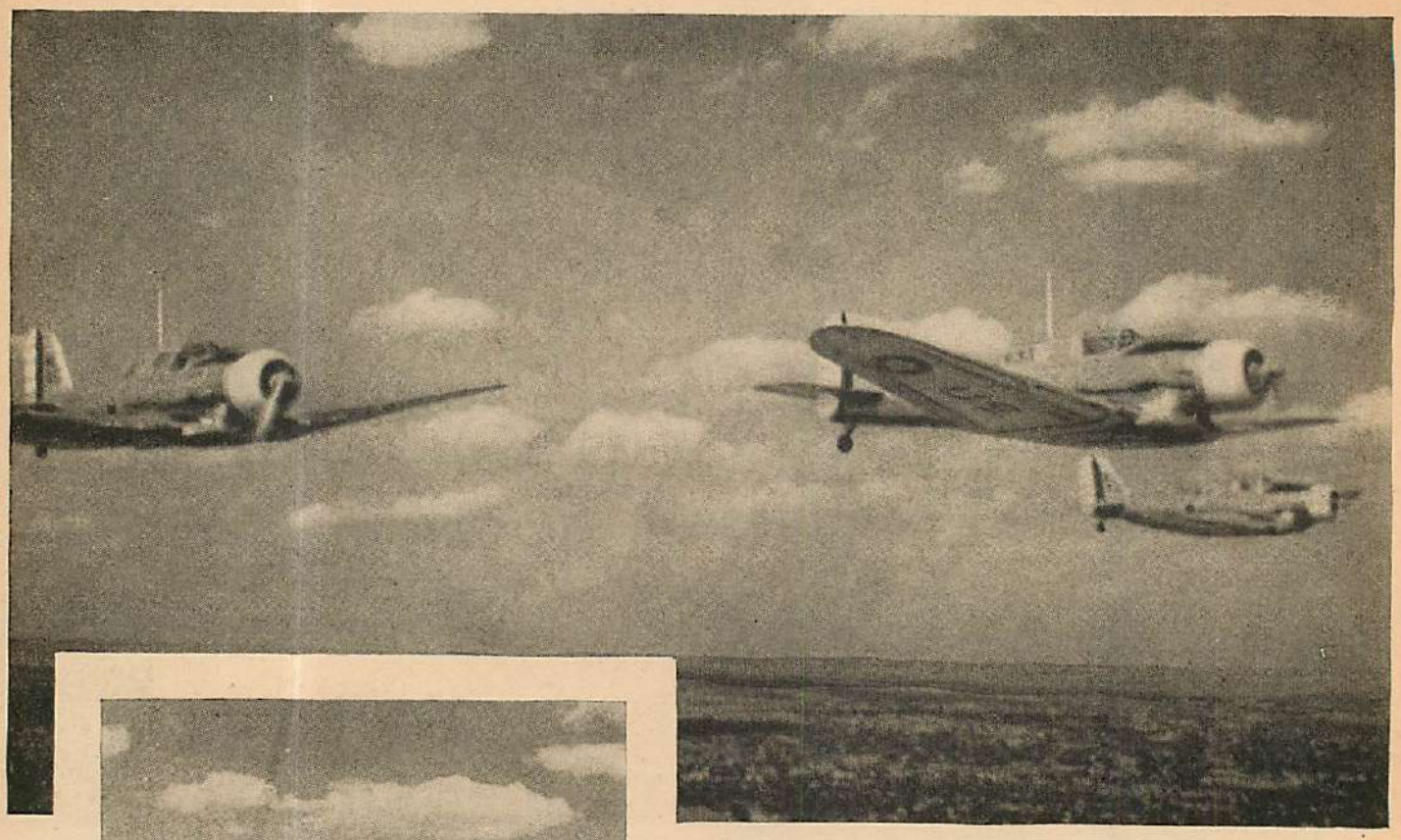
Back in 1932 the Glenn L. Martin Company of Baltimore began manufacturing an entirely new type of bomber for the U. S. army. This was the famous B-10, progenitor of practically all modern medium bombers. The Martin bomber has been constantly refined and improved ever since and several hun- *(Turn to page 56)*

FLYING DREADNAUGHT

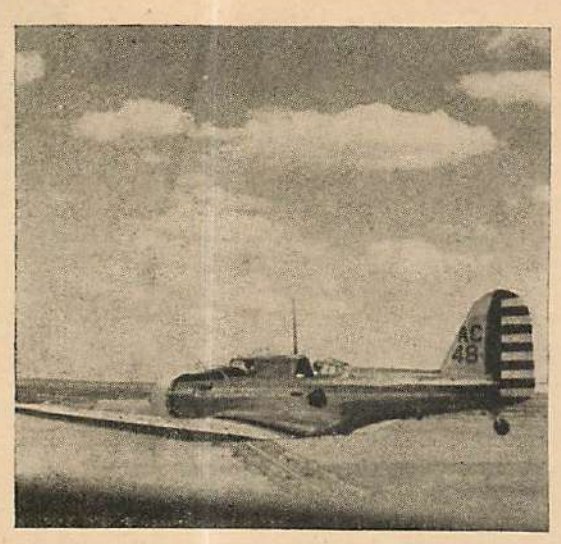
The Navy's newest patrol bomber, the Consolidated XPB2Y-1, recently proved her mettle by making a round-trip, nonstop, transcontinental flight. The formidable XPB2Y-1 is fully soundproofed and has a heating and ventilating system. Engines are Pratt & Whitney Twin Wasps of 1,050 h.p. each. Following Consolidated practice, wing tip floats retract to form wing tips.

Globe Photos

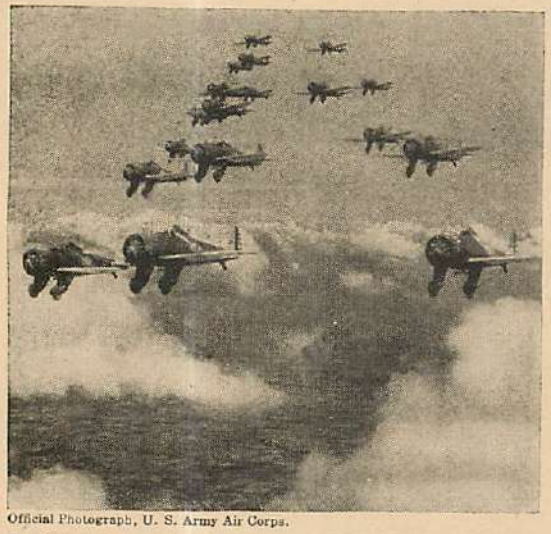




The third element of an attack flight as viewed by a wing man in the second element. Planes are the fast Northrop A-17As.



A left wing man's view of his element leader. Experienced pilots say no formation is better than its wing men, for they must be able to follow any lead.



Official Photograph, U. S. Army Air Corps.

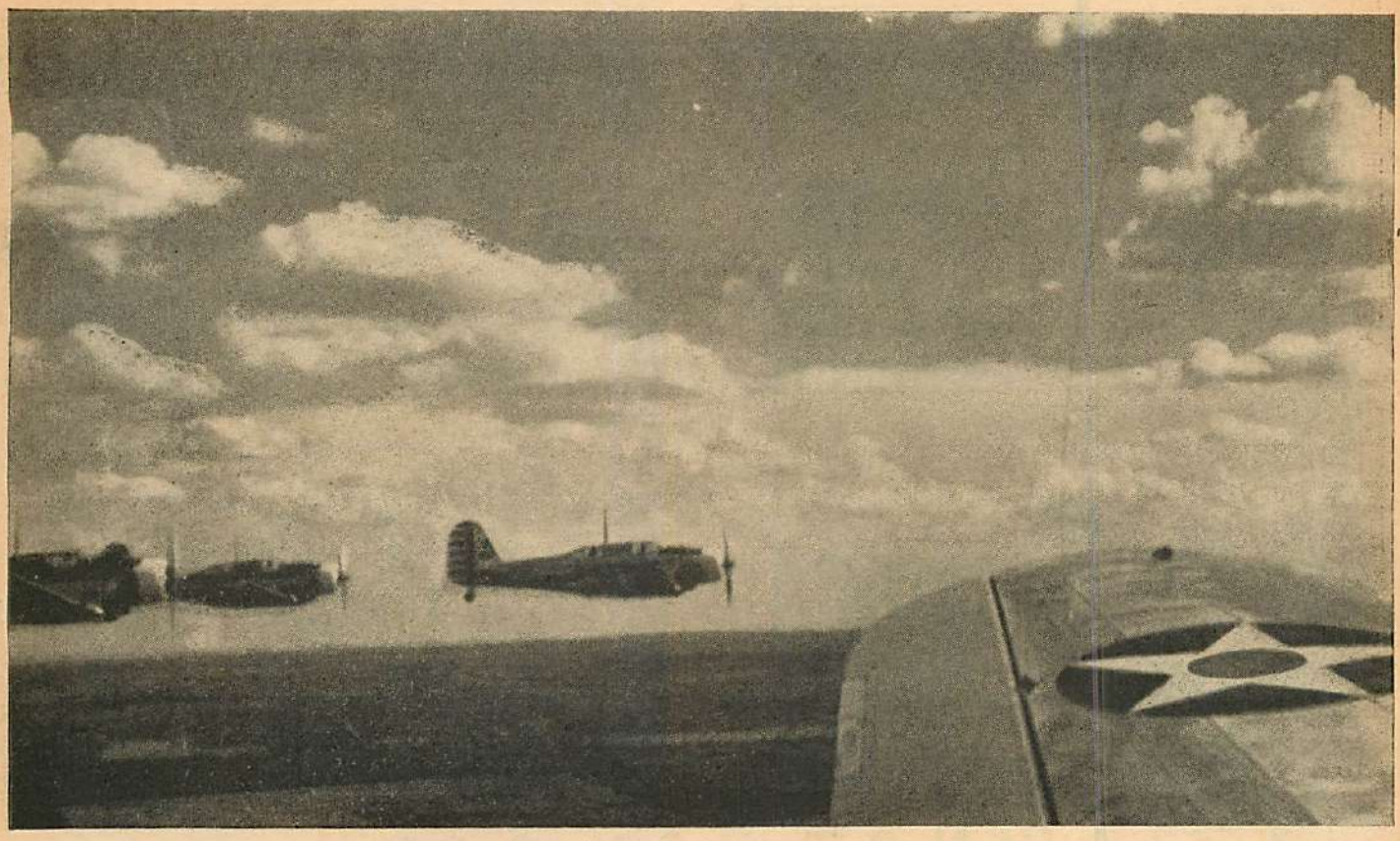
To illustrate one of the formations described these P-26s are shown in an echelon of Vs, or elements. This grouping was evolved through long experience.

FORMATION

THE ability to fly good formation is one of those accomplishments that look easy if you don't know how. The more smoothly and efficiently it is performed the easier it looks, whereas it is actually one of the most absorbing and sometimes the most exciting of all types of flying. Learning it is a much bigger job than learning to fly. Most pilots remember their first solo flight as one of the supreme experiences of their lives. But for those who train at military schools, the first attempts at flying in formation are just as exciting and often a great deal more frightening than the first time up alone.

Formation flying differs from individual flying even more than dodging through heavy traffic differs from breezing along country roads. When any pilot, no matter how experienced, tries formation flying for the first time he feels very much like a hillbilly trying to operate an automobile in the middle of New York City. In fact, he feels worse; for where Uncle Silas could always kill his engine and sit still until he figured out what was expected of him, the formation pilot must do the right thing immediately—or else. While in close formation he is continually on the verge of running into another airplane, and he is supposed to keep himself in just that predicament for an indefinite length of time.

When the plane a few yards ahead turns directly in



Silhouetted against the rising sun the second element of an attack flight climbs into position. To each pilot the other ships in the flight seem to be suspended motionless in the air. The photos of the Northrops were snapped by the author while on duty.

FLYING

An army pilot brings you all the thrills of flying a fighting plane in formation.

by FRANK LAMBERT

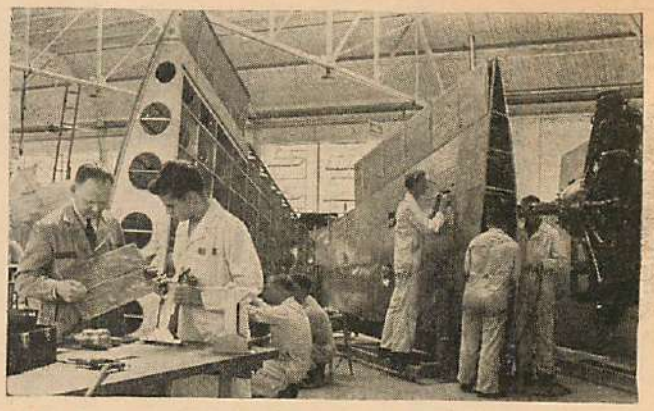
front of him, his strong and healthy instincts make him want to pull away just as fast and as far as possible. But he mustn't, for that would be dodging, and dodging is not formation flying. He must force himself to stay close and train himself to move exactly with the plane ahead. When it turns he must follow suit, either toward it or away from it, but he must never get any closer and—hardest of all in the beginning—he must never get any farther away. The ability to do just that is one of the things that can't be learned by correspondence, and it can't be learned by viewing the other plane from a distance. He must fly so close that the other pilot can see the paleness of his face.

Good formation fliers move in unison just as smoothly and precisely as trained dancers, and rapid maneuvering in formation is actually something like waltzing—without the music. It becomes enjoyable after a while, after the proper motions and reactions become habitual and automatic. But while formation work is something like dancing, it's like dancing with people who wear spiked shoes. One mistake and the dance is over. That's what makes beginners so nervous.

Yet even the beginner, to whom formation flying is something of an ordeal, is often fascinated by it. The first sight of another plane sitting up there beside him, apparently motionless and with no visible support, is like witnessing a miracle. He can feel the firmness of his own plane under him, feel its motion and the beat of the propeller so distinctly that he has come to accept the idea of being supported by the resulting air pressure as quite logical. But this other plane, as he approaches it closely, seems to be just hanging there like something in a dream, not moving toward him or away from him, making no sound that he can hear and apparently not even disturbing the air, its passengers gazing at him blankly as though they were enchanted like the plane. No wonder so many beginners become enchanted themselves, so much that they forget everything they are supposed to do, until they feel the instructor seize the controls and hear him say things that would bring even an insane man back to his senses.

A very large percentage of the flying time of military pilots is spent in formation training and practice. The skill acquired in the first year of intensive flying training is merely elementary. A truly accomplished formation pilot, one who can fly accurate and dependable formation in any position, is the product of no less than hundreds of hours of practice. Some fellows never become really good at it, no matter how much practice they get, and despite the fact that they may be pretty good pilots otherwise. Sometimes they are temperamentally unsuited to doing things in "rhythm," and sometimes *(Turn to page 62)*

Before you begin the actual construction of aircraft, you are taught the all-important phase of designing and draftsmanship.



With the present trend to all-metal aircraft, naturally one of the most completely covered subjects is sheet-metal work.

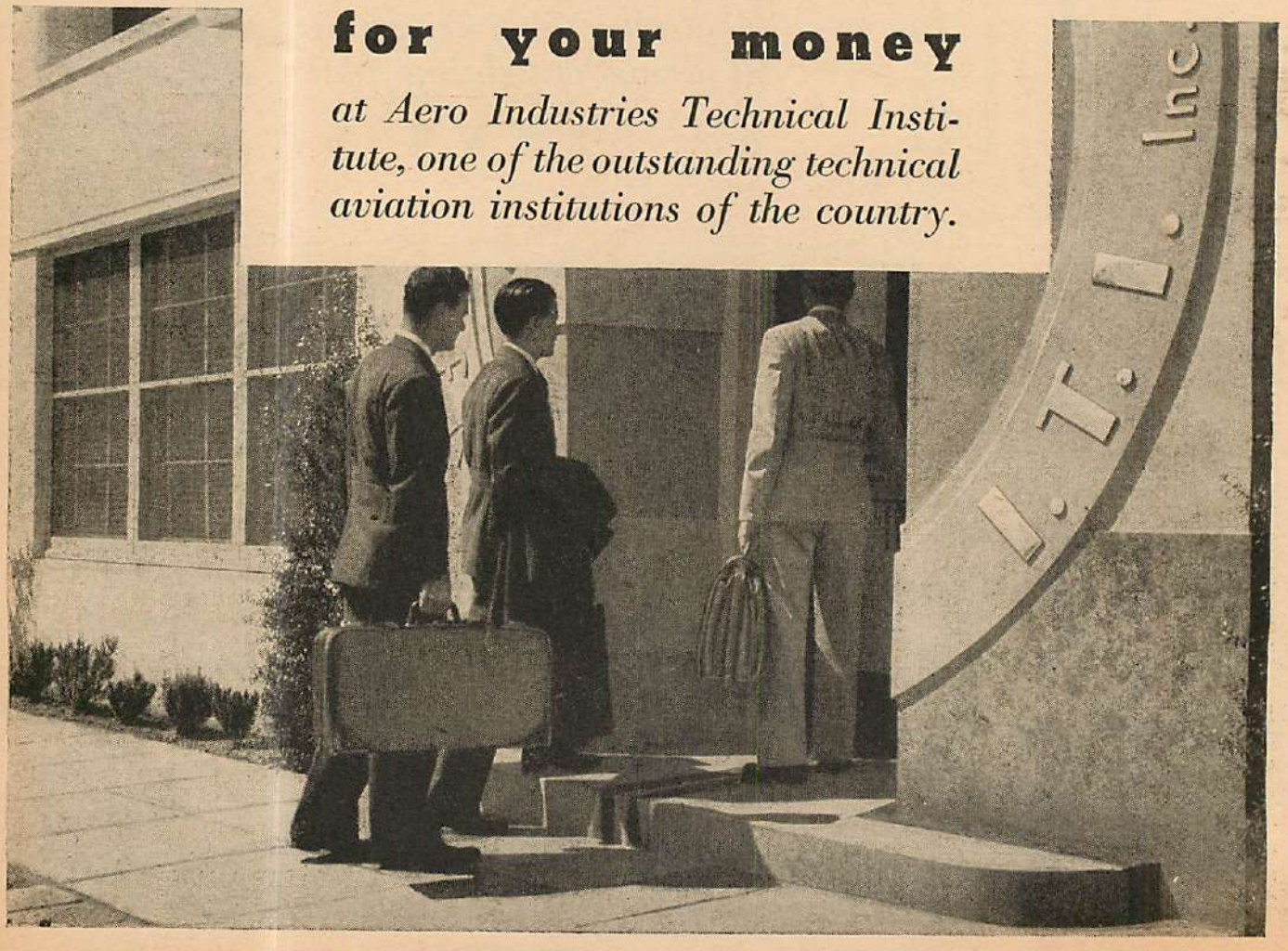
You learn the system of heat-treating aluminum.

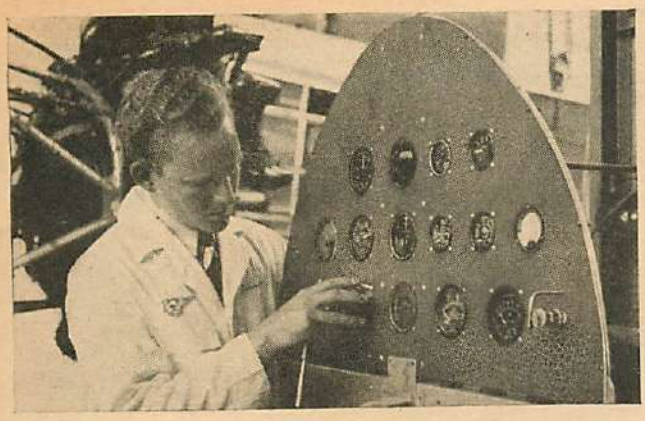
Drop-hammer technique is a subject well covered.

WHAT YOU GET

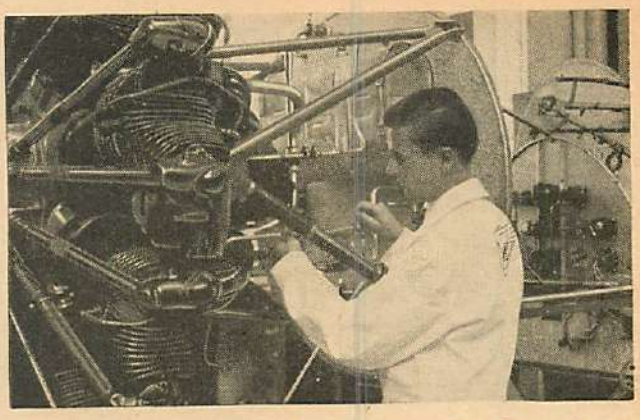
for your money

at Aero Industries Technical Institute, one of the outstanding technical aviation institutions of the country.

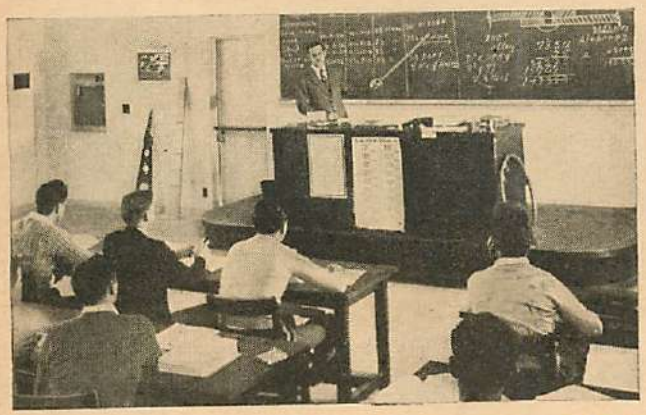




Instrument installation, often omitted elsewhere, is thoroughly taught during the course here, which includes every vital step.



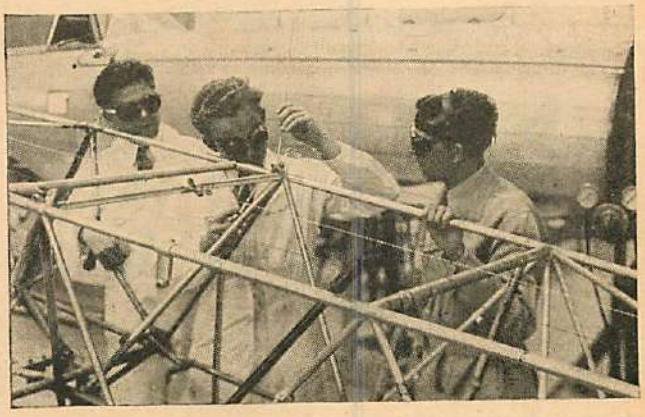
The training program includes complete instruction in the art of engine installation, all-important to correct plane operation.



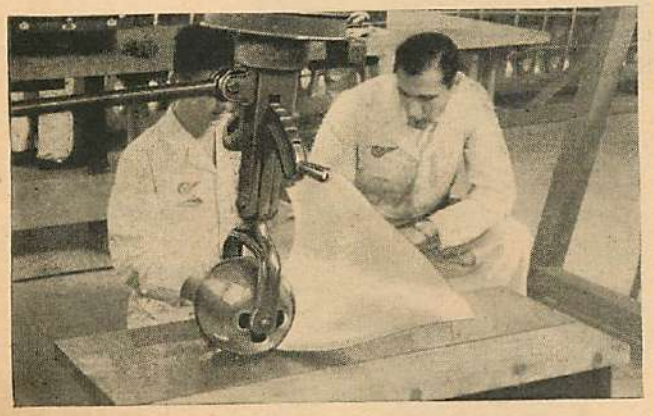
Classroom work? Certainly, but vastly interesting and full of many demonstrations, and problems that are important to you.

Metal parts are in some instances cast from sand molds, but first come plaster casts. Your course includes this subject.

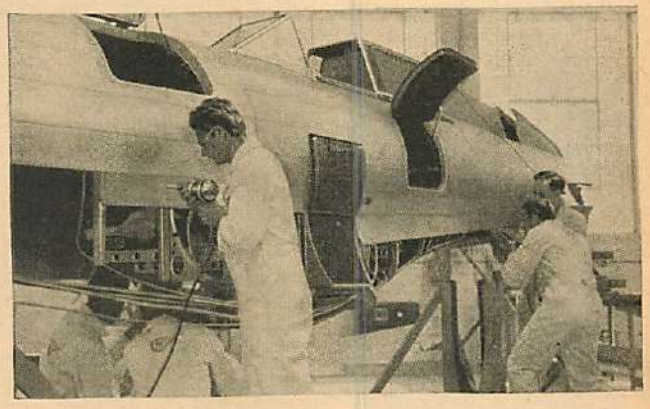
The importance of radio installation and testing is stressed by detailed instruction and complete laboratory radio equipment.



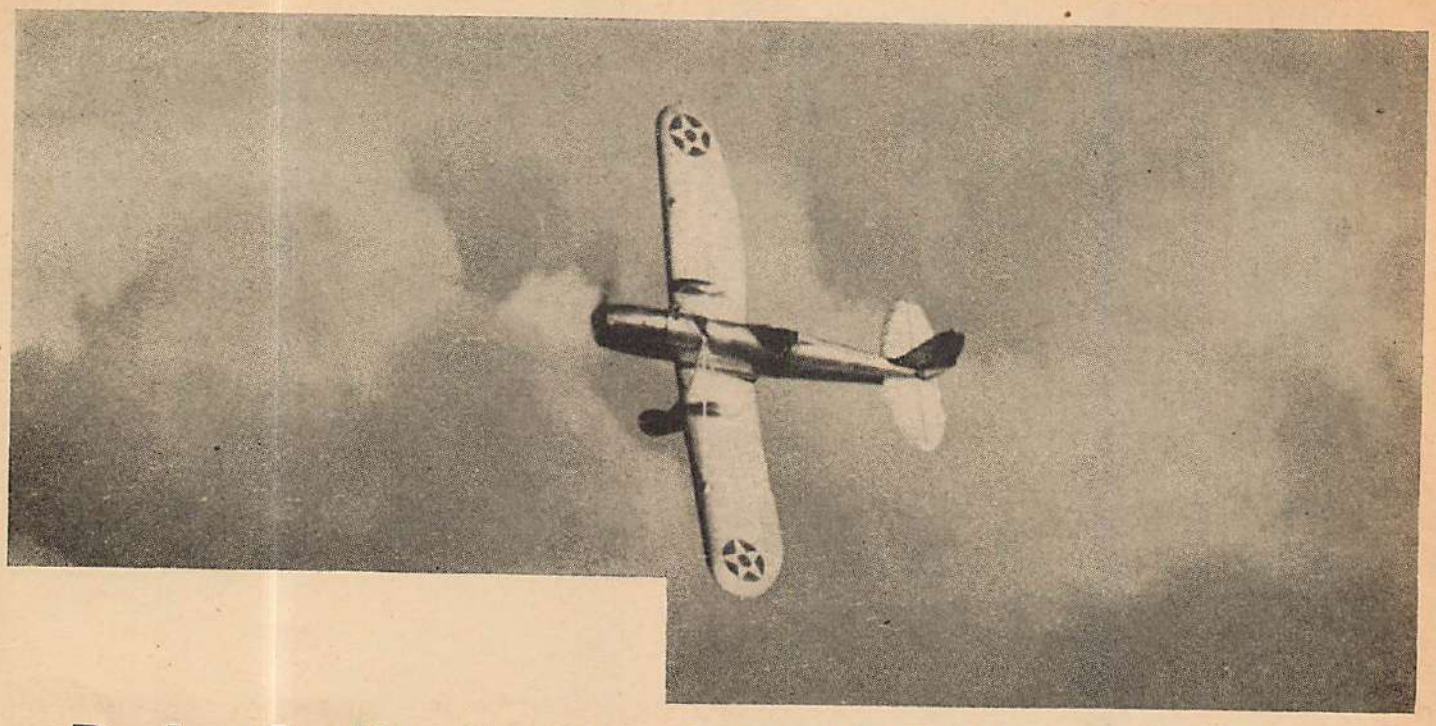
Arc welding and torch welding, important to metal fuselage construction, are arts in which the student acquires proficiency.



Crowning machines, unusual in schools, give first-hand experience in a little-taught but essential phase of metal work.



—and so on, through every subject important to the student who has chosen aviation as his career and success his goal.



An action shot of the Ryan S-T-M, showing this splendid light military trainer favored particularly by the Guatemalan army air force.

PLANES or PILOTS?

This vital question is spotlighted in this timely, informative article presenting interesting food for thought.

by ARCH WHITEHOUSE

England takes a new training step. The R. A. F. is accepting "direct-entry" observers for training who have had no previous experience.

Wide World

THIS article is being written directly to every reader of Air Trails who is in any way interested in learning to fly. Whether you own a private, amateur, limited commercial or commercial ticket, or whether you are just one of the thousands of light plane enthusiasts who hope to get a ticket, this item is for you. For you, my friend, are the most important factor in the future aërial defense of the United States.

Let them all write the most startling articles about our bombers, our attack ships and our pursuits. They can tell you of the miles per hour, the speed at which they will dive or the bomb load they will carry. They can talk all about the guns, the instruments, the variable-pitch props and the imposing bank of instruments—but, until *you* get in the cockpit, take the stick and fly her, she's just another piece of mechanical equipment with the most important cog wheel missing.

"Planes or pilots?" a noted British aëro editor has been saying for weeks now. He has been listening calmly to all the wild stories of the estimated strength of the German air force. He has also listened in turn to the weekly reports of the British aircraft factories, where they are supposed to be turning out 400 military planes a month.

"It's all very interesting," he has said, "but what about the men who are to fly them? Where are they coming from? In any effort staged on a large scale to build up reserves there is always the bottle-neck business involving the training of pilots."

And how right he is will be found in a further item to the effect that the British government has made an outright appeal to employers who have pilots of the Royal Air Force Volunteer Reserve on their payroll, to allow these men a six months' leave of absence so that they can take required training with service squadrons. This news in itself is to my mind the most important in the matter of British rearmament, and sums up a point that I have been trying to put over for years. The same situation confronting Britain will be faced in this country, too, unless some method of eliminating the bottle-neck of man power is made truly effective.

Let us look at some of the figures on the activity and progress of the British Civil Air Guard scheme, which to some extent is being copied in this country. On the whole the scheme appears to be working far better than was originally expected, in spite of criticisms that were directed at the plan by certain factions in this country.

From official information forwarded directly to me from the British air ministry by Mr. C. P. Robertson, who is in charge of the press and publicity bureau, I learn that in the first four months of the Civil Air Guard activity, 5,550 members passed their physical examination. More than 1,380 members of the C. A. G. now possess "A" licenses, or what we might call private tickets. At present 3,550 are actually taking flying lessons, many in light planes, and the rest are taking ground instruction or attending official lectures on military aviation. There are sixty schools taking part in the scheme and at present 330 aircraft are being used for instructional purposes. Supplies of Civil Air Guard uniforms are now available, and they are being distributed to all enrolled members. During the first three months of operation the air ministry paid out well over $200,000 to the flying clubs engaged in C. A. G. training.

I am offering these facts and figures to show what can be done in the matter of a civilian training scheme, and I hope it will help allay the fears that such a movement will fail if tried in the United States.

Let us accept the fact that Great Britain is closer to any possible war crisis than any other democracy, and that she should know what she is doing. Instead of giving all her attention to turning out thousands of aircraft that may or may not be obsolete by the time the expected emergency arises, she has sanely planned a training program that will, above all, produce pilots.

Great Britain has purchased N. A. trainers in this country. She has also purchased a number of Lockheed ships that are to be fitted out for *(Turn to page 79)*

Rudy Arnold

The difference between private and military training planes. In the foreground, private Cubs, and behind them naval trainers.

Wide World

Homework there's no kick about. Miami boys listen in on the beam from an Eastern airliner for use in aeronautical course of study.

AIR CORPS MAY TRAIN IN CIVIL SCHOOLS

UNDER a bill now pending in Congress, the war department is authorized to begin an emergency training campaign to turn out pilots and mechanics. Civilian air schools will be used to give preliminary instruction to 4,000 prospective fliers in the sixteen months beginning March 1st. Eleven classes of 370 cadets each will be started every six weeks until 2,134 pilots are obtained. From March 1st, 700 men will be taken into the air corps each month. In July, the number will be increased to 1,000 a month.

In two years, the corps will be more than doubled and will have 4,663 officers and 43,337 men. It now has 2,495 officers and 18,194 men.

Lieut. Albert H. Near, president of the Air Reserve Association.

Howard Knotts, World War ace, new N. A. A. general counsel.

OFFICIAL SENIOR N.A.A. NEWS

Prepared by

William R. Enyart, Sec. NAA.

SURVEY SHOWS AVIATION RANKS FIRST

Aviation ranks first in the interest of America's youth, according to Ernest Gamache, research director of Air Youth of America, in discussing the committee's survey work before the recent N. A. A. convention. Gamache also pointed to the usefulness of this interest, if properly directed.

For over three months Air Youth, the organization headed by Winthrop Rockefeller, has been gathering factual material under the active direction of Gamache. Excerpts from his talk follow:

"First, as to the interest of youth in aviation. Our investigations were limited to the age range of eight to twenty-five. So universal is youth's interest, in all age groups irrespective of geographical location, that we may conclude aviation ranks number one.

"Merely by way of indicating how early this interest starts, let me cite the results of a study made by Professors Witty and Kopel of Northwestern University in the vocational and career interests of youth from the first to the eighth grade, except for the fifth where it was secondary, they conclude present-day boys prefer to be aviators rather than cowboys, doctors, soldiers or policemen. Teachers, both in academic and vocational schools, leaders of group activity and others working with youth report essentially the same thing.

"At the present time, with the recent announcements of the president, interest is running even higher. The reactions of civic and service clubs, patriotic societies, educators and those dealing in problems of juvenile delinquency would indicate that the time is propitious for guiding youth's interest into constructive channels."

Gamache reported that the preliminary survey indicated little value was being derived from this tremendous force principally because of a lack of organized effort in directing this interest toward meeting the exacting present-day vocational requirements of aviation.

Italy, forging far ahead in her program of youth aviation education, believes in the training of young pilots through the medium of gliders. These young Italians are attending a glider school.

Asserting that no one can dispute the desirability of enlisting youth's interest, Gamache said: "Aircraft manufacturers and air-line personnel managers report a continued increase in vocational opportunities but a severe lack of trained personnel to fill such positions in locations where the aircraft industry is active. Mr. Charles S. Mattoon of Curtiss writes that 'the industry is expanding very rapidly and is having considerable difficulty in securing a sufficient number of qualified individuals to carry on the very exacting work so typical of the industry. Very few men trained in other lines of industry have the proper attitude or ability to make good in aviation.' Schools specializing in aeronautic vocational training report close to 100% placement of their graduates. Public schools, teaching basic aeronautics, report it to be their most popular elective."

Character building is one of the most important phases of air-youth education, Gamache said, and pointed out that "the findings of those dealing in problems of juvenile delinquency report, as Omaha, that 'it is the finest activity to prevent youth between the ages of ten and twenty-one from becoming street and tavern habitués.'"

Considering the best methods of directing youth aviation interest, Gamache stated: "The most effective methods are developed in classes or groups and are to be found in schools or in sponsored and directed leisure-time activity." Programs which produce the best results, he said, are planned along lines of progressive stages of interest.

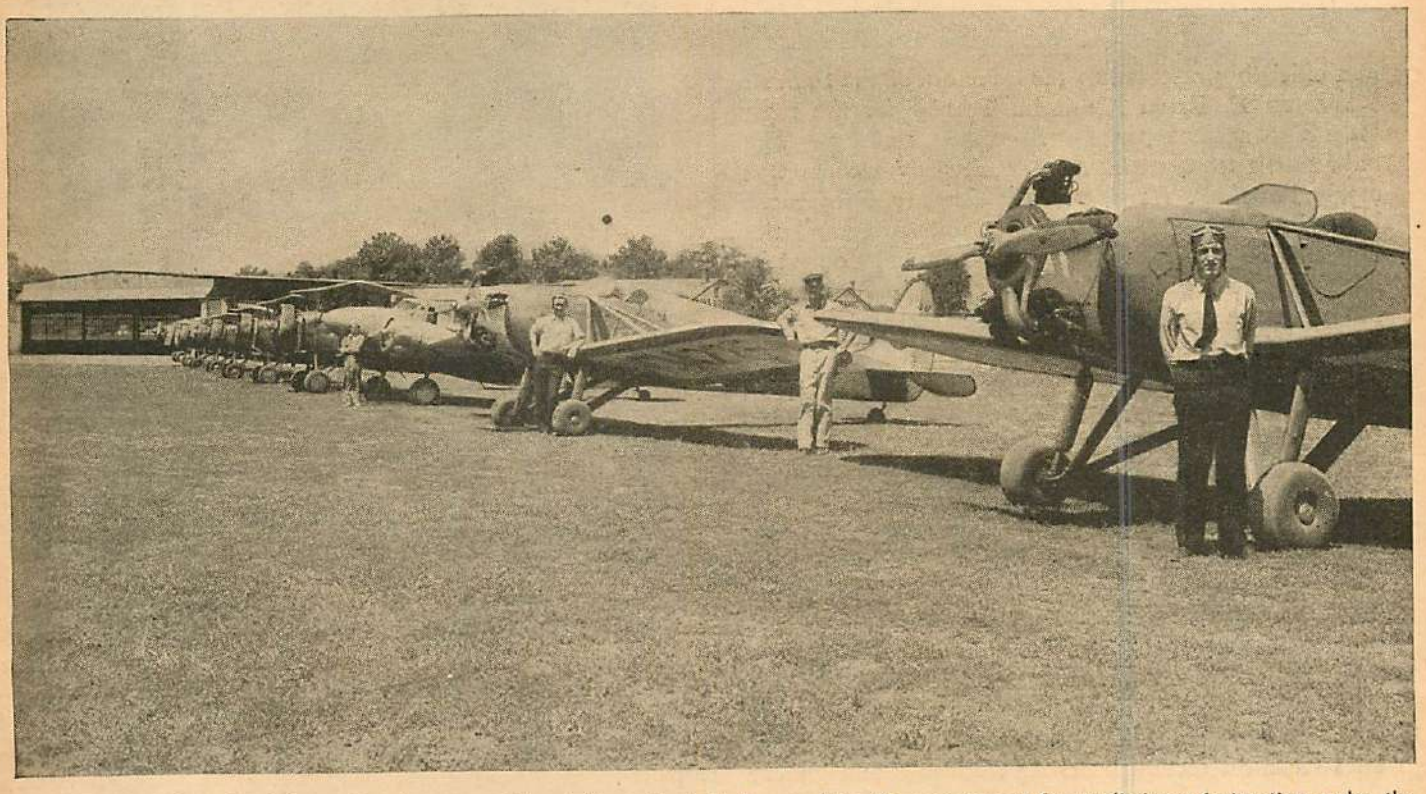
Gamache said that model building had proved one of the most effective ways of maintaining concentrated attention among younger boys. Contests and proficiency awards were said to play a major part in stimulating interest.

In closing, Gamache declared that leaders are available and more can be trained to provide needed guidance in aviation. "Constructive and tried methods exist which produce the desired results. It is to the welfare of society that the work be undertaken. Youth, then, should be assisted in a more constructive use of leisure time and thereby encouraged to a better appreciation of aviation."

TO AID PRIVATE OWNERS

To fill the growing need for a centralized clearing house for private-flying promotion and for development of helpful services to the private owner, a private flying division of N. A. A. is being established. Action to establish such a division was taken by the annual convention in January, and since that time an organizing committee has been working on details. This is in follow-up of the increased activity on the part of national headquarters during the past year in the interests of the private flier.

A feature of this new division will be the development of new-type services helpful to the private pilot. Included among the varied service possibilities being considered are the following: Trip routing and map-book rental service; gas-tax refund service; radio-station and operators'-license renewal and frequency-check reminder service; follow-up at Washington *in re* minor installation (Form 466) problems; European and Pan-American tour service; financing and insurance information service; off-the-airways landing information; emergency landing service; title and title transfer problem, Washington follow-up; airport-to-town special taxi service for members; private-owner "approved" airport service stations; authorized "member" accessory service representatives (radio, instruments, propellers); radio *(Turn to page 60)*



Typical of the splendidly equipped commercial aviation schools to be used by the government for preliminary instruction under the new war department plan, Parks Air College stands at attention. This line-up of ten modern planes represents part of their equipment.

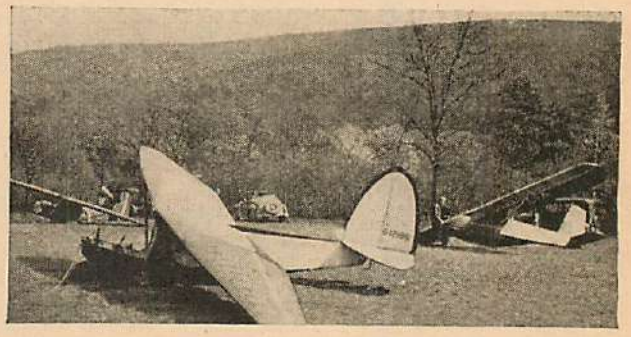
GLIDING AND SOARING

SECOND PLANNING CONFERENCE

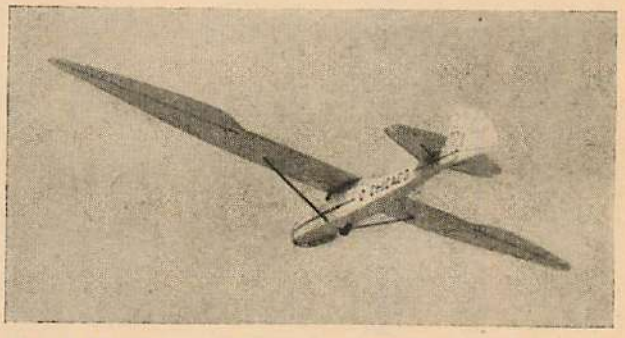
THE Second Planning Conference of the Soaring Society of America was held this year at the Roosevelt Field Hotel, Roosevelt Field, Mineola, New York, on February 11th and 12th. Originally it was planned to hold it at Philadelphia, but due to the resignation of Lewin Barringer the meeting was transferred to New York. The conference opened with a luncheon at which Mrs. Warren Eaton officially presented to the directors of the S. S. A. the Warren E. Eaton Memorial Trophy for the most outstanding achievement in American soaring. The winner of the trophy will be announced by a committee comprised of E. P. Warner, Lester Gardner, Dr. George W. Lewis, William Enyart and Carrol Cone, and the trophy will be presented during the National Contest in Elmira on June 24th.

After luncheon Richard duPont talked on the N. A. A. conference held in St. Louis. He reported that the N. A. A. indorsed a government-sponsored program in gliding and soaring in connection with the youth movement and asked all those present to decide on a comprehensive program which he was planning to present to Senator Engel for submission to Congress.

After a lengthy discussion the following program was adapted: 1. The Civil Aeronautics Authority purchase through its development section a sailplane and a utility glider in order to be better acquainted with the problems of motorless flight; 2. The C. A. A. pay for the training of one hundred glider students at schools or clubs designated by the S. S. A. with a tuition fee not to exceed $250 per student; 3. The national committee for aeronautics technical section purchase sailplanes and gliders to study construction and flight problems; 4. The U. S. army air corps purchase two two-place and one single-place sailplanes, for student training at Randolph Field.



Plenty of activity at Wurtsboro, N. Y., these spring days, as the Hudson Valley Soaring Club starts the 1939 season.



Joseph Steinhauser's Goeppingen-Wolf intermediary sailplane sails smoothly and silently over the Michigan dunes.

The second session of the day was spent in discussing glider manufacturing problems under the chairmanship of the Schweizer brothers, manufacturers of all-metal ships.

The next day started with a discussion on construction and engineering problems and licensing requirements. Milton Stoughton, engineer of the Brewster Aircraft

The S. A. A. annual meeting in progress. Left to right, Art Ramer (standing), Unidentified, Ernest Schweizer, Alfred Koch, Gus Scheurer, Paul Schweizer (back to camera), Unidentified (standing), Peter Riedel, Walter Setz, Unidentified (standing), Emil Lehecka.

conducted by Alexis Dawydoff

One of the "grand old men" of motorless flight! Friend Hawley Bowlus, snapped by Editor at his California plant.

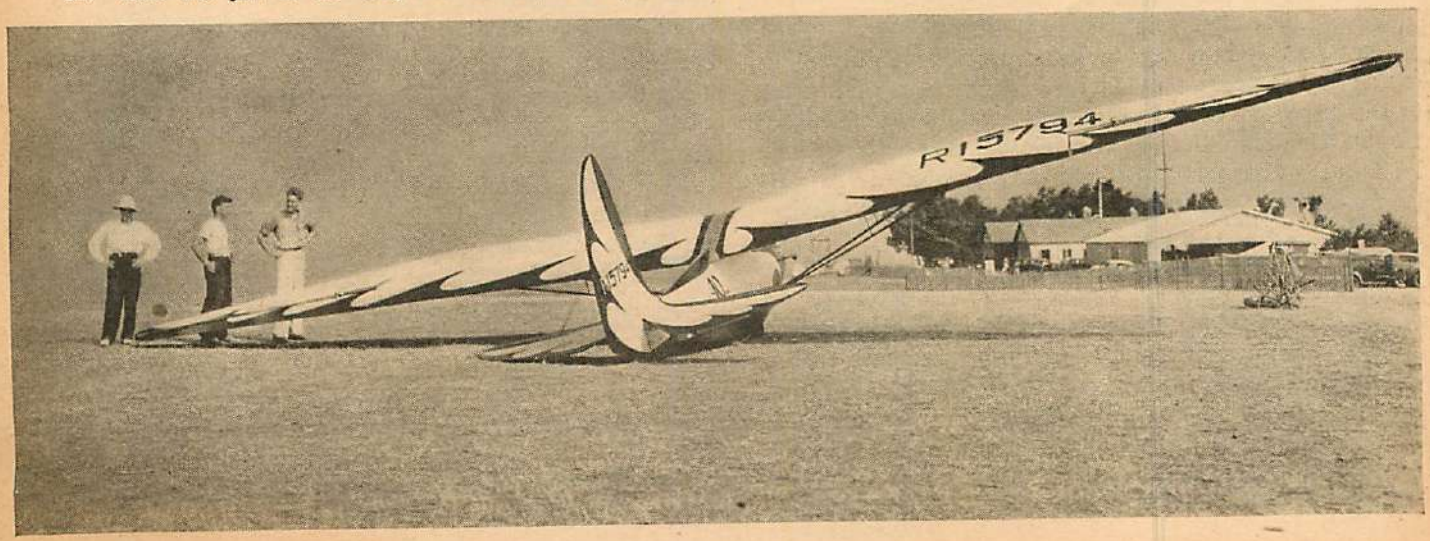
Wayne Thomis, aviation editor of Chicago Tribune, goes into a huddle with Peter Riedel at the Frankfort meet.

Company, was chairman. It was suggested that regulations for licensing gliders and sailplanes be made less stringent and that stress analysis be replaced by a static load test; that a technical committee for glider research be created with members appointed by the S. S. A. president, and that these members in turn appoint regional committees in the seven C. A. A. regions to co-operate with the C. A. A. inspectors. The meeting then adjourned for luncheon.

In the afternoon Arthur Lawrence, secretary of the S. S. A., announced the result of the election of S. S. A. officers which was held during the directors' meeting. All officers were unanimously re-elected: Richard duPont, president; Charles H. Gale and Dr. Wolfgang Klemperer, vice presidents; Mrs. Warren Eaton, treasurer, and Arthur Lawrence, secretary. Additional directors appointed were Col. R. E. Olds, C. O., First Bombardment Group, Langley Field, Virginia, who led the six Flying Fortresses last year on the flight to Rio de Janeiro, and Dr. George Lewis, director of the N. A. C. A. research laboratories. Henry Wightman, Silver "C" pilot and holder of the distance record for utility gliders, was appointed manager. Lawrence also announced that headquarters of the Soaring Society will be moved from Philadelphia to the N. A. A. building in Washington, and that the society's Ross Ibis sailplane is for sale, since a two-place, all-metal sailplane has been ordered from the Schweizer brothers. Mrs. Eaton contributed $800 as down payment for this ship.

The next announcement concerned the Elmira contest. This being the tenth consecutive soaring contest, it was decided to "go to town." Approximately 260 pilots are expected to participate this year, and half as many gliders. About $10,000 is expected to be raised for prize money, half of it to go toward the point award system. There will also be special prizes for goal and altitude flights. All entrants are going to be divided into two groups; Group 1 will consist of Silver "C" pilots, and Group 2 of "C" pilots, though after the latter have reached or exceeded Silver "C" flight requirements during the contest they will be eligible to compete in Group 1. Only those who have earned a *(Turn to page 71)*

A "Sun Spot" before your eyes. Bob Auburn's cleverly painted ship resting on Harris Hill at Elmira, New York, before a take-off. Note the gull of the wing and the tapered tips. Behind and to the right lie the hangars and pilot rooms at the field.



Be Patient With Uncle Sam

GREETINGS, Air Adventurers!

1939—solo this time!

That was the slogan we started back in our January issue when Air Trails established its new organization known as the Solo Club. Since that time we have been gratified with the response and the number of members attracted. Here and there, as we saunter about the airports, we come upon keen-eyed chaps wearing the Solo Club pin, and to be perfectly frank it is the finest lapel pin of its kind. We have been wearing ours now for weeks and have felt a strange air of superiority when it has attracted the attention of other pilots.

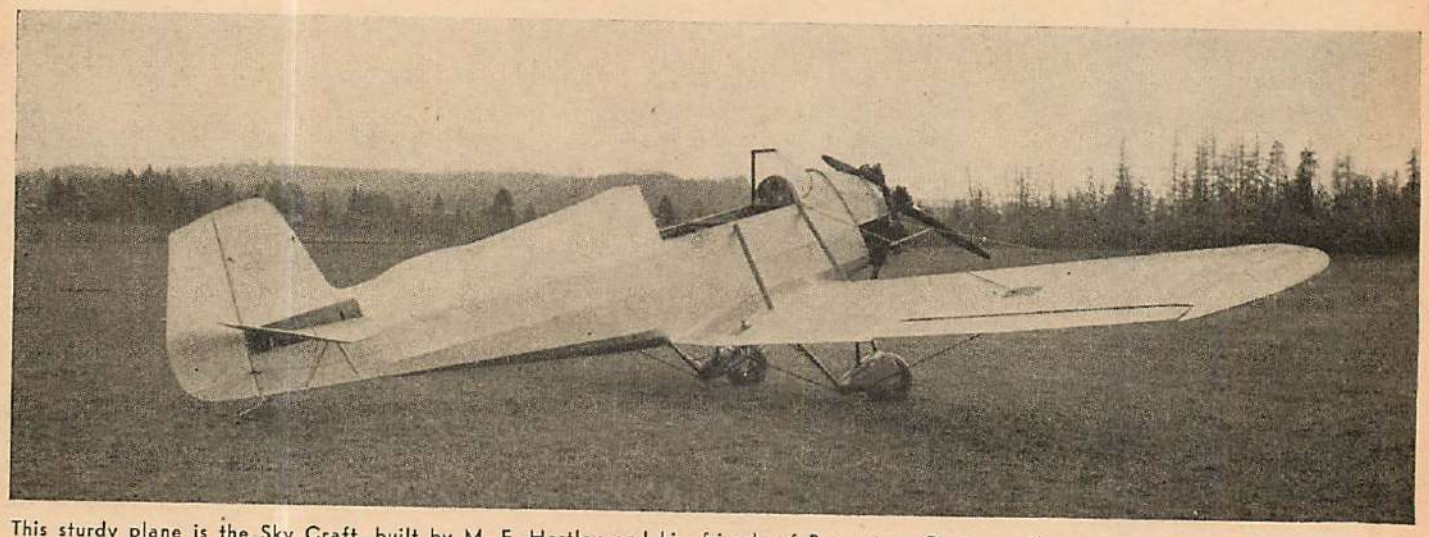
Have *you* soloed yet?

Perhaps this is a new tack for us, but we're heading for a very important pylon in this business. We want to see our Solo Club files packed so tight we will have trouble clamping the drawers closed, and now we are looking forward to full co-operation by our Air Adventurers. There's a method in our madness, as the saying goes, too.

For the past few months American aviation has been pointing for the military market. War scares played up along prearranged lines have built up a war-consciousness in this country, and we are now fluttering along on the wave of mass hysteria. It is our prediction that the year 1939 will go down in history as one of the wildest periods in American military plane production history.

President Roosevelt, realizing the need for pilots in his attempt to stiffen the defenses of the land, has announced the first details of a plan that has been designed to produce 20,000 young airmen as part of a civilian air force.

Since the newspapers and the air experts have been handling most of the details in the daily prints, the plan has become something of an aërial maze, and it is no wonder the young men of this country are somewhat stunned and bewildered. So far, no two reports or accounts of the 20,000-pilot plan seem to jibe, and it has taken a heavy battering from the pacifistic press, the tuition side of the industry, and of course politics has fired an odd volley here and there.



This sturdy plane is the Sky Craft, built by M. E. Hartley and his friends of Beaverton, Oregon. Ship is two-place, Velie-powered.

What has happened is that the president, realizing that something must be done on a broad scale to produce pilots, has taken the best of some of the European plans, boiled them all together and evolved an idea that appears to fit the American scheme of things.

Like the Civil Air Guard plan now actually in use in Britain, the American plan will run into some snags, but like the C. A. G. thing it will produce pilots. It will give patriotic young men a chance to fly, or learn to fly, and it will play some part in a broad program of national defense. There will be mistakes made and there will be a jumble of angles to it, all of which is to be expected, for no plan however well designed originally can cope with all the mental twists and quirks of the human race. What will be most required is patience and fortitude, for the plan will not click at first, but will take some time to get into the groove.

From correspondence received from interested readers we learn that adverse publicity on the 20,000-pilots plan has caused many to believe that the plan will be open only to young men in our colleges and universities. Others believe that it will be for a select group that has friends in the administration. As a matter of fact, the early reports of the plan were not quite clear, and there were statements out to the effect that the colleges only were to be checked for suitable material.

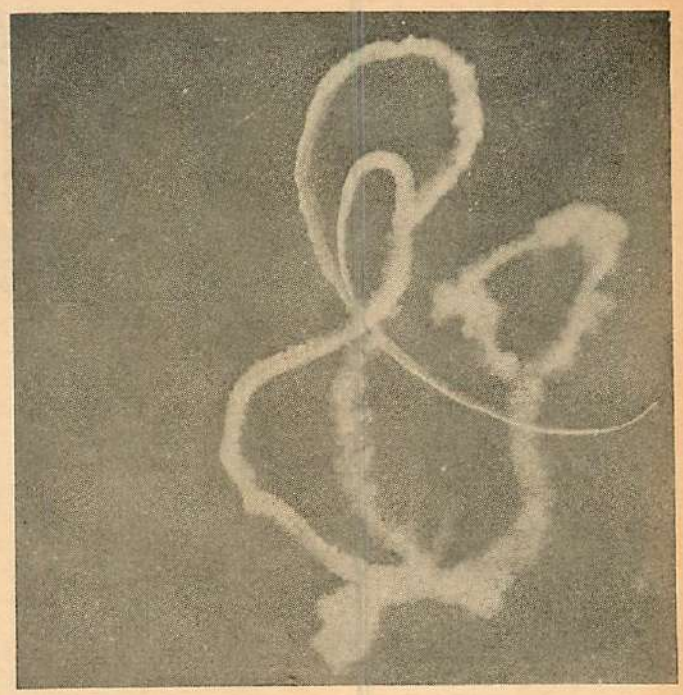
All these ideas are based on the fact that few realize the goal of the training scheme. To get the whole idea straight in our Air Adventurers' minds, it might be well here to straighten this matter out once and for all.

It is not the plan of the national air scheme to train 20,000 highly skilled military pilots. Such a plan would be impossible. The last class leaving the advanced training class at Kelly Field numbered only 171 fully trained pilots. When we consider the fact that these men had been under instruction for nearly two years, it is easy to see that the plan of training 20,000 such pilots is practically an impossibility with the present training set-up.

What the plan aims to do is to teach as many young men as is humanly possible to fly. They will be given a short concise course in primary training on primary ships—light planes, to be exact. They will then be given a little time on a primary military plane, and wherever possible allowed to become crew members aboard larger military planes so that they can become accustomed to military duties under the authority of skilled military airmen. They will get short courses in machine guns, aërial cameras and military map reading.

In other words the government plans to teach as many young men as possible the barest rudiments of military aviation. They will know how to fly primary types, receive instruction in primary military tactics, armament, and, to break it all down to its lowest common denominator, be taught "air sense."

The basic idea then is to have 20,000 or more young men available for an emergency. Should that emergency arise, they will be selected for posts with service squadrons. Most of them will of course be given short "refresher" courses under high-pressure conditions and many will be found suitable for the cockpits of service planes. Many may find that they will *(Turn to page 66)*



An aerial dog fight traced in smoke. This unusual photograph was taken by Air Adventurer Joel Isenberg, of Montreal, Canada.

A Trans-Canada Lockheed Electra in one of the company's hangars. Photograph by Howard Becker, High Prairie, Altabasca, Canada.

Actual size of your Air Adventurers pin.

(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, 1939.)

WHAT'S YOUR QUESTION?

Question: Have the plans for the P-37, Seversky Executive and the Northrop dive bomber ever appeared in Air Trails? Who manufactures the Bell Fighter and what is its speed? V. B., Baltimore, Md.

Answer: The above-mentioned plans have not been published in Air Trails. The Bell Fighter is manufactured by the Bell Aircraft Co., Buffalo, N. Y. Its top speed, according to rumors, is approximately 300 miles per hour.

Question: Is there any place where I could get plans to build a light plane at home? If so, how much will it cost? T. T., Hawthorne, N. J.

Answer: I do not know where you could get plans to build a light plane at home. The light-plane manufacturers do not sell plans of their ships. You might try the Payne Aircraft Co., Joliet, Ill.

Question: I would like to know where I may get drawings of a Pratt & Whitney or a Wright radial engine of about 300 to 400 horsepower. Where can I get plans for the Westland Lysander? R. S., Chicago, Ill.

Answer: Write to the Wright Aeronautical Corp., Paterson, N. J., or Pratt & Whitney Aircraft Co., Hartford, Conn. Plans for the Westland Lysander were published in our June, 1937, issue.

Question: Can you tell me if a boy thirteen years old can belong to the N. A. A., and what it costs? Where can I get three-view drawings of a solid scale model of the Short Brothers Cavalier flying boat? What is the highest known speed ever attained by anything? T. S., Grand Rapids, Mich.

Answer: A thirteen-year-old boy can belong to the N. A. A. The dues are three dollars per year. Write to the National Aeronautics Association, Dupont Circle, Washington, D. C. I do not know where you can get plans for the Short Cavalier, but I suggest that you write to some of the aviation magazines which have model departments. The "highest speed ever attained by anything" takes in a lot of territory. Light travels faster than anything known, 186,000 miles per second. The fastest man has ever traveled is 600 miles per hour in a diving airplane; this is almost as fast as sound, which travels 750 miles per hour.

Question: I would like to know whether an airplane will dive faster with the motor full on or with the motor at idling speed. E. P. W., Darby, Pa.

Answer: The terminal velocity of the ship will be always the same, regardless of the speed at which the propeller rotates. Wide open, an airplane will reach its terminal velocity sooner than with the motor at idling speed.

Question: Could you give me a description of the Keystone army bomber? A. F., Denver, Col.

Answer: The Keystone bomber is an equal-span biplane which carries a crew of five, has a bomb-load capacity of 2,150 pounds, and is equipped with three machine guns. Span is 74′ 9″, length 48′ 9″, height 17′ 2″, weight empty, 8,075 pounds, fully loaded, 13,334 pounds. Its top speed is 120 miles per hour, cruising speed, 111 miles per hour, landing speed, 56 miles per hour.

Question: Could you give me any information on the picture inclosed in my letter? I would like to know how much this ship costs, and if it can be bought on the installment plan. A. L., Brockton, Mont.

Answer: The ship illustrated is a Welch OW. Its price is $1,495, and I understand it can be purchased on the installment plan. Write to Welch Aircraft Industries, Inc., South Bend, Ind., for further details.

Question: Could you tell me where I could get any information on liquid-air rockets? What is the address of the American Rocket Society? B. F., Chicago, Ill.

Answer: You can get the information from the American Rocket Society, whose address is 31 West Eighty-sixth Street, New York City.

Question: I am going to graduate from high school this year and would like your advice on the type of work I should take at college if I were to become a transport pilot or a mechanic after graduation. J. U., Bulger, Pa.

Answer: Mathematics, physics and chemistry are the three subjects that will help you most if you want to become a transport pilot. You do not need college education to become a mechanic. Vocational training in shop work as offered in a number of high schools is sufficient for that.

Question: I am interested in building a primary glider similar to the one shown on page 29 of the December, 1938, issue. Where could I purchase plans for one like it? Please tell me the address of the company that sells the book, "Gliders and Gliding," by Barnaby. L. B. B., Jr., Arkadelphia, Ark.

Answer: Plans for this ship, the Mead primary, are no longer available. A similar ship for which you may obtain plans is manufactured by MacFarland Aircraft Co., Greenville, Ohio. The book referred to is sold by the Ronald Press, 15 East Twenty-sixth Street, N. Y. C.

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

Model Making

NEXT MONTH

"The Mystery Man," a novel gull-winged gas job with a contest record, designed by Elbert J. Weathers, features the June model department. This is the model that caused the upheaval at the Model Academy meeting last November. It seems that Weathers had designed a landing gear which did not take off with the ship but was not dropped in flight. A built-in third wheel effected the landing. Not bad, eh?

* * *

A contest-winning stick model by Jack Swartz continues the series of Air Trails championship models. This job is another from the Akron group.

* * *

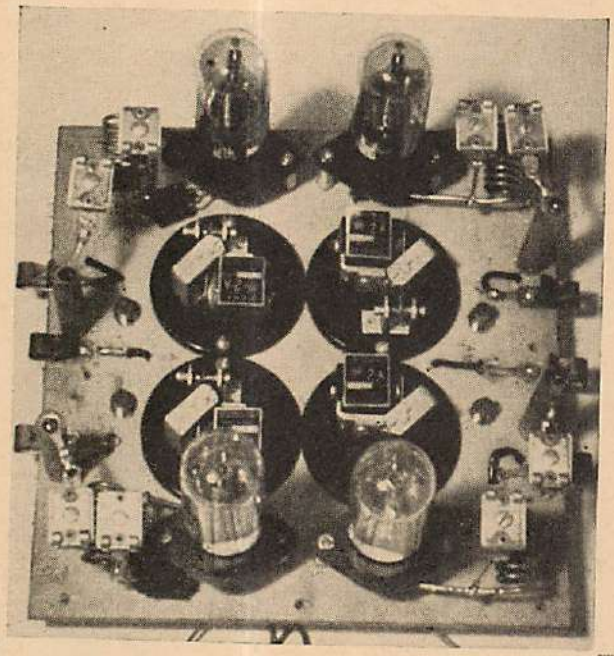
Frank Zaic introduces an interesting feature bringing to you news and detailed information of the latest developments in model research, design, construction and flying. This series is different and is important to you if you really know models.

* * *

Beginners' articles and plans make the June model department one of value to novices and newcomers as well as veterans. Martin Dickinson brings forth another of his accurate detailed drawings. The next issue will be the best ever. Don't miss it!

the latest in radio control

by CLINTON B. DESOTO
Assistant Secretary, American Radio Relay League



WE might as well be honest about this radio-control thing.

We haven't had a ship yet that would take off under radio control, circle around until it hung high in the heavens and then perform a breath-taking series of loops, rolls and power dives before being guided down to a smooth, sure landing—all with infallible reliability. That's what we'd like to do, of course, and what some day we hope to do—but so far we haven't done it, and as far as we can learn no one else has, either.

There's a lot to be done before that goal can be realized, as those who have played around with radio control at all well know. Not only will the gear have to be perfected far beyond its present state, but radio-control pilots will require training as extensive and as thorough as for full-sized ships if comparable performance is to be had.

But before anyone is appalled by these difficulties, let it be understood that there are plenty of thrills short of that ultimate goal. If there is satisfaction in seeing a rubber-band model fly—if there is a kick in watching a gas job buzz up into the blue—then there is also an almighty wallop in seeing a model make even the simplest turn when it does so in response to your finger on the control.

And even before that, the assembly of the control mechanism and the initial testing provide satisfaction of a major order. Every department of the project affords the keenest satisfaction and pleasure. So don't think that because perfection isn't in immediate sight the radio-control field holds nothing worth while now.

Radio control is the coming thing

Above—Radio receiver unit. Below—The 14-foot Cub powerplant is a special Forster Brothers' two-cylinder, 2/3 h.p. engine, weighing under 3 lbs.

So far as practical equipment for powered models is concerned, the Hull escapement system, described in August Air Trails, is highly satisfactory for preliminary work. That fact was established by the several successful installations of it entered in the radio-control event at the Nationals in Detroit last year.

Such ships are flown much the same as ordinary gas models; that is, they take off and land themselves, with neutral controls. While in the air limited maneuvers such as slow turns, climbs and dives are made possible by the single-cycle three-position control tabs.

But for complete maneuverability it is obvious that some form of continuously reversible control is required, so that the degree of turn and climb can be set precisely and so that overcontrol can be corrected or a change in the maneuver accomplished without going through the full cycle. Such a control system was developed for the experimental airplane to be described.

DESIGN

The model resembles the famous Cub in its general outlines, with such modifications as were dictated by its special purpose. This basic design was chosen because of its outstanding success both as a full-sized ship and when used in flying scale models.

Originally the plan was to include four control channels, with a total weight of thirty-five pounds.

However, when it was decided to enter the Nationals at Detroit and the weight limit was found to be twenty-five pounds, some paring was an obvious necessity. Upon consideration it was concluded that elevator and rudder control were the most essential, at least in the present experimental stage, and only these were retained. That meant a five-pound saving in radio gear—the design of the control gear itself being modified as well. Replacing the ailerons with a light falsework, changing the heavy wheels to lightweight M & Ms, and a little general trimming around the ship eliminated the remaining excess. (Yes, despite reports the gross weight actually was a few ounces under the limit.) Fortunately, the discarded weight was so displaced as to cause only a minor change in the center of gravity, compensated for by shifting the batteries.

Actually, a somewhat smaller and lighter plane could be used to carry the present control gear. Something like twelve-foot span, twenty feet of wing area, weighing from ten to twelve pounds without radio equipment—something like that should do the job nicely.

But that's another ship. For an all-around experimental craft such as this one, which may be called on to carry up to ten or twelve pounds of control gear, somewhat more bulk and ruggedness are essential. To build a ship of this kind constitutes a fascinating undertaking, for it represents a venture into a comparatively untried field—a combination of full-size and model design, with some of the problems of each.

For instance, the wing is made almost entirely of balsa. The fuselage, on the other hand, has no balsa structural members whatsoever.

WING

The wing is in two sections, for convenience in transportation and storage. The main spar is made up of two 1 x ¼" pieces of yellow pine, spaced one inch as

—plans for the second-place radio-control winner at the last Nationals.

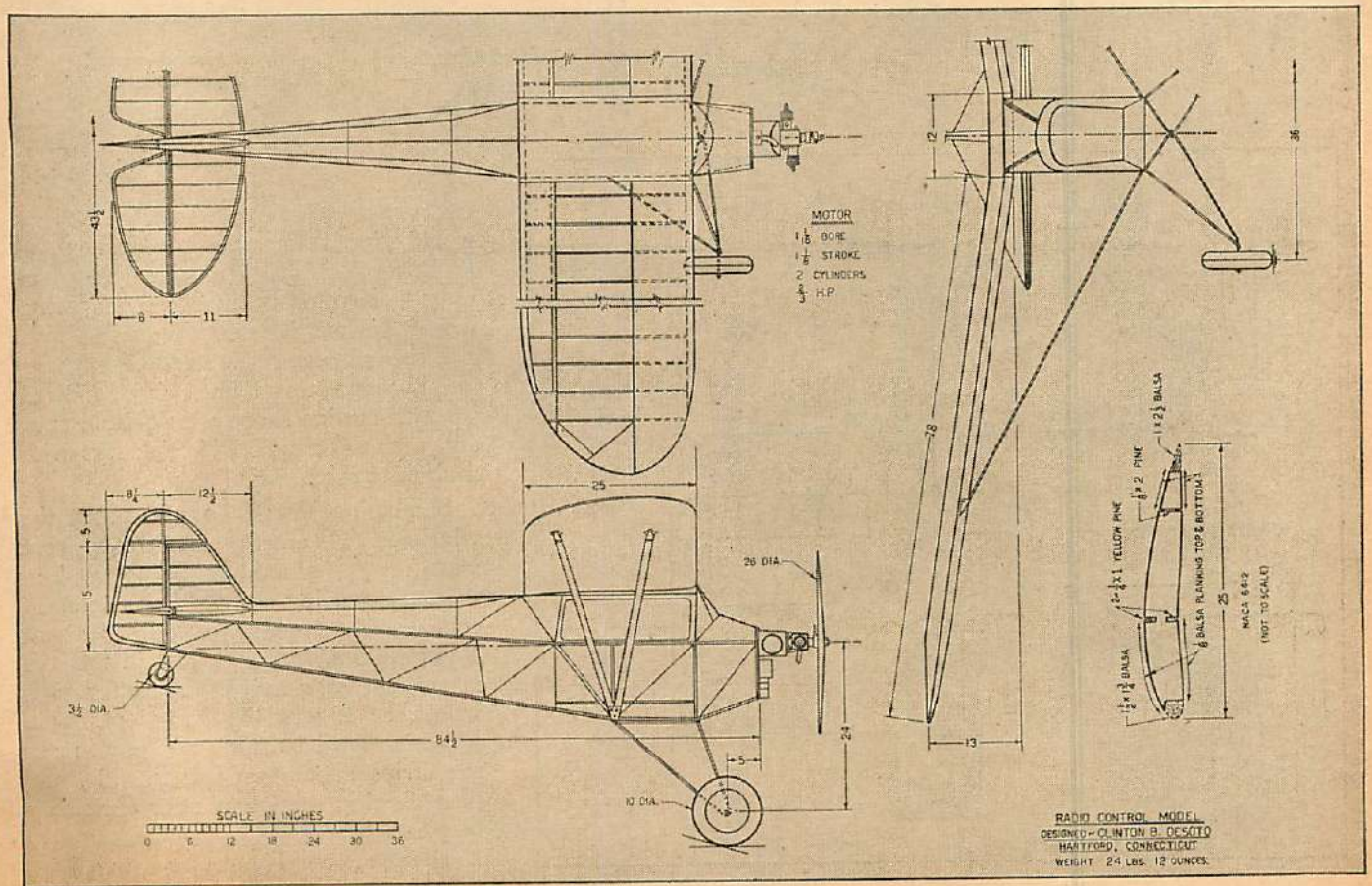


Figure 1

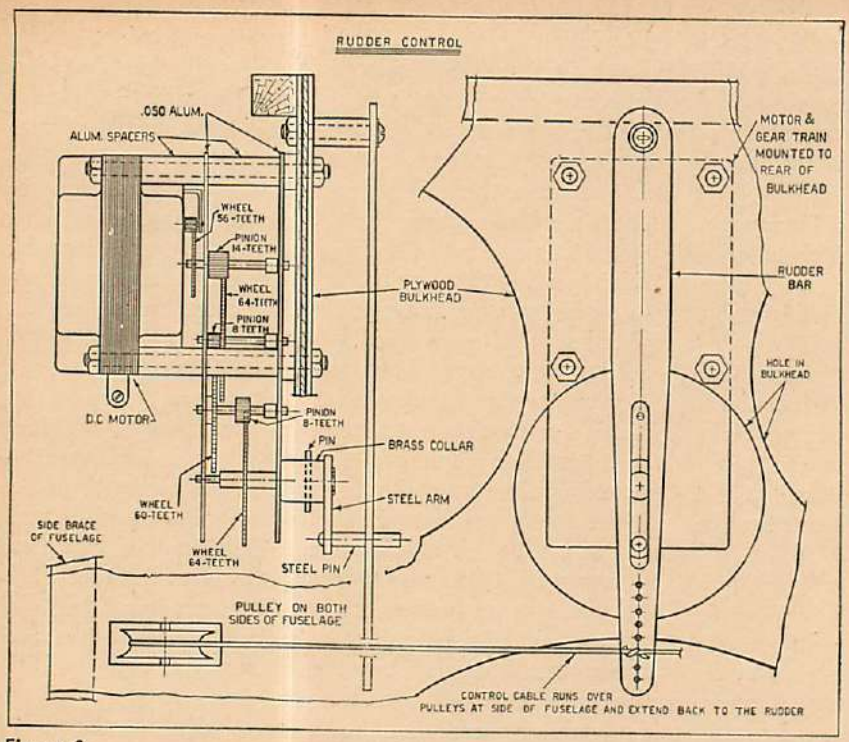


Figure 2

assembled on the balsa ribs (see Fig. 1). In the center another length of pine is cemented between the two spar members for about a foot each way to make a short solid spar at this critical point. Another insert at the tip provides a solid terminus for the taper.

The rear spar is of 1/8 x 2" pine. The ribs are butt-jointed onto it, front and rear.

The leading edge is made of a husky chunk of hard balsa, stepped to facilitate attachment of the ribs. It is capable of withstanding a relatively terrific head-on collision. The trailing edge is also solid and heavy, of hard balsa, slotted to insure accurate rib alignment.

The leading edge and a part of the trailing edge (except where the ailerons originally were located) are planked back to the adjacent spar, using 1/8 x 2" balsa planking. (Narrower planking

THE LATEST IN RADIO CONTROL

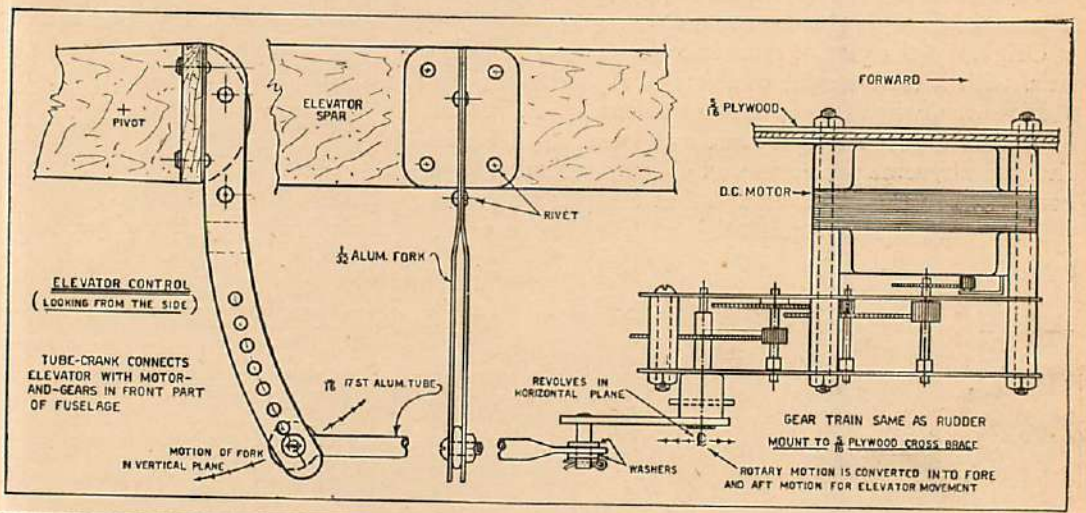
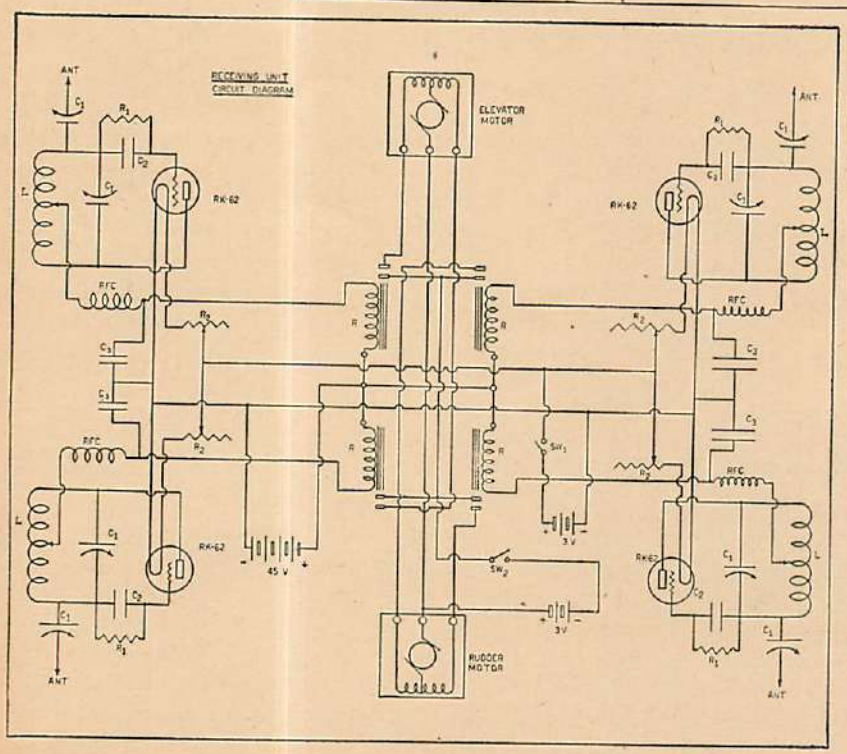


Figure 3



would give a smoother contour on the L. E. top.) This results in strong box spars—and a tremendously strong wing with a substantial safety factor.

The ribs were made in the customary fashion by cutting large chunks of hard balsa to outline shape with a band saw, and then slicing off 1/8"-thick ribs with a circular saw.

Something should be said about the wing tips. As an experiment, they were made of 3/16" aluminum tubing, set into the balsa leading and trailing edges. A considerable amount of reinforcement was required, however, and in the end no weight was saved. A better plan would be to cut the wing outline in 1/2"-thick hard balsa on a jigsaw, making strips about two inches wide, and then carving the edges after cementing in place.

The demountable center wing joint

utilizes face plates of 1/8" aircraft plywood, two for each spar, extending into the wing about six inches on each side. Bolts are then run through these and through the spars—a dozen in the main spar, six in the rear—with washers and nuts, all 6/32", all of aluminum. Lengths of 1/4" hardwood dowel are set in the L. E. and T. E. (which are bent at the dihedral angle six inches from either end so they lay flat on the fuselage) of one section, with corresponding holes drilled in the other section to receive them. Pieces of 3/64" aircraft plywood cover the top of each section near the joint, adding to its strength.

V struts are provided, not so much to strengthen the wing as to keep the fuselage reliably attached to it. They are made of 1 x 1/4" lengths of yellow pine carved to what passes for a streamline shape. Fittings of 1/32" sheet aluminum are provided for attachment.

The actual wing fastening consists of four 5/8"-wide strips of 1/16" hard aluminum, two on each spar, which are held by the outside bolts in the joint fittings. These are fastened to 1/4" pine cross pieces which comprise part of cabin structure at the top. Another pair of strips holds down the leading edge. This type of wing mount seems much more practical in a model of this sort than any form of elastic fastening or wing release.

Covering is of 100-weight cambric, given three coats of airplane dope (not thinned model dope). This material is preferable to any other yet tried, tightening in drumlike fashion, strong but reasonably light.

The dihedral ratio of the wing is one inch to a foot; in other words, the tips are raised thirteen inches.

The airfoil section is a personal pet, possibly less desirable in the present case than a streamline section of lower lift. Yet it still seems a useful compromise between low landing speed (high lift) and good stability (low center of pressure travel). It is actually an N. A. C. A. 6412 section modified to reverse the camber at the trailing edge.

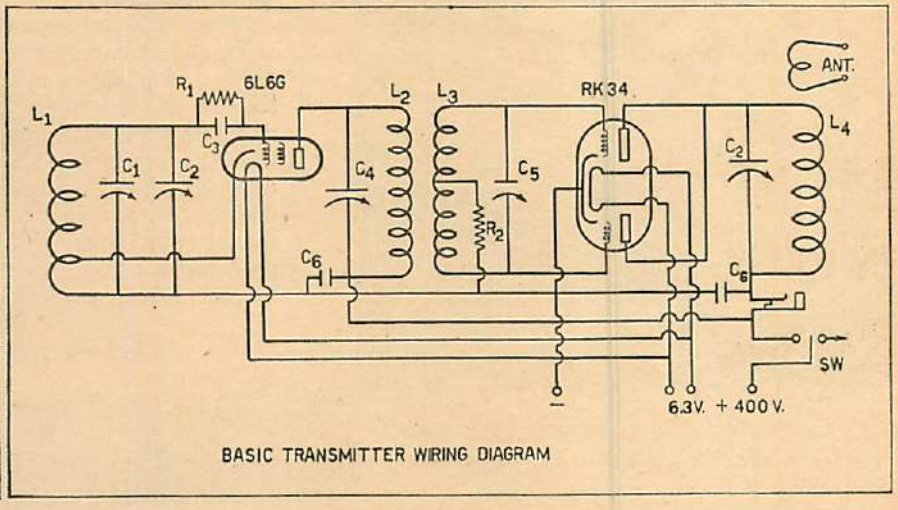
FUSELAGE

The fuselage framework is made almost entirely of spruce. It is necessary to secure high-grade aircraft spruce; the ordinary kinds, even Sitka or silver spruce as commonly sold in mill yards, are not generally satisfactory. If high-grade spruce is not available, yellow pine is the next choice for weight versus strength.

The four main longerons are 3/8" square. (All 3/8" members are shown in the side-view drawing of Fig. 1 as double lines). All other structural members, including the turtle-deck stringers, are 1/4" square.

The cabin window frames, the fire wall, and a platform for batteries in the bottom (occupying the space just above the landing gear) are all of 5/32" basswood plywood, of the sort used in jig-saw work. The material is light and fairly strong; it must not be allowed to get wet, however. A 1/64" plywood covering over the cowling in front of the windshield strengthens that section and provides smooth fairing.

All joints are reinforced by substantial gussets made of 3/64" aircraft plywood, tacked in place with small brads and liberally cemented. Ordinary heavy cellulose nitrate cement was used; although casco glue might give a stronger joint, experience has indicated that it is difficult to use because of the long drying time, and that it is treacherous because poor joints do not always show up immediately. Gusseted joints are amply strong with nitrate glue, even butt joints on spruce, if properly made.



BASIC TRANSMITTER WIRING DIAGRAM

The wing and motor mounts must be thoroughly braced in a ship of this sort. After all, they encounter stresses up into hundreds of foot-pounds. In the case of the wing, a brace from the rear strut of the landing gear to the main spar would have been desirable, but this would have made access to the radio gear difficult. Substantial cross-bracing seems to have sufficed.

The fire wall must also be solidly attached, with rigid internal cross-bracing. This bracing is applied particularly between the points where the motor-mounting brackets are attached, and the main longerons; it was put in after the motor shook half the fire wall loose in an initial installation.

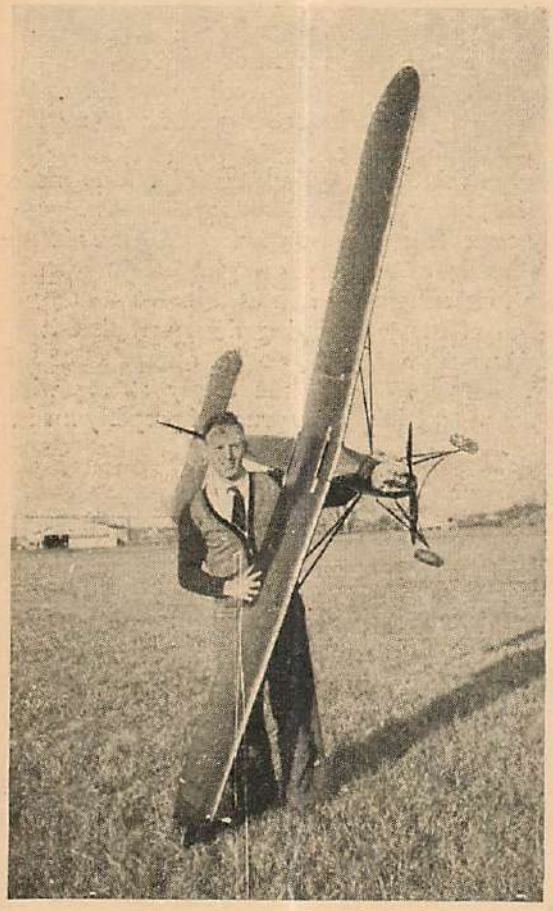
CONTROL SURFACE

Both rudder and elevator are made wholly of balsa with the exception of the main spars. Since each surface is in two parts, these spars are dual members which also support the hinges; they are built up of 1/4" square pine reinforcing 1/8" pine cut to the proper outline. The general constructional detail is indicated in the drawings.

A balanced rudder is used for no truly *(Turn to page 72)*

FLIGHT RECORDS AND CONTESTANTS IN COMPETITIONS.

model



Richard Kispert, Cincinnati, and 10-ft. radio-controlled gas job. Weight 8 lbs.; engine Forster.

Right—An unusually neat Stinson scale gas job built by Robert D. Hawkins, of Ashley, Indiana.

Below—An interesting stick by Robin Brown, of Purcell, Oklahoma, is held by Murrell Mitchell. Stick is diamond, wings gulled. Note stabilizer.

COMPETITION WITHOUT SPORTSMANSHIP. R. W. Pinckney, secretary of the Gas Model Aeronauts of Chicago, speaks his mind on a very vital topic:

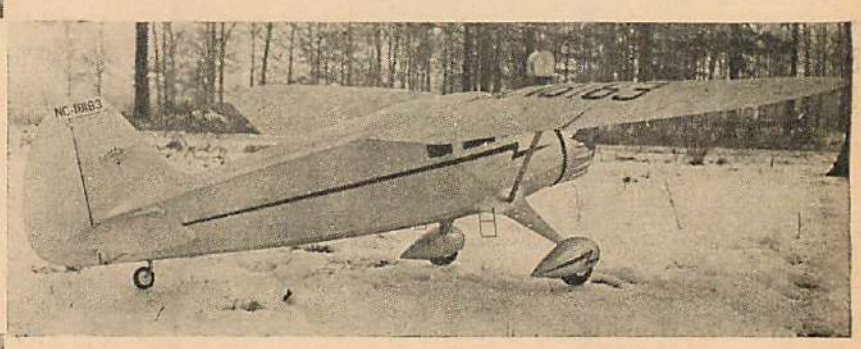
"Building Gas Models is a hobby—flying gas models is a sport.

"Without the sporting end it is doubtful whether model aviation would have grown in such rapid strides. Unfortunately, many evils have crept in and threaten to kill the tremendous popularity it now enjoys.

"The American modeler is suddenly realizing that contests are responsible to a great extent for keeping his hobby and sport alive, and that more attention should be paid to competition. Many a 'crockery-chaser' is guilty of sharp practices such as pushing on the take-off, weighing in with putty or heavy batteries, substituting wings—these and a dozen more stunts bearing out the well-known saying, 'It ain't the ship that counts, it's how you fly it.' Competition without sportsmanship dies overnight. It is no wonder the newly proposed N. A. A. rules brought a torrent of squawks because they handicap certain motors and ships and mean an unequal basis for competition.

"Some day the spirit of the golden rule will be applied to model rules, and at long last model planes will be constructed with confidence. Regulations will be strict and rigidly enforced as to wing loading, power loading, and motor run. In contests R. O. G. will mean rise-off-ground *unassisted*. There will be less delayed flights. Consistency will *mean* consistency. (Three flights of two minutes each still show more consistency than three flights of one minute, one minute, and four minutes.) Spot landings will be featured in special events along with payload and safety. Stress analysis will be required before permitting ships to fly.

"Just as soon as the circus stuff is taken out of gas-model flying



the sooner all will benefit, including big aviation. There is no reason why model airplanes should not or could not be a research laboratory for private, commercial and government aircraft."

And these opinions represent the sentiments of the Gas Model Aeronauts as a body. Furthermore, the club is backing them up with a program that calls for no prizes at all, or else some battered old mug that will call for considerable nerve on the part of the winner before he'll exhibit it publicly—let alone crack up three models trying to win it.

G. M. A. members are building their own flying field, which will include over a hundred acres devoted exclusively to model flying. The field will make it possible for them to fly as much and as often as they want to.

CHICAGO MODEL AIR SHOW. The Central Modelplane Society of Chicago will hold its Third Annual Air Show in the Exhibition Hall of the Hotel Sherman on April 26th, 27th and 28th. As in the

matters

CLUB NOTES AND NEWS OF MODEL ORGANIZATIONS.

previous shows there will be a complete exhibit from the manufacturers. The club will have on view about fifty of its own planes, including radio-controlled jobs, amphibians and bimotors. Prizes will be awarded the best noncommercial exhibits by vote of those attending.

Last year's attendance figure of twenty thousand is expected to be topped. All interested are cordially invited to exhibit or attend the show.

CONTEST CALENDAR. INDOOR RUBBER MEET. May 7th, Industrial Building, Syracuse, N. Y. Sponsored by Syracuse Model Airplane Club.

ANNUAL S. M. A. C. INVITATION MEET. May 14th, Syracuse, N. Y. Outdoor stick, fuselage and gas. N. A. A. rules. Prizes will be trophies, medals and merchandise. For entry blanks write to the Syracuse Model Airplane Club, 214 Hudson St., Syracuse, N. Y.

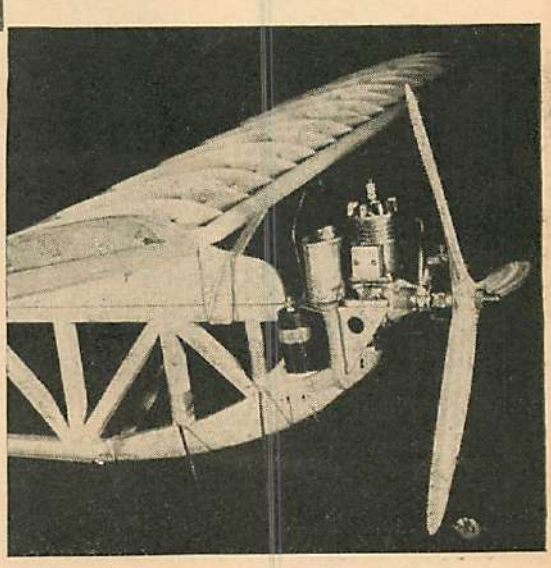
N. Y. STATE EXCHANGE CLUBS INVITATION MEET. May 28th, Sidney, N. Y. N. A. A. Sanction. Open to all modelers. Hand-launched stick and fuselage R. O. G. events for rubber; endurance and stunt events for gas. Thirty-six prizes, consisting of gas motors, gas-model kits, trophies, medals, totaling $250 in value. Local organizations and citizens will be hosts to contestants. Luncheons will be furnished. For entry blanks write to Harry C. Copeland, Director, Syracuse Model Airplane Club, 214 Hudson St., Syracuse, N. Y.

NEW JERSEY STATE RUBBER MODEL MEET. May 30th, Stiles Street Field, Linden, N. J. Sponsored by Linden Model Aircraft Club. Events include stick, fuselage and glider divisions, with events for out-of-State visitors. Prizes. Information from Linden Recreation Commission, Linden, N. J.

Above—From Oslo, Norway, comes this photo of Anre Haug Smith and his Cyclone-powered job.

Left—Another scale Stinson gas job. This one was built by F. Morrison, Des Plains, Illinois.

Below—The three-bladed propeller (see December, 1938, issue) used by W. D. Hay, Appleton, Wisconsin. He reports smoother operation.



NEW JERSEY STATE GAS MODEL MEET. July 29th, Hadley Field, South Plainfield, N. J. Sponsored by Linden Model Aircraft Club, N. A. A. rules. Events for out-of-State visitors, who are welcome. Prizes. Write Linden Recreation Commission, Linden, N. J.

THIRD ANNUAL GAS MODEL MEET. August 13th, Miller Field, Staten Island, N. Y. C. Sponsored by Richmond Model Flying Club. For further information write to the secretary, Charles Guarnien, 26 Bond St., Staten Island, N. Y.

SEVENTH ANNUAL OUTDOOR FLYING MEET. August 26th, Lebanon, Pa. Sponsored by Exchange Club. Complete schedule of outdoor events, both gas and rubber. Information from Contest Director, Lebanon Exchange Club.

Editor's Note: Additional meets listed further on.

STIX, BAER & FULLER. St. Louis has always been a stanch supporter and promoter of model aeronautics. From there have come quite a few of the nation's leading contest builders. *(Turn to page 68)*

NATIONALS

by LEO BAILEY

"The Old Stand-by" would best describe this design adopted by contest builders around Akron.

ANOTHER winning model has come from one of our best model centers of the country, Akron, Ohio. The Senior Fuselage model of Leo Bailey, which is a consistent winner, again shows Akron on top.

Because of the inherent flying qualities of this design, and its contest-winning tendencies, this model has become an old stand-by of the designers and others. Complete records of its flying prowess would be imposing—but too long. However, a good indication of the model's abilities can be recognized in the fact that besides taking first in the Senior Event at the '38 Nationals, with the second highest duration in its class, a copy of the original won first in the Scripps-Howard contest. In the same race the original took fifth place.

This model incorporates two features in design which at the present time are not very widespread. First, it has a moderately high-angle wing setting, and second, it has a rubber tensioning device which is exactly the same as Albert Judge used on his 1936 Wakefield Winner. Setting the wing at the angle of 4½ already puts it practically at the angle it will fly, and makes excessive down-thrust unnecessary. Using the rubber tensioner allows an excessively long motor without the necessity of a long, unwieldy and ugly fuselage.

FUSELAGE

The fuselage is of the cabin type and square-cornered.

Make a full-sized layout of the fuselage sides and pin the longerons of ⅛" square hard balsa to the drawing. Cement in the ⅛" square hard balsa braces and diagonals and also the fore and aft main cross-braces of ⅛ x ⅜" and ⅛ x ¼". Coat the joints liberally with cement. Build the other side of the fuselage on the first one, keeping a sheet of wax paper between both halves so that they will not stick together. Allow the cement to dry thoroughly—three hours should suffice—in order to be sure that the fuselage sides will not change shape. (Note that the boom is built attached to the fuselage in order to keep it lined up. It is removed after the fuselage is completely built, but not covered.) Remove the sides from the drawing and build the fuselage up by inserting the cross-pieces at the wing leading and trailing edges, top and bottom. After those joints have dried, cement in the nose and tail main cross-braces. The remainder of the cross-braces may be inserted after the glue holding the nose and tail cross-braces has set.

The next job is to make the nose and tail plugs. Cut the boom off and build the tail plug on it as shown in the drawing. Use care when constructing the nose plug. Its proper construction is important. Follow the dimensions given on the drawing carefully.

SENIOR FUSELAGE WINNER

The landing gear is made of bamboo. The struts make a V, the apex of which is at the double cross-piece at the top of the fuselage. Additional strength is obtained by binding the struts to the lower fuselage longerons with thread. Put the two-inch-diameter wheels in place after the glue holding the axles and struts has dried.

The landing-gear attachment was the last operation before covering. The fuselage should be covered with a good grade of tissue. Use banana oil to attach it to the longerons and cross-pieces. (You may use a double covering for additional strength.) After the fuselage is covered, spray the paper with water. After it is thoroughly dry, paint it with model dope. Spraying the papering with water insures a tight covering with a minimum of wrinkles. Doping increases the strength of the fuselage.

WING

The wing of this model is of the regular construction and is of the polyhedral type.

Make a template of the rib section of hard balsa and cut out twenty-seven ribs from 1/16" soft sheet balsa. The front spar is 1/8 x 3/8" medium-hard balsa, the rear spar is 1/8" square balsa. (Note that the spar slots in the ribs are deeper than the spars. They are made that way in order to keep a smooth surface after the wing is covered.) The leading edge is 1/8" square and the trailing edge is 1/8 x 1/2".

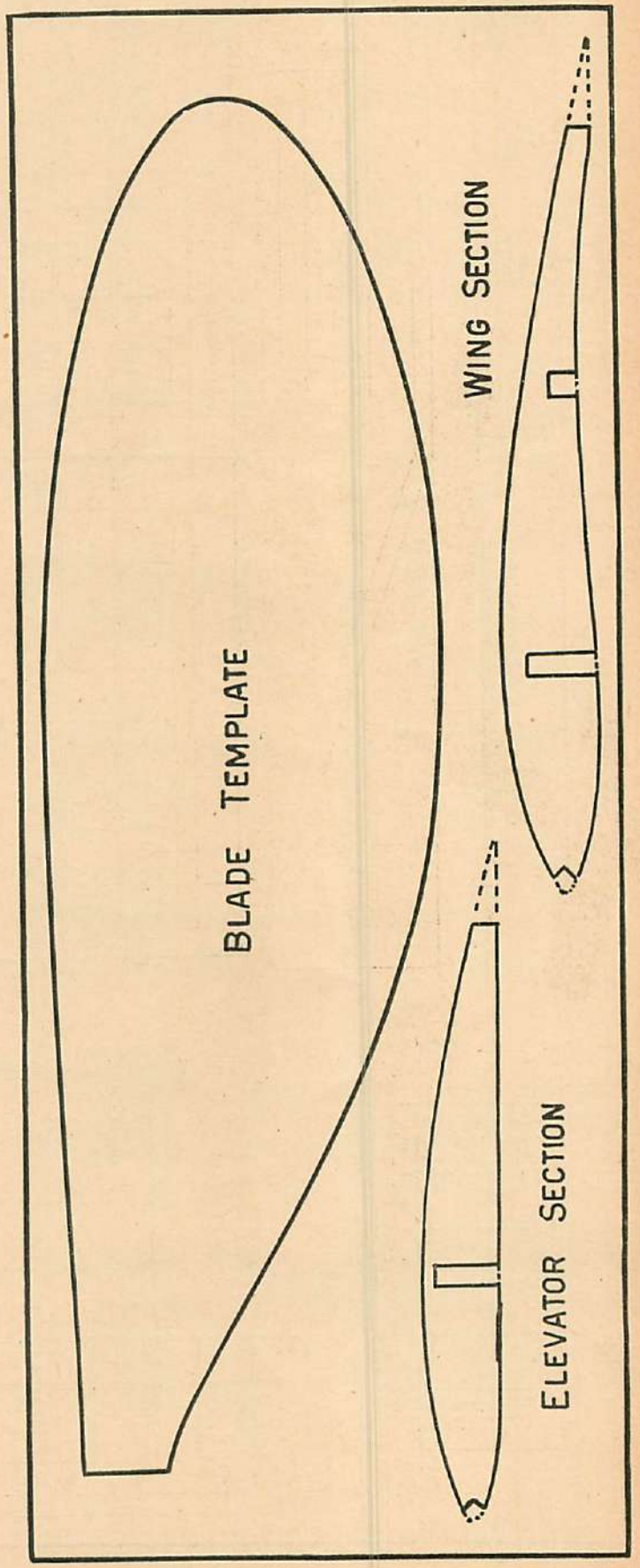
Lay the spars on the full-size drawing of the wing and cement the ribs in place. After the cement has dried, attach the leading and tapered trailing edges. The tips of the tapered 1/8" sheet balsa are then cemented into place. Cut the spars, and leading and trailing edges at such an angle that the proper dihedral of 5" under each tip is obtained. Then 1/32" thick sheet gussets should be cemented to each side of the main spar and trailing edge in order to increase the strength of the joints.

After all the cemented parts of the wing have thoroughly dried, cover it with a good grade tissue. The top side is usually covered first, as it is the more difficult. The paper should be sprayed with water to shrink it and give it a smoother, finished look. After the paper has shrunk, dope it with a thinned-out dope. Take extreme care that the paper does not stick to the spars, as a smooth section is desirable.

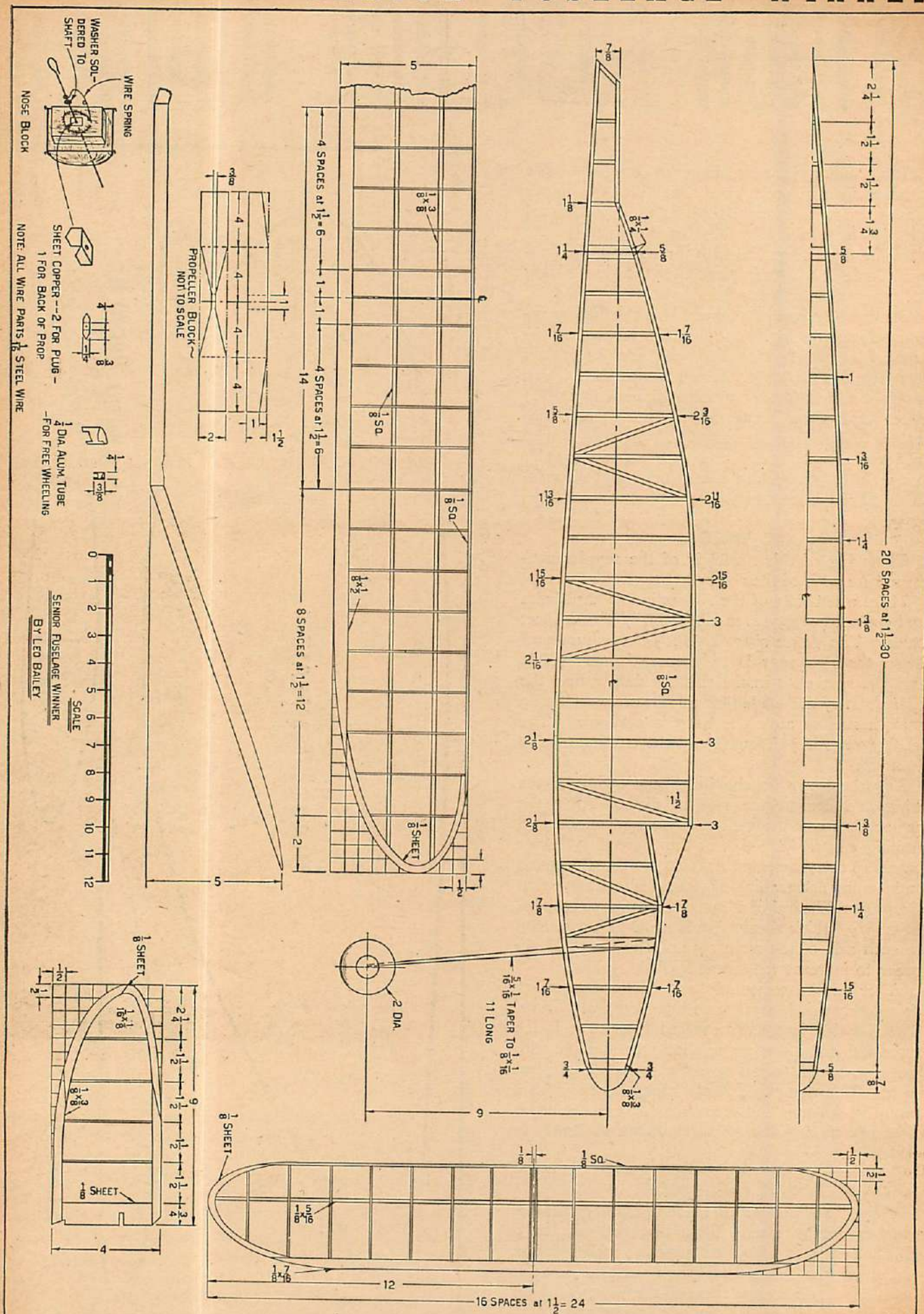
TAIL AND RUDDER

The tail and rudder are made in exactly the same manner as the wing. Note that the tail has a Clark Y type of airfoil, whereas the rudder is flat.

Cut out the sixteen tail ribs from the 1/16" soft balsa sheet and cement them to the 1/8 x 5/16" hard balsa spar. (Note that the center ribs are spaced 1/8" apart to hold the rudder rib *(Turn to page 67)*



NATIONALS SENIOR FUSELAGE WINNER



THE AMERICAN ZIPPER

by WALTER KAHN

Fun for the beginner or expert—a novelty in simple flying models.

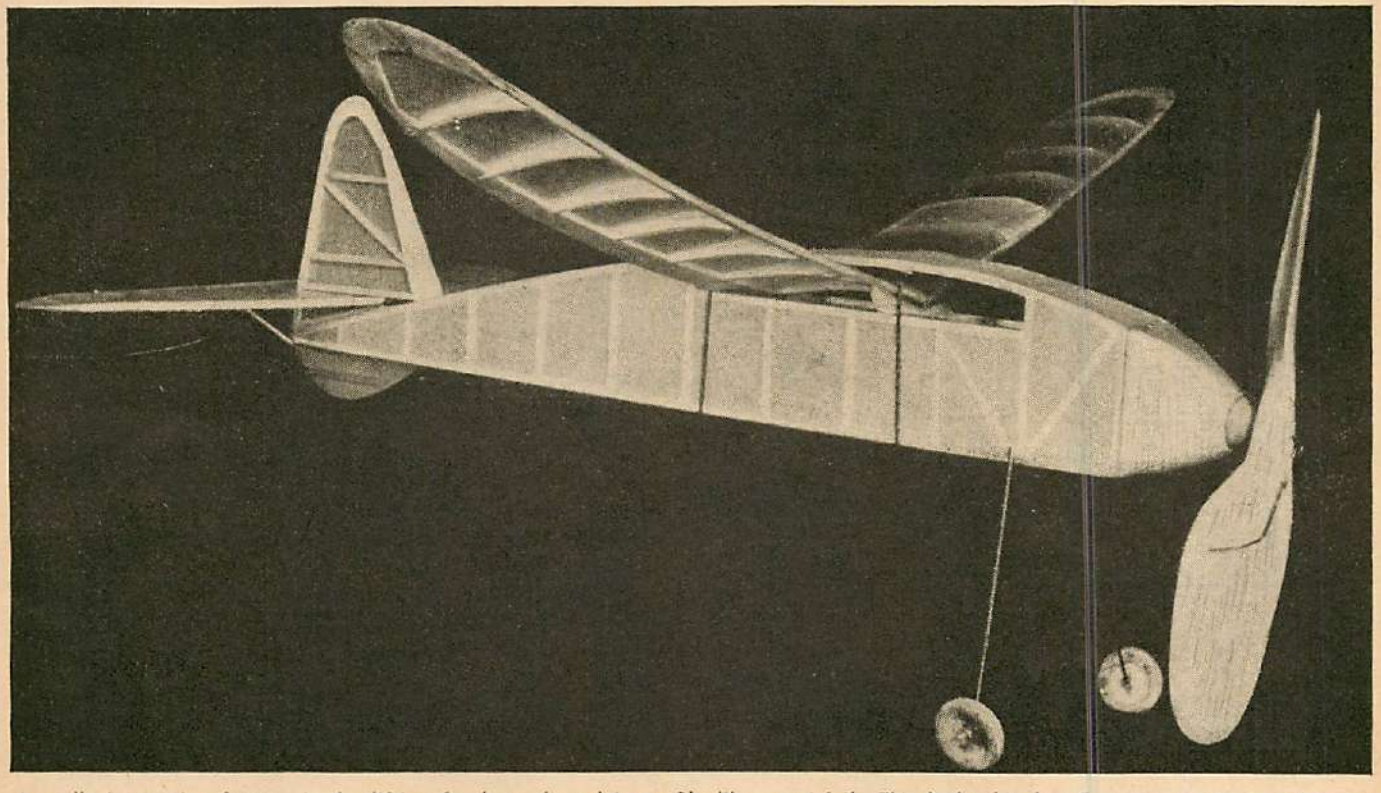
ALTHOUGH the American Zipper is comparatively small, it is unique in that it possesses the qualities of a contest ship. Its fast rate of climb and flat gliding angle are a combination always hoped for but seldom realized even from contest ships. On a calm day, without the aid of thermals, the model was clocked to the tune of one minute and thirty seconds. But let's dispense with the usual run of introduction and get right down to work.

With the exception of one half of both the wing and stabilizer, the plans shown on the following pages are full-size and complete. Since both sides of the wing and the stabilizer are constructed in one unit, it is first necessary to trace the side of the part shown to serve as a layout for the other side. As the plan is to be used as a jig, it is suggested that it be covered with translucent paper, preferably wax. This will prevent the parts from adhering to the plan.

FUSELAGE

The fuselage frame is constructed entirely of $^1/_{16}$" square stock. The sides are first made by laying out the fuselage on the plan and maintaining the members in position, until the cement sets, by small pins, placed at intervals along the fuselage outline. Care should be taken not to stick the pins through the members themselves. This, as is obvious, will weaken the entire structure. The amount of cement to use at each joint should be minimum. Too much cement will not only result in a sloppy job but will add unnecessary weight and weakness in the joints.

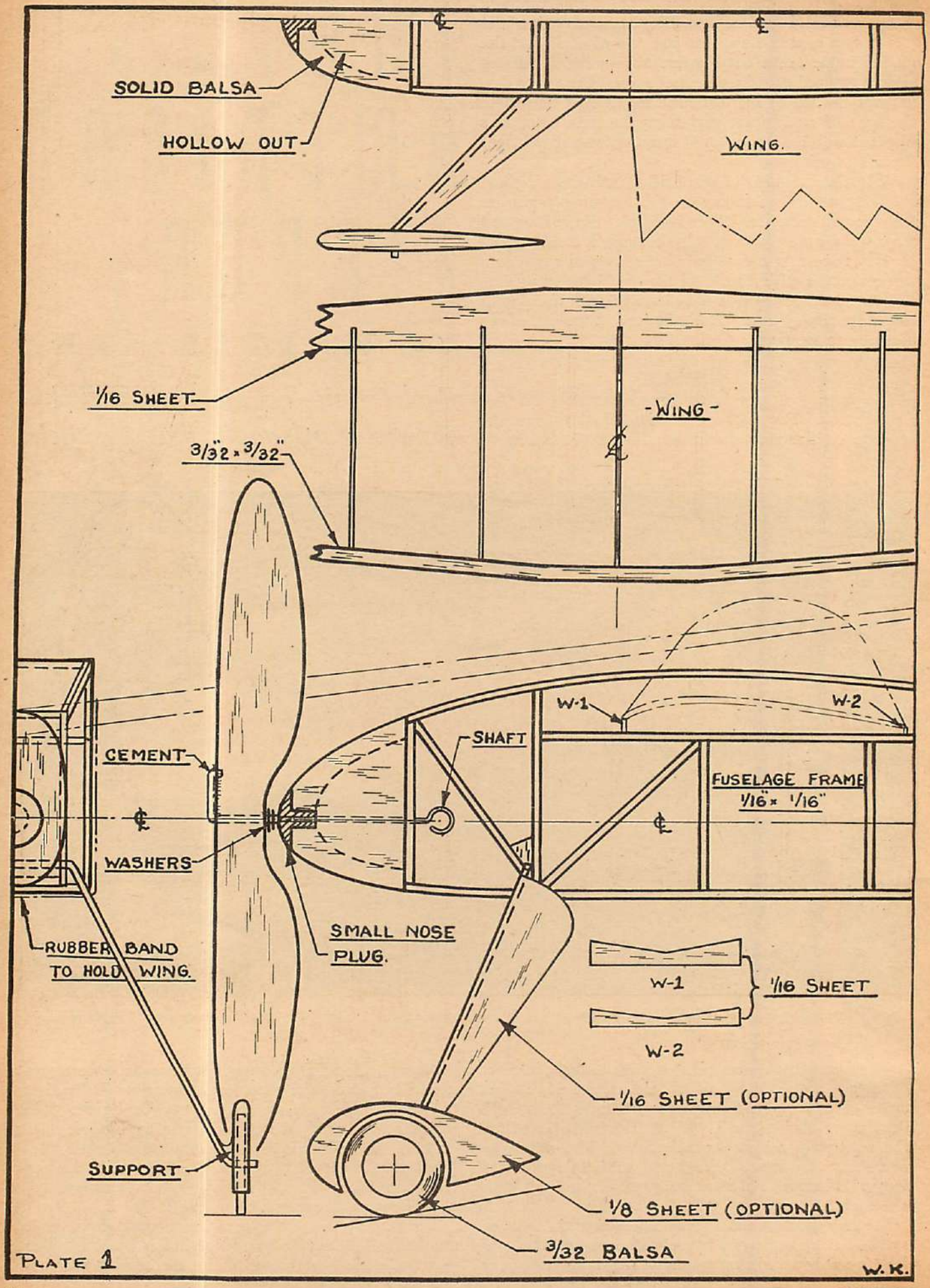
The two side frames of the fuselage may be made together, one on top the other and then cut apart, or else they may be made separately. In both cases it is imperative that they be exact.

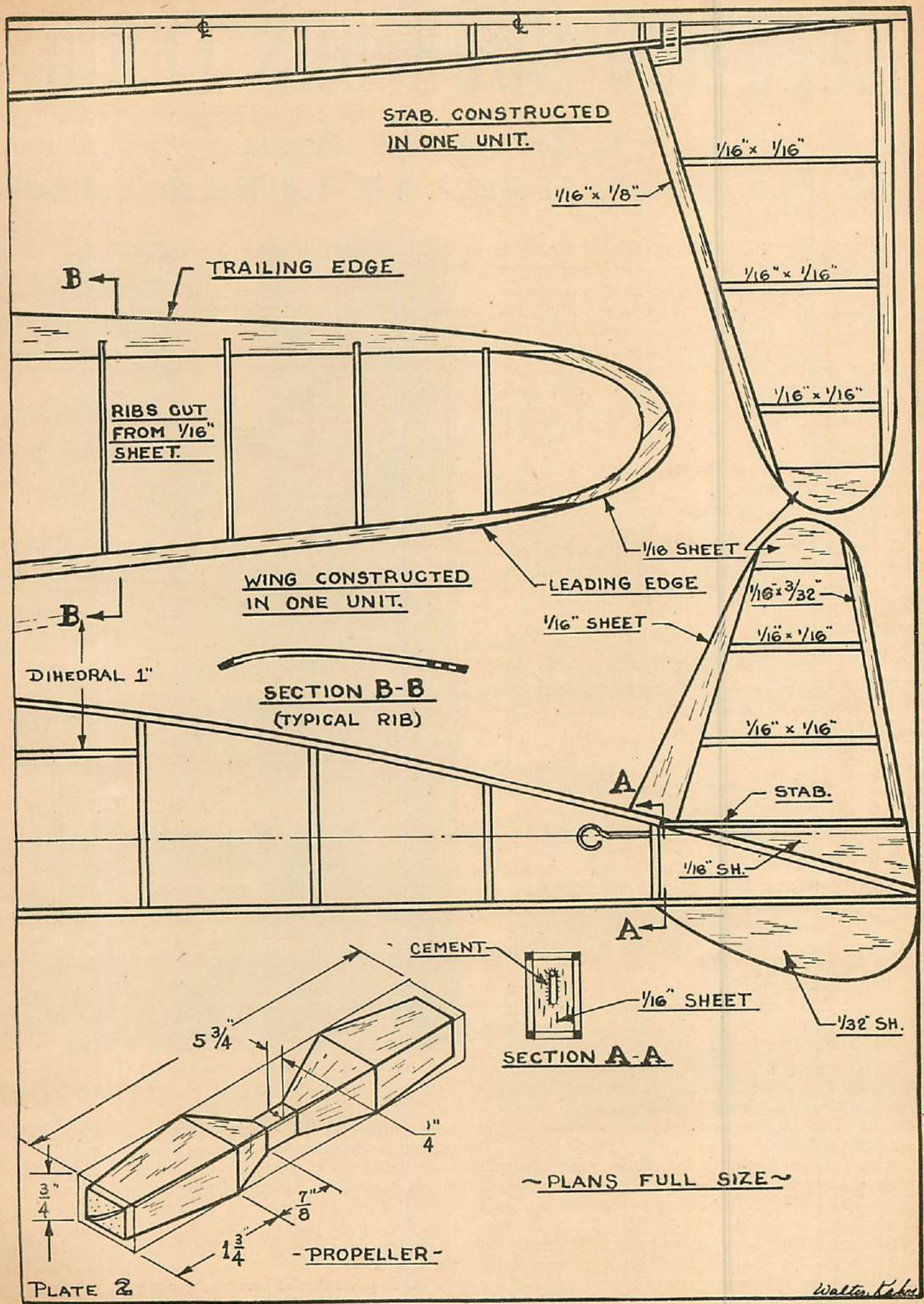


A really interesting feature is the lifting fuselage shaped in profile like an airfoil. This little ship has flown over 1:30 in calm air.

After the side frames have been formed they are connected by the top and bottom cross members. The sizes of these members are shown on the top half view. The nose block is next. It is carved from a very soft piece of balsa. The block is temporarily attached to the fuselage and thus carved to shape. It is then removed and the inside hollowed out. The nose of the block is cut to allow for a small nose plug as shown.

The landing gear is formed from #8 wire. It is attached to the fuselage by cement, and if desired further secured in place by thread. After the landing gear has set, the nose block is next cemented *(Turn to page 67)*


SOLID BALSA
HOLLOW OUT
WING.
1/16 SHEET
-WING-
3/32 x 3/32"
W-1
W-2
SHAFT
CEMENT
FUSELAGE FRAME
1/16" x 1/16"
WASHERS
SMALL NOSE PLUG.
RUBBER BAND TO HOLD WING.
W-1
1/16 SHEET
W-2
1/16 SHEET (OPTIONAL)
SUPPORT
1/8 SHEET (OPTIONAL)
3/32 BALSA
PLATE 1
W.K.


STAB. CONSTRUCTED IN ONE UNIT.
1/16" x 1/16"
1/16" x 1/8"
1/16" x 1/16"
1/16" x 1/16"
B
TRAILING EDGE
RIBS CUT FROM 1/16" SHEET.
1/16 SHEET
LEADING EDGE
WING CONSTRUCTED IN ONE UNIT.
1/16" x 3/32"
1/16" SHEET
1/16" x 1/16"
B
DIHEDRAL 1"
SECTION B-B
(TYPICAL RIB)
1/16" x 1/16"
A
STAB.
1/16" SH.
A
CEMENT
1/16" SHEET
1/32" SH.
SECTION A-A
5 3/4"
1/4"
3/4"
7/8"
1 3/4"
-PROPELLER-
~PLANS FULL SIZE~
PLATE 2
Walter Kabo

SELECTING YOUR GAS ENGINE

Are you confused by the new gas rules? Do you really know just which engine you should purchase? **by IRWIN POLK**

A TWO-STROKE-CYCLE engine is one which completes the admission of fuel vapor and air mixture, compression of mixture, combustion of mixture and the expelling of the burned mixture in two strokes of the piston or one revolution of the crankshaft. To model builders these engines are a source of constant power and a means through which their experiments in aëronautics can be carried on to a more advanced stage. While being the greatest boon to model aëronautics they are also its biggest arm ache.

The development of the miniature gas engines market has been so rapid that almost every month brings forth a new motor, thereby making a choice more difficult.

You should first decide whether you want to build large or small models. If small, then how small? In order to reach a satisfactory decision let us analyze the new National Aëronautic Association Power Model Rules which divide power models into four distinct classes:

Class A. Models having a wing area up to 225 square inches. These models must use engines having up to and including .20-cubic-inch displacement.

Class B. Models having 226 to 450 square inches of wing area. These models must use engines having up to and including .30-cubic-inch displacement.

Class C. Models having 451 square inches of wing area and over. These models must be powered with engines having up to and not over 1.25-cubic-inch displacement.

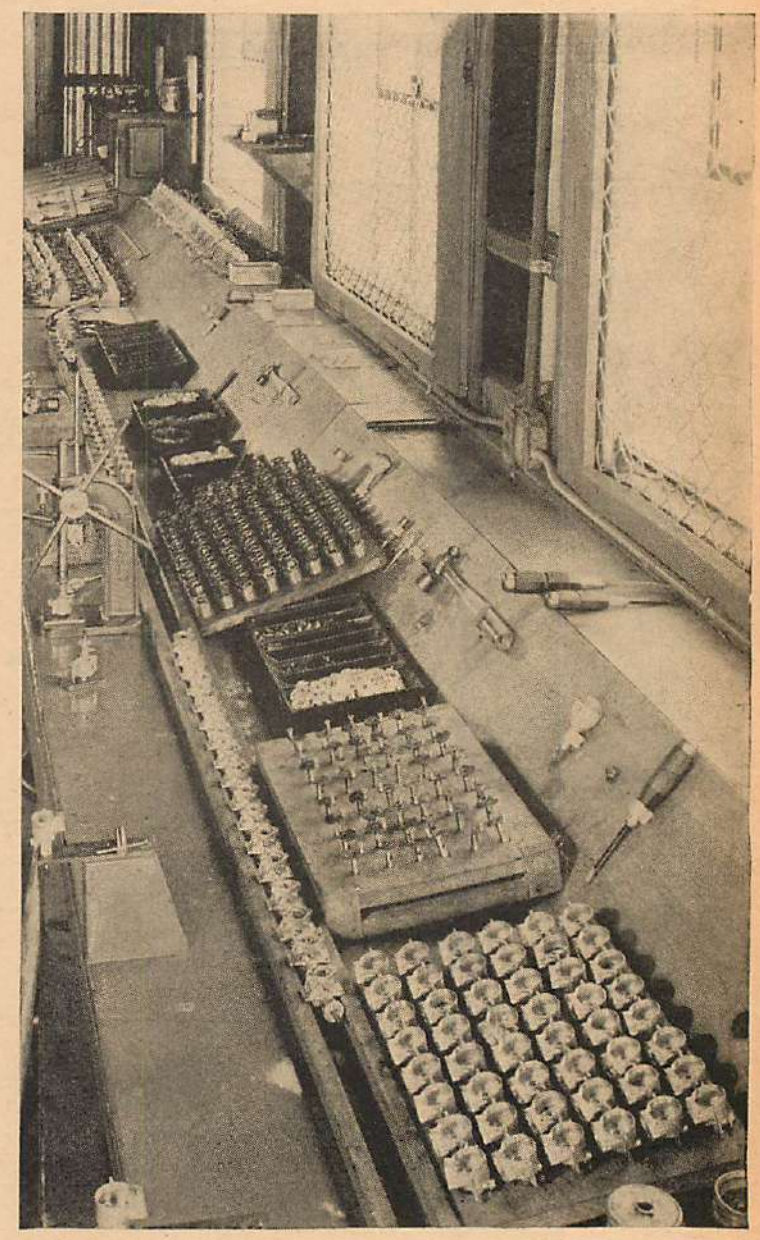
Open Class Models. These are of any wing area and any engine power providing they conform to the general Power Model Rules.

Models in all classes have to conform to the following rules: In official contests the motor run must be no greater than twenty seconds from the instant the model rises off the ground. Models must weigh at least eight ounces per square foot of wing area. They must conform to the N. A. A. fuselage cross-section rule and their total weight must not exceed seven pounds. The winning time shall be the average of the three official flights.

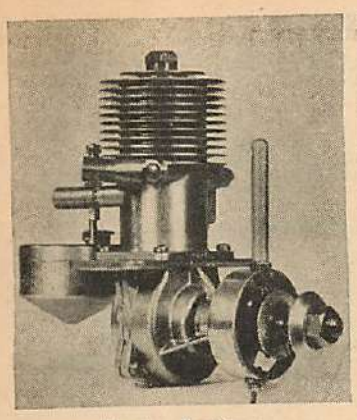
Regardless of whether it is your intention to fly in competition or not, you might as well build within a specific class. (Just in case your model turns out good anyway.)

Take your Class A engines and ships. If you live in a city, if you have no car and if you are cramped for working space at home, you will want to build a Class A ship. Aside from being small, comparatively easy to build, models in this class are very economical, costing hardly more than a rubber model to build. We know builders who are able to turn out a Class A model in one week's spare time. If you contemplate working in this division you are not going to be able to save money on your power plant, since the small engines themselves are more costly to build. The saving lies in the small ship.

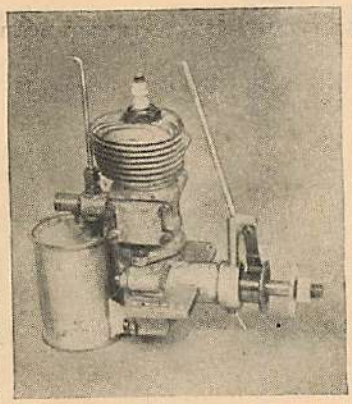
Bear in mind that at present there are not very many kits on the market for A engines, though some of the



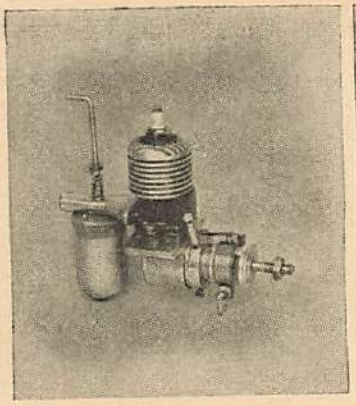
Cyclone assembly line, crankcases, foreground, to finished engines.



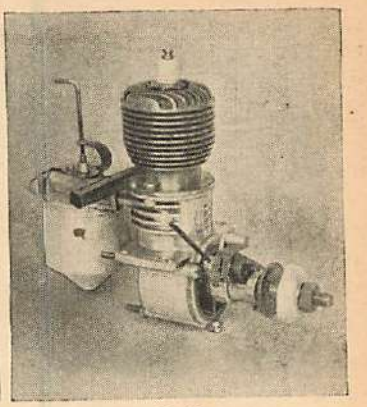
Forster Brothers



Dennymite



Trojan



O. K.

B model kits may be used successfully. The day is not far off when kit manufacturers will see the practicability of a model which can be cheaply built in a short time, tucked under the arm and taken in a trolley car or subway to the nearest open space. And where a crack-up or washout will not mean weeks and months of work to repair the damage.

CLASS A ENGINES

Elf. Of the following A engines, the Elf was probably the first on the market, and is the only model aircraft engine having a double bearing crankshaft and a float carburetor. This tiny power plant also boasts a fully inclosed automobile-type timer located in the back of the crankcase. Its 1½ volt coil is, without a doubt, among the highest rated ignition units on the market. Its sand-cast aluminum cylinder is precision-fitted with a thin steel liner. It is purposely made a trifle heavier, thereby making possible practically vibrationless operation.

Bantam. The Bantam is the latest addition in the Class A family. It is considered by many as the most beautifully made model engine. It, like the Elf, uses a steel liner within an aluminum sandcasting. The Bantam has specially treated mounting flanges which in case of a severe crack-up have a tendency to bend rather than snap off.

Brat. The Brat was the first engine in this class to be put out on a production basis. It has a steel cylinder with an aluminum head. The crankcases now come through die-cast of #212 Alco aluminum. This alloy being an excellent bearing material, no other bearing is used. The connecting rod is made of Hi-Speed bronze. The latest Brats are coming through with two piston rings.

Bee. The Bee, considerably improved over the original, now has a Chapmanized steel pistol and is a lapped job. Chapmanizing provides an extremely hardened surface which insures long wear. This engine is really put out on a large production basis. The timer is of the type used on the Ace engine which is also manufactured by Syncro Devices. It has a split-type crankcase which is held together by means of four bolts making possible economic replacement of the front portion which contains the bearing. The engine may easily be inverted by loosening the lock nut at the intake manifold.

Kaydet-Chunn. The Kaydet is apparently the Chunn being manufactured by a different firm at a lower price. The by-pass and intake in this engine are cast integrally with the cylinder. It has a swipe-type timer.

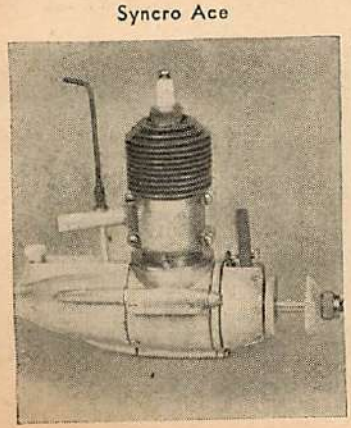
Condor. The Condor is a very high-compression engine but it has not as yet made a mark for itself. The crankcase is apparently cast in a permanent mold and it has an original timer, as you will note from the photo. Its permanently fixed exhaust manifold makes for cleaner operation. This engine has a tiny screen at the intake manifold and in the gas line which prevents any dirt or grit getting into the cylinder with the gas or air.

Husky. The Husky is now radically different than when originally presented, as you will note by comparing the photographs. The new one, considerably lighter, has a new inclosed timer.

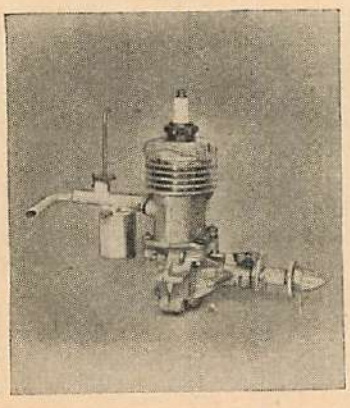
Pee Wee. The Pee Wee has a cast-iron cylinder and piston. Those being shipped now have a slightly larger bore and stroke, and deliver more power. The original engine was ½ x ½".

Madewell Mite-Wasp. The only difference between the Madewell Mite and the Wasp is that the by-pass and intake manifolds on the Mite are bolted *(Turn to page 76)*

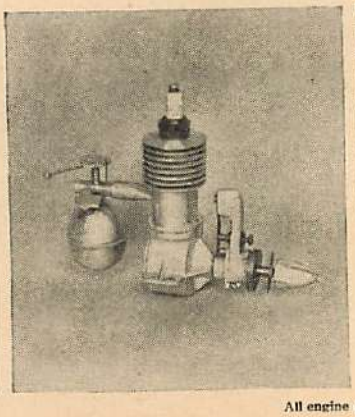
Syncro Ace



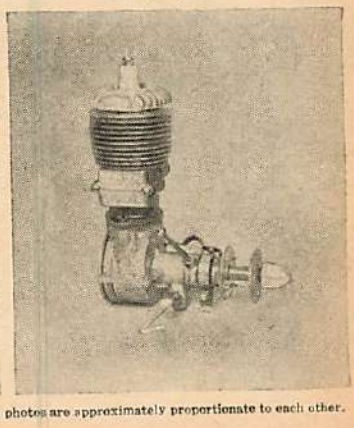
Husky Jr.



M & M

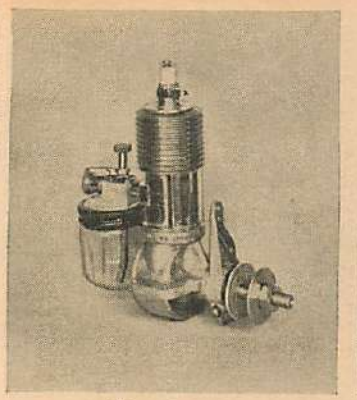


Baby Cyclone

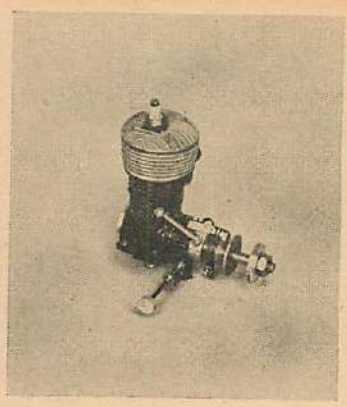


All engine photos are approximately proportionate to each other.

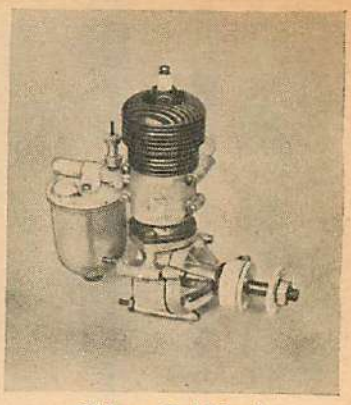
New Husky



New Brown



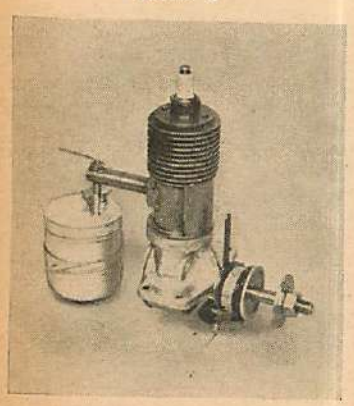
Hi-Speed



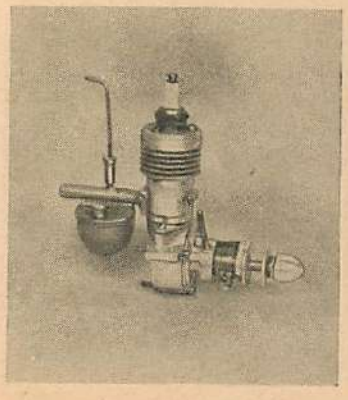
Ohlsson Gold Seal

	NAME	LIST PRICE	BORE & STROKE	DISPLACEMENT	TYPE CYCLES	PORTS	WEIGHT INCL. GAS TANK	PISTON TYPE
C	BROWN "B"	21.50	7/8 × 1"	.6 cu.	2	4	7oz.·400 Gr.	LAP
C	BROWN "D"	10.00	7/8 × 1"	.6	2	4	7oz. 383 Gr.	2 RINGS
C	BROWN "NEW" 13/D	12.50	7/8 × 1"	.6	2	4	7oz. 383 Gr.	LAP - 2 RINGS
A	BANTAM	16.50	19/32 × 19/32"	.165	2	3	3oz. 100 Gr.	2 RINGS
A	BRAT	16.50	9/16 × 5/8	.155	2	4	3oz. 253 Gr.	LAP
A	KAYDET	12.50	5/8 × 17/32	.163	2	4	4oz. 30 Gr	LAP
A	CONDOR "MIDGET"	18.50	5/8 × 19/32	.18	2	4	3oz. 383 Gr.	LAP
C	CYCLONE "BABY"	9.00	3/4 × 13/16	.368	2	3 ROTARY VALVE CRANKS	7oz. 359 Gr.	LAP
C	DENNYMITE	17.95	9/10 × 9/10	.57	2	4	10oz. 230 Gr.	LAP
A	ELF	21.50	34/64 × 19/32	.156	2	4	4oz. 60 Gr.	3 RINGS
C	FORSTER "B"	17.75	1 1/16 × 1 1/8	.989	2	4	14 oz.	2 RINGS
C	GWIN AERO	12.00	7/8 × 13/16	.487	2	4	8oz. 240 Gr.	2 RINGS
B	HIGH SPEED	12.75	3/4 × 5/8	.275	2	2 ROTARY VALVE CRANKS	4oz. 328 Gr.	LAP
A	HUSKY Jr.	12.50	5/8 × 5/8	.19	2	4	5oz. 58 Gr.	1 RING
A	HUSKY "NEW"	12.50	5/8 × 5/8	.19	2	4	3oz. 218 Gr.	LAP
A	MADEWELL	17.50	9/16 × 19/32	.146	2	4	4oz. 392 Gr.	LAP
B	M & M	17.50	43/64 × 11/16	.246	2	4	4oz. 362 Gr	LAP
C	OHLSSON "GOLD SEAL"	18.50	7/8 × 15/16	.562	2	4	9oz. 128 Gr	LAP
B	OHLSSON "23"	16.50	11/16 × 39/64	.23	2	3	5 oz.	LAP
C	O-K	21.50	9/10 × 1"	.635	2	3	10oz. 212 Gr	3 RINGS
A	PEE WEE	14.50	9/16 × 9/16	.138	2	4	5oz. 327 Gr.	2 RINGS
C	SYNCRO "ACE"	13.75	7/8 × 15/16	.562	2	4	11oz. 292 Gr.	2 RINGS
A	SYNCRO "BEE"	12.50	1/2 × 5/8	.122	2	4	4oz. 35 Gr.	LAP
A	TROJAN "Jr."	18.50	5/8 × 5/8	.19	2	3	4 oz.	LAP
A	WASP	14.95	9/16 × 19/32	.146	2	4	4 oz. 278 Gr.	LAP

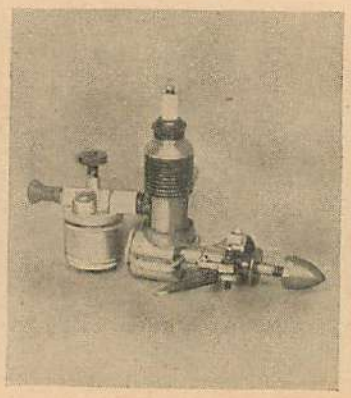
Brown D



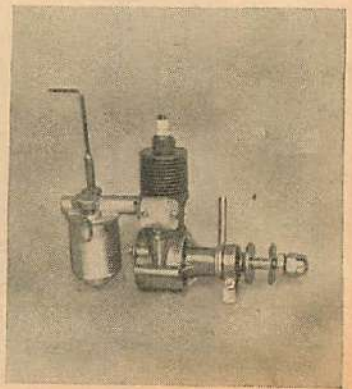
Madewell

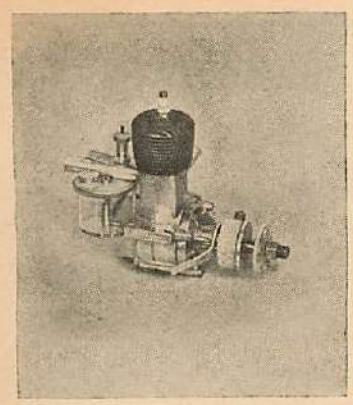


Condor



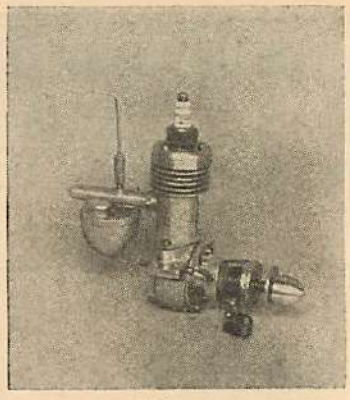
Pee Wee



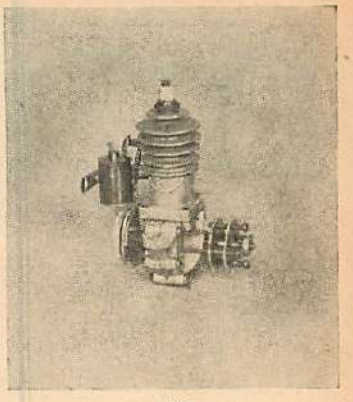


Ohlsson "23"

Syncro Bee



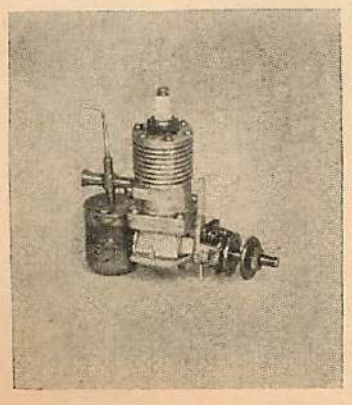
Wasp



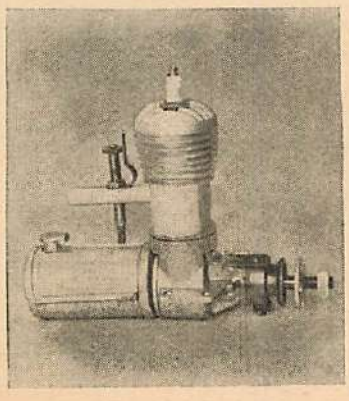
Elf

PLUG	MOUNTING	FUEL & OIL MIX.	TEST BLOCK	RECOMMENDED PROPELLER	SPARK COIL	CON-DENSER	REVERS-IBLE	INVERT-IBLE
BROWN	BEAM	3-1 SAE 70	YES	14" DIA. 8½" P.	BROWN	.1 MFD.	YES	YES
BROWN	BEAM	3-1 SAE 70	NO	14" DIA. 8½" P.	BROWN	.1 MFD.	YES	YES
BROWN	BEAM	3-1 SAE 70	YES-NO	14" DIA. 8½" P.	BROWN	.1 MFD.	YES	YES
CHAMPION-V2	BEAM	3-1 SAE 70	YES	11" DIA.	SMITH-3V	.05 MFD.	YES	YES
SPECIAL	BEAM	3-1 SAE 70	YES	9" DIA.	SMITH-3V	.1 MFD.	YES	YES
CHAMPION-V1	BEAM	3-1,4-1 SAE 70	YES	10-12" DIA 6-7" P.	SPECIAL	.006 MFD.	NO	YES
CHAMPION-V	BEAM		YES	3 BLADE SPECIAL	SPECIAL "SEVISON"	IN COIL	YES	YES
A-C	BEAM	3-1,4-1 SAE 70	YES ENGINE MOUNT	12¾" DIA. 8" P.	SMITH-3V	.1 MFD.	NO	YES
CHAMPION-V	BEAM	3-1 SAE 70	NO	13-13½" DIA.	SPECIAL 3V	.1 MFD.	NO	YES
CHAMPION-ELF	BEAM	8-1 SAE 60	YES	12" DIA. SUPPLIED	SPECIAL ELF 1½V	.03 MFD	NO	YES
CHAMPION-V	BEAM or RADIAL	15-1 SAE 70	NO	16-18" DIA.	FORSTER 3V	.1 MFD	YES	YES
CHAMPION-V	BEAM	2-1 SAE 70	NO	12" DIA.	SPECIAL 3V	.25 MFD	YES	YES
CHAMPION-V2	BEAM	3-1 SAE 70	YES	12" DIA. 8" P.	SMITH 3V	.1 MFD	NO	YES
CHAMPION-V	BEAM	4-1 SAE 70	YES	11" DIA	SMITH 3V	.1 MFD	NO	YES
CHAMPION-V2	BEAM	3-1 SAE 70	YES	12" DIA	SMITH 1½V	.05 MFD	YES	YES
CHAMPION-V	BEAM or RADIAL	3-1 SAE 70	YES	12" DIA	SMITH 1½V	.05 MFD	YES	YES
CHAMPION-V	BEAM	3-1,5-1 SAE 70	YES	10½-12" DIA	M&M 3V	.1 MFD	YES	YES
CHAMPION-V	BEAM or RADIAL	3-1 SAE 70	NO	14" DIA	SMITH 3V	.05 MFD	NO	YES
CHAMPION-V2	BEAM or RADIAL	2-1 SAE 70	NO		SMITH 3V	.05 MFD	NO	YES
A-C	BEAM or RADIAL	3½-1, 6-1 SAE 70	YES	9-11" DIA.	SMITH 3V	.1 MFD	YES	YES
CHAMPION-V2	BEAM	3-1, 4-1 SAE 70	YES	9-10" DIA.	SMITH 3V	.1 MFD	YES	YES
CHAMPION-V	BEAM	4-1 SAE 70	NO	12-16" DIA.	SYNCRO 3V	.1 MFD	YES	YES
CHAMPION-V2	BEAM or RADIAL	4-1, 50-60 SAE	NO	9-10" DIA	SUPER LITE 3V	.05 MFD	YES	YES
CHAMPION-V2	BEAM	4-1 SAE 70	YES	9-10" DIA	SMITH 3V	.1 MFD	NO	YES
CHAMPION-V	BEAM or RADIAL	3-1 SAE 70	NO	9-10" DIA	SMITH 1½V	.1 MFD	YES	YES

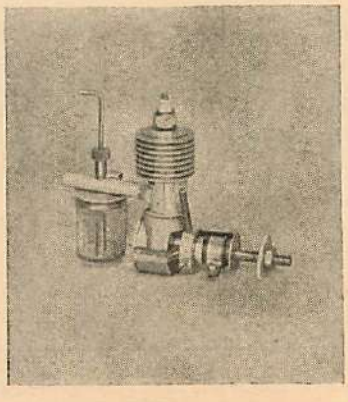
Kaydet



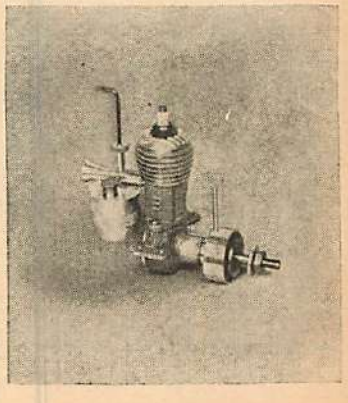
Gwin Aero



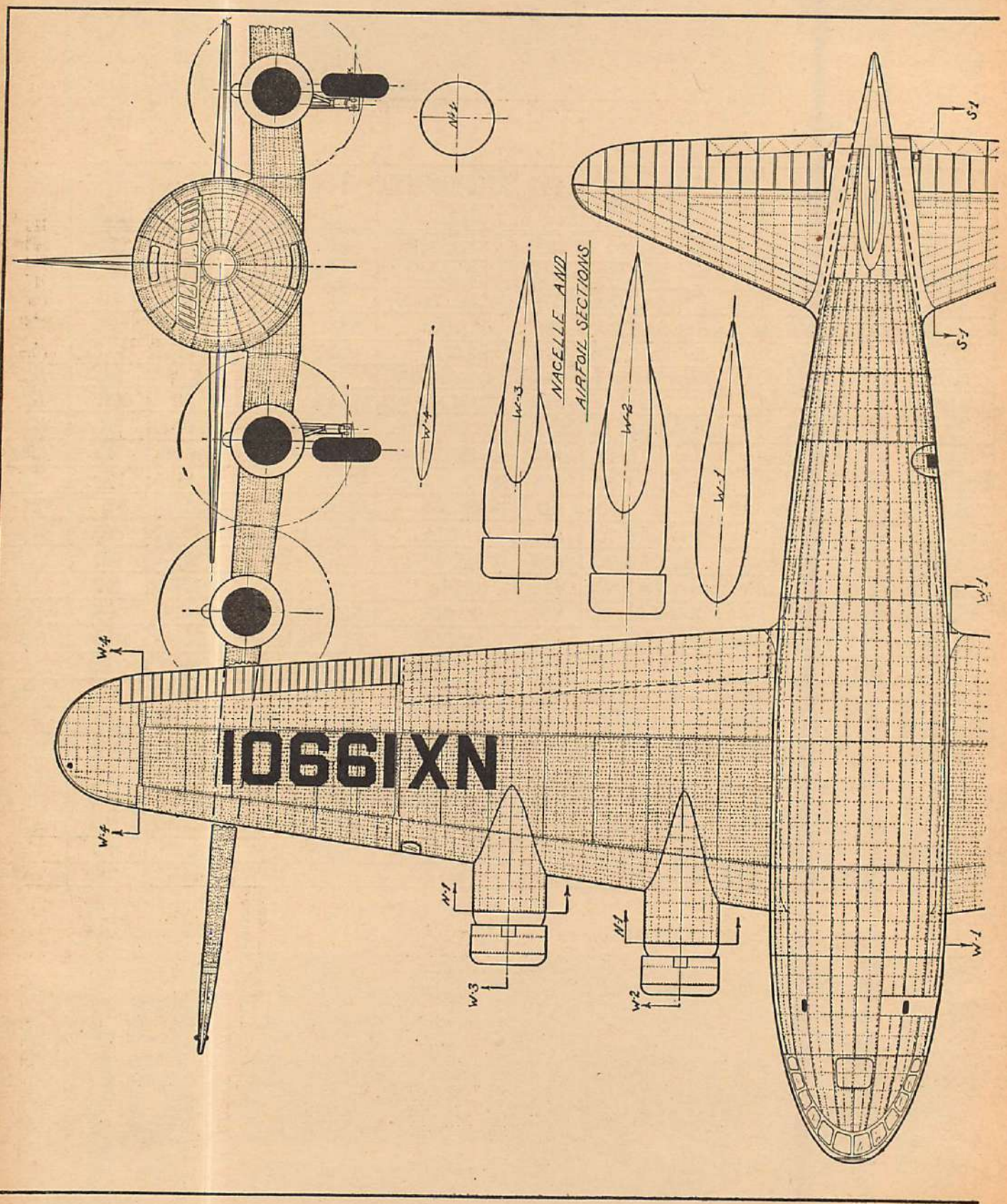
Brat



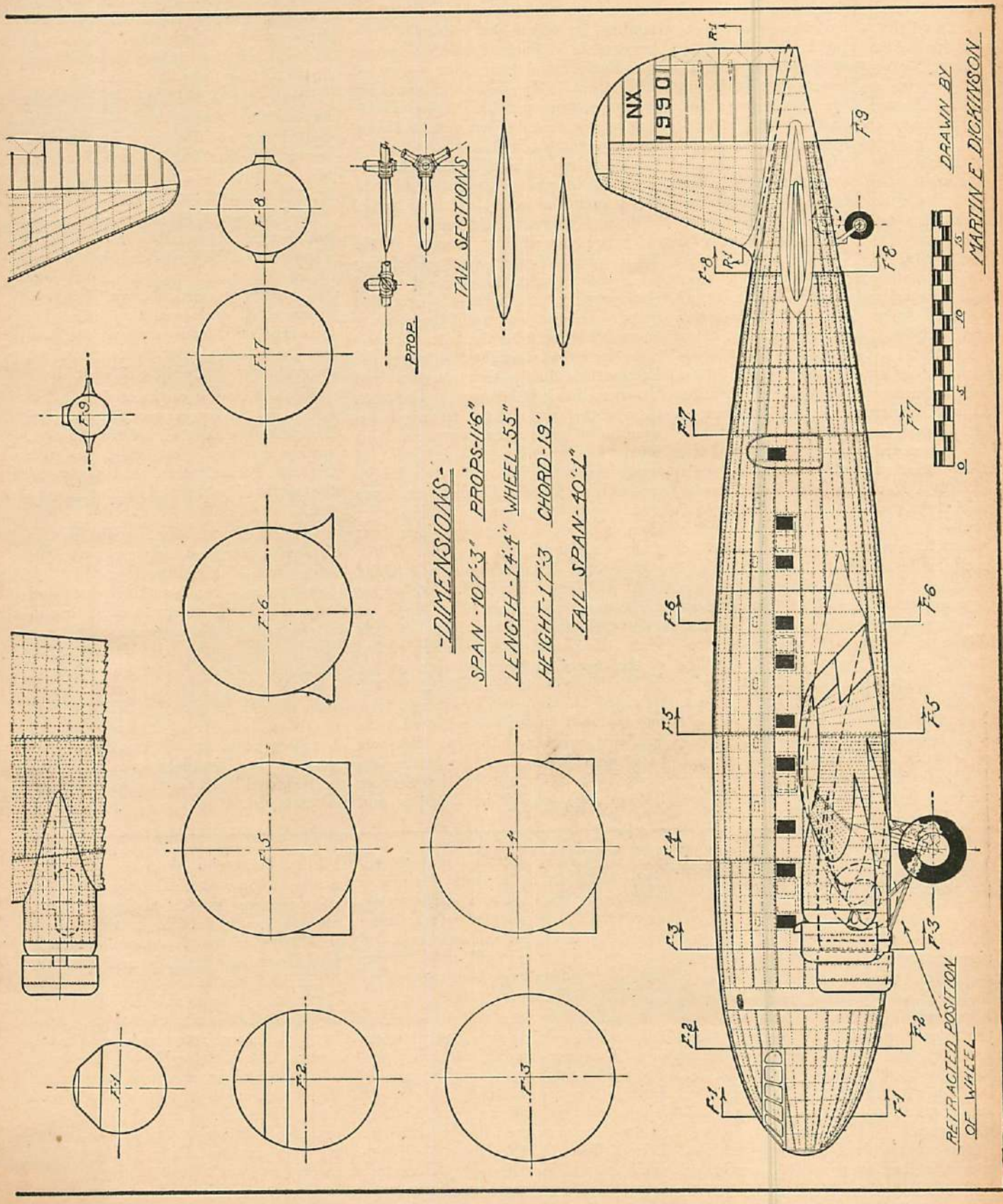
Bantam



THE BOEING STRATOLINER



the latest set of technical detail drawings made exclusively for Air Trails by MARTIN E. DICKINSON



ALL THE THRILLS ARE NOT FOR THE PILOT

(Continued from page 7)

and just about everything else in Chicago during the next three years. When he finished the course he was getting free tuition for teaching a class, two free meals a day for working in a cafeteria during lunch hour, making five dollars a week as ticket taker in a theater, doing odd jobs of painting for an advertising agency, and getting free room rent by sleeping in an undertaking parlor at night. It was those three years that gave Knight such a true perspective.

With a hundred dollars in his pocket he stormed New York. For a time he worked for what he terms a "firm." The firm was a meal ticket but Knight was looking for a career, so he became a free lance and was very well pleased with the results.

War clouds were looming black over this country and months before it was declared Knight decided that if it was coming he wanted to go, and most of all he wanted to go as a flier. The government, or somebody, had different ideas. In the business of getting an education in art Clayton Knight had forgotten to get a degree attached to his name, and the government, or somebody, had the theory that without at least two years in college it was impossible for a man to fly. So he kept up his free-lancing and continued to bombard Washington with letters anent his desire to join the army as an aviator.

When he had just about given up hope and had worked his art business up to where it was paying him a thousand dollars a month, the government relented, and he found himself drawing thirty dollars a month at Austin, Texas, which was about as far away from New York as they could send him.

Between drill periods, picking cigarette butts off the parade ground and doing other odd jobs that were deemed necessary in the making of a good soldier, he managed to get in a bit of study. He passed among the first ten of his class and as a signal reward was one of the first to be sent to Europe. His orders were that he was to go to Italy with a certain Captain LaGuardia. Someone fumbled the orders and instead of Italy he was held in England, where he cursed the English and everything connected with them. He went through their ground schools and their flying schools and by the time he was sent to France as a replacement for the 206th Observation Squadron, flying D.H.9s, he had decided the English were just about the finest group of men he'd ever mixed with, and he still thinks so.

There followed four months of the hardest kind of work any type of flier was called upon to do, observation and photographic. No fighting. They had guns, three of them, two for the observer and one fixed gun for the pilot, but their orders were not to fight but to get the information, fulfill their mission and then run like hell for home. The trouble was that some of the German ships were faster, so between them he and his observer managed to get in a bit of scrapping on the side, and were officially credited with two German machines shot down, without ever getting more than a few holes through their own plane. That's flying.

October 5, 1918, while on a bombing flight with nine other D.H.9s, his motor misbehaved and four of a flight of twenty Germans picked him for their meat. He and his observer disabled two of the enemy, and they in turn set fire to his ship with tracer bullets. Knight managed to stamp out the flames, then he was shot through the leg with an explosive bullet and the gas tank was punctured. He managed to set the ship down in a field next to the German headquarters, ended in a ditch and turned over. The observer tried to set fire to the plane but the German soldiers got there first.

Clayton Knight was probably the only allied flier to take much of his baggage with him into Germany. His home airdrome was being moved at the time, so he had loaded everything he could pack in his kit bag into the plane.

Shortly after the Armistice, Knight returned to France, and then to the United States. He says the Germans treated him fine, but it was hell to have his own squadrons fly over and bomb his billet almost every night.

Back home and off his crutches, Clayton Knight returned to his painting. Then he met Elliot White Springs, one of his War-time buddies, and Springs had written an aviation story. Knight illustrated it, and from that point has advanced until he is not only the top-flight aviation painter in America, but an authority on aviation in general.

Aviation owes a great deal to Clayton Knight for having preserved so many of the striking events of aviation in war. In his syndicated art strip, he, with Captain Rickenbacker, has portrayed the stories of aviation's heroes in pictures.

Clayton Knight still flies, but mostly as a passenger, and his pencils are ever busy doing sketches from life and jotting down notes. He has flown over and painted scenes of most of the air lines in North and South America. Whatever else he does his heart is still with aviation. He fills an important niche in aviation that would have been impossible had he remained an integral part of it. With his paintings and books he has done more for aëronautical science than he could possibly have done had he remained in the service as a pilot or an executive.

Medium Bombers

(Continued from page 22)

dred of them have been delivered to the army to date. Model 166 is one of the air corps' present standard medium bombers. It is powered with two 1,050 horsepower P&W Twin Wasps and carries a useful load of 5,302 pounds. The maximum speed is 255 miles per hour, with a cruising range of 2,000 miles. The 166 carries a crew of four or five and is armed with three defensive machine guns.

Another standard air corps middleweight is the Douglas B-18, a military version of the famous DC-2 transport. The prototype of this model won the army bomber competition in 1936, together with an initial order for ninety machines. The latest variation, designated B-18A, is provided with a redesigned bomber's post and new front and rear gun turrets. In all, 250 Douglas medium bombers have been ordered by the United States army.

A quick look here and there seems indicated in order to round out this survey. Excellent bombers are being produced by some of the smaller powers. Holland has several good Fokkers and Koolhovens. The newer Polish P. Z. L. fighter-bombers are highly efficient. Prior to Munich, Czechoslovakia developed a number of high-performance ships, as did Roumania and Yugoslavia. The result of German influence on the aviation industries of these powers remains to be seen. The Scandinavian countries are fast developing domestic aircraft production. Up to the present time, however, they have favored foreign models, mainly English and German. Japan and Russia have similar inclinations. The Mikado's air force has been buying manufacturing rights and planes from Germany, Italy and the United States. The Soviet evidently believes in buying American, as she is reported to be commencing large-scale production of Vultee, Martin and Boeing B-17 bombers. If imitation is, as the old saying goes, the sincerest flattery, I guess old Uncle Sam won't have to worry about the quality of his fighting planes for a while, anyway.

TEST PILOT TEST

(Continued from page 16)

not do a spin test. And so it goes. One man's meat is the big multimotored ships, while the next one may be in his glory diving and cavorting around the skies in a powerful single-seater fighting plane. That is why the manufacturer who has a test job submits to the insurance company a list of test pilots who are satisfactory to them.

The insurance company knows test pilots as perhaps no one else does. They check the list of perhaps half a dozen names. First they cross off the names of pilots who are inexperienced with the type of plane to be tested. By elimination they select the man they think best suited for the particular job. Then they consider his mental attitude toward this one test. Is there any reason why he could not give a fair and unbiased report on the performance of the ship? Was he ever employed by the firm, fired from it, or overfriendly with any member of the firm? Is there one single reason why he might be inclined to give either an extra-favorable report or a bad one? In other words, his mental attitude must be open and clear, and he must realize the importance of the tests he is about to make.

Then they check with the manufacturer as to his attitude toward the test pilot under consideration, his knowledge of him and the like.

Even then they are not satisfied. They take no one person's word for anything regarding the test pilot. They check with his family and his friends as to his general habits and his mental condition. They check and recheck, and when he is finally selected they are sure, as are the manufacturer and the purchaser, that he is the best man available for the strenuous work ahead of him, that he is a man interested in his work, qualified to do it, and has been living a clean, normal, wholesome life.

But even at this point the insurance company may make another check. They reserve the right to have the test pilot chosen for the job undergo a medical examination three days prior to the test flight, again on the day of the first flight, and at any period during the tests that they deem necessary, especially before the terminal-velocity dive.

With the test pilot accepted and O. K.'d by the manufacturer, the purchaser and the insurance company, the final details of the policies to cover the job are completed, and a ten-thousand-dollar policy is made out on the test pilot's life. Then the long, grueling work of finding out what the plane will do under any and all circumstances begins.

The test pilot, who is either an engineer himself or has a good practical knowledge of it, joins forces with the designer and engineers and goes over every report of the plane's structure and its stress and wind-tunnel tests, so that he may have all available information as to what he may expect when he gets the ship into the air. He personally goes over the airplane and inspects every smallest detail. It's his life he's gambling with, and if he lives it is at the price of careful, painstaking detail.

All controls are carefully tested on the ground to see that they are working freely. Special attention is paid to the fuel lines. The mishap most dreaded by test pilots is not the much-heralded terminal-velocity dives, but what they term "plumbing failures" at the take-off—motor failure caused by broken or clogged fuel lines.

The motor is given exhaustive tests to check for cooling, and then comes the flying test. The plane is taxied around

the field to find out how it controls on the ground under all conditions, and to see if the brakes are adequate and function perfectly. Sometimes they wait for weeks for favorable weather. When conditions are right the motor is gunned, and as gently as possible the new airplane is eased off the ground in straight-away flight. When safe altitude has been attained a few simple test turns are made around the field and the ship brought in for a landing. It is then checked by the ground crew of engineers and mechanics.

Next a flight is made for temperature. The plane is climbed and temperature readings taken every two minutes. From this reading an average is struck, and tests are continued as near as possible at this point. Mathematically, this can be converted on the ground to apply to flying conditions anywhere on earth. A bimotored plane tested at average temperature in New York for take-off and climb on one motor and then flown to the tropics would not even fly on one motor until adjustments were made to compensate for the change of atmospheric conditions.

Then come a few hours of straight flying to test out the controls, prove that the motor is functioning correctly and the instruments are doing their stuff and are in the best possible position to be readily seen or handled by the pilot. It is during this spell of flying that most of the "bugs," as minor faults and peculiarities are called, develop, are reported by the test pilot and corrected if possible by the engineers and mechanics who are in constant attendance during the tests.

If it is a multimotored plane that is being tested, the pilot has at least one man with him on the initial flight, necessary to operate the landing gear and so forth. After that he is accompanied by a copilot and one or more engineers who tend to the taking of data of the ship's performance and check the instruments. These planes are so large that the pilot has his hands full just flying, and the gathering of information must, of necessity, be left to the engineers.

In reality two types of tests are conducted, stability and performance. Performance tests gain the most publicity, for they include the speed tests and the spectacular terminal velocity or zero lift dives and aerobatics, if it is a military-type plane being tested. Multimotored planes are never put into the terminal-velocity dives. The stability test is the one on which the department of commerce grants an A. T. C. (approved type certificate).

In flying an airplane they consider three types of stability: stable, neutral and unstable. A plane is considered stable if, after being moved out of the normal flight path, it will eventually return to normal flight. A plane which, when moved out of its normal path, continues to carry on in the direction in which it has been moved is termed "neutrally stable." A plane which, when moved from its normal flight path, tends to continue and increase that movement until it may fall off into a spin is termed "unstable." These spins are more dangerous, from the point of testing, than are the terminal-velocity dives, but it is possible for a pilot to leave the ship during a spin, although great care must be taken if it becomes a flat spin.

The stability tests tell the test pilot all he or anyone else needs to know about handling the plane in normal flight. He knows what the plane will do with the motor on or off while gliding, climbing, cruising and on the take-off and landing.

But military planes are not designed for normal flying alone. They are built to fight, and fighting means maneuverability. Pilots being equally skillful, the plane that has the greatest speed and can stand up under the great strain of aerobatics is the most likely to win, and the test pilot must find out what the plane will do and if it can stand the strain that it may be subjected to in any position that a plane can get into. They must prove how it functions at high altitude and at sea level as well as in the much-publicized dives.

The dives come last. By the time the test pilot is ready to do the test dives he knows the plane so thoroughly that he is reasonably certain it will stand the strain. Gradually the steepness of the dives is increased until the time comes for the final, the 7½ G and the pull-out.

He takes the medical test to find out to the satisfaction of the insurance company if he is physically fit to stand the terrific strain. Some pilots wrap their abdomen in rolls of bandage and adhesive tape, the theory being that the tape holds the intestines more securely in place during the tense moment of the pull-out from the dive when the centrifugal force tends to drive him through the bottom of the plane. Most test pilots, however, regard this as little aid and disregard it. Some pilots shout, scream or sing while they are in the terminal-velocity dive. This is supposed to counteract to some extent the rapidly changing atmospheric pressure. Some recommend it, others ignore it. These are idiosyncracies of the test pilots and are more the result of legend than any actual proven advantages.

The pilot has no time to worry once the dive is started. He's had weeks of preliminary testing and plenty of time to do his worrying. Now he climbs near the ceiling for the plane and may actually be invisible from the ground. At full flying speed he noses the plane toward the ground as straight as it is possible to guide it. Faster and faster it bores through the air, and so terrific is the pressure that the air has the feeling of being solid material. The pilot is busy with his instruments, alert for the first sign of failure of any component part of the plane. He watches the altimeter, the head temperature, the air-speed indicator, and all other instruments while the ship hurtles earthward, and makes notes on a pad fastened to his leg. One of the great mysteries to everyone but the test pilots themselves is how, during the few seconds of the dive, they are able to see so much and make intelligent notes, but they do.

Now and then he finds time to glance outside to see that he's holding true to his downward course. That's not hard, for he's "standing on the rudder," as they term it, looking straight down. A matter of seconds and the dive is ended, ten, twelve, or fifteen thousand feet, then comes the crux, the pull-out, the most agonizing strain that is ever put on an airplane.

Braced solid, the pilot eases the controls gently back, eyes glued on his instruments. He feels the controls "take." There is a smashing, squashing second when the bottom of the ship hits the seemingly solid air. If anything in the air will tear a plane apart, this is it. The needle creeps, 4, 5, 7, 7½ Gs, and the pilot eases forward on the controls to ease the pressure. He's hit the 7½ G pull-out on the nose. If it should happen to be 7.4 or 7.6 it's rotten. For his own satisfaction he tries to make it exactly 7½ G. In a series of what look like stair steps, the pilot eases the plane out of the terrific dive and returns to a more normal dive and lands at the field. There the ship is taken in charge by the engineers and mechanics, who go over every inch of it to see if any weaknesses have been developed by the dive test.

But the tests are not finished. After all repairs are completed, if any are necessary, the dives are repeated until all concerned are satisfied they have done their best and that they have an airplane.

Pilots have been known to "black out" —lose consciousness—during the pull-out, and fall thousands of feet before regaining control of themselves and the ship, but the medical examinations have eliminated most of these chances.

Commercial airplanes do not of necessity have to undergo such torture-inflicting tests as do the military planes. They will never be called upon to hold together through a 7½ G and pull-out, but they are tested just as carefully and to a point far beyond anything they are ever likely to encounter in actual flying. Stability is the great thing for this type of plane, stability and speed. And here comes the only phase of testing where a pilot may be tempted to make a false report.

Most airplane manufacturers commercialize on the speed of their planes as the car manufacturer does on the low

oil and gas consumption of his cars. It is doubtful if there is a single commercial airplane on the market that will come up to its maker's claims for speed. A friendly test pilot can dive the plane a bit, or take advantage of a favorable tail wind to get a speed that looks good on the performance sheet. But flying cross-country under normal conditions, this speed is never reached. One well-known test pilot, flying his own ship, a good make, claims he has never been able to get within twenty miles of the speed credited for it by its makers. Those pilots who are listed in the top brackets will not sign the final certificate to anything except what they have actually found out for themselves. That's why they remain at the top and why the insurance companies O. K. them.

Test piloting is a hard, exacting business and there is no place in the profession for exhibition or ballyhoo flying. Everything the pilot does is for a specific purpose. He is there to do a job, and on the correct results of his work may depend the lives of numerous pilots and passengers. Then, too, the purchaser of the airplane is most likely to have his own tests flown after accepting the plane, and any falsification by the original test pilot would be revealed, and the manufacturer would have the plane back on his hands. This is especially true of planes that are tested for the army and navy, which exact the most rigid tests of any purchaser of airplanes in the world.

From the results of the tests conducted by the test pilot a handbook is prepared for the convenience of future users of that type of ship. This book gives the complete performance of the ship under any and all conditions, the action of the instruments, and details of the operation of the motor. It has to be right.

Occasionally something unforeseen comes up to add a bit of spice to the job of testing. It's part of the test pilot's lot to be able to handle any such emergency that may arise.

A well-known test pilot while testing a plane designed for seaplane-carrier work had a most unique experience of this sort. The plane was equipped with a device to keep it afloat in case of a forced landing on the water; two rubberized bags that could be inflated by the pilot releasing compressed air from two canisters. Then someone conceived the idea that the pilot might not be able to release the compressed air and something should be done to make the action automatic.

A control device was added and extended to the under side of the wings in such a way that if the plane landed in the water the force actuated the controls, released the compressed air and inflated the bags.

The test pilot was giving the first plane so equipped its 9 G dive test. Everything went fine until the pull-out; then, when the solid air pressure struck the underside of the wings it tripped the controls exactly as the water would have done. The first thing the pilot knew two inflated bags were retarding his speed and had wrapped themselves around the tail unit of the plane, and he was battling a plane equipped as no plane had ever been equipped before. Somehow never exactly clear to the pilot or observers he managed to fight the ship to the ground and a safe landing. And that particular device was eliminated.

Another well-known pilot left the slide cover of his cockpit open during a 9 G dive. The speed of the dive created a vacuum inside the cockpit and the external pressure capsized the cockpit around the pilot. It was a skeleton ship that he landed, but something else had been added to the knowledge of flying planes in terminal-velocity dives.

The price of life for a test pilot is eternal vigilance. He must never forget or leave a single detail to chance. With an army pilot at the controls and a test pilot beside him to check the instruments, a multimotored bomber tried to take off at Dayton Field with the controls locked. Result, a complete and a very expensive wreck because they forgot.

No special licenses are required for test pilots, the rigid requirements of the people employing them being the most important factor in keeping them on their toes. They work in close co-operation, and no A1 test pilot will take on a job that another pilot has quit or turned down because of unethical tactics or because the ship does not come up to his standards of safety.

Most pilots prefer testing military or the big commercial jobs, for they know that the greatest engineering skill in the country has gone into their construction and that no money has been spared to make them strong and safe. It's the little jobs that sometimes give them the jitters. Manufacturers working on a new idea, such as a tailless ship or a flying wing, or someone working on a shoestring who has had to skimp on quality to get his ideas together—these give test pilots gray hair. In this kind of testing anything can happen, and does, and as a rule they cannot afford to have the top-notchers test the job.

Fatalities among test pilots who can pass the rigid tests of the insurance companies are few and far between. One of them has been testing for twenty years and is still rated in the top brackets. They are expert fliers, good engineers, clean-living hellions who do a hard, dangerous job well and don't seem to see anything romantic about their calling.

N.A.A. NEWS

(Continued from page 31)

range data service; airport gas, hangar and service credit cards; unlisted weather bureau telephone information; members' standard hangar rates; members' compass swinging, battery and brake check-up service; members' ship and pilot log books, F. A. I. touring pilot and rating certificates (suitable for framing).

The organizing committee for the new private flying division named by President Horner is made up of Roger Wolfe Kahn, W. W. Brinckerhoff, and the writer. Division activity at N. A. A. headquarters will be under the direction of the writer.

Since many of the services under consideration as listed above are of interest and value only to the active pilot or plane owner, it is probable that a special private-owner "service" membership at a higher rate than the regular three-dollar N. A. A. membership will be established. Individuals registering for such a service membership would be required to be regular members of N. A. A. and would pay such nominal annual fees and such special service fees in addition to the regular fee as are decided upon.

Consideration is being given by N. A. A. officers and officials of the Private Fliers Association, which has been operating during the past year as the private flying affiliate of N. A. A., to an arrangement whereby the P. F. A. would become more closely integrated with the association. One procedure under consideration would establish the Private Fliers Association as the new private flying division of the association. Under this plan, the P. F. A. would operate as the specialized subsidiary of the association for the field of private flying.

The increasing complexity of radio station and operator licensing requirements and particularly of frequency-check requirements make a reminder or follow-up service, it is believed, of special value to private owners. Thus, where a private owner has a radio transmitter, it is not only necessary that the station license be renewed annually, but that frequencies used be checked quarterly. If quarterly checks are not made promptly, the station license is suspended by the F. C. C. The service envisioned would keep a record of the date of station license renewal and quarterly frequency checks and would remind the plane owner by suitable postal notification, supplying blank forms when needed.

Many States give a tax refund on aviation gasoline. However, to obtain this refund, receipted bills for gasoline purchase must be forwarded before a certain deadline date, to a special office in each State, making use of a certain form. The date for filing, the filing office and the form to be used vary from State to State. The detail of keeping these forms on hand and filling out such statements in conformance with the various State departments and knowing just the right address to which they must be sent are particularly onerous. It is planned that the private flying division office at N. A. A. headquarters will keep up-to-date on the various State tax refund details and maintain a good stock of refund application forms. Private-owner members, it is proposed, can merely send in their receipted gas bills and details of making refund application will be handled for them.

With the continued modernization of airway facilities, the information held by individual private owners on radio range-marker beacons, on airport traffic-control services, and the dozen and one items which go to make up complete cross-country air-touring data is often considerably out of date. This is particularly so in the case where an individual wishes to make a trip by private plane to a point distant from his usual sphere of flying activity.

It is planned that up-to-the-minute route, radio data and map material will be available to private-flier members. Perhaps strip maps made up in book form can be made available on a rental basis for individuals who plan extended trips over areas and routes where they would not normally have the required maps in their possession.

Careful investigation will be made of the possible service which could be rendered by designation as "approved" service stations of fixed-base operators who have demonstrated above-average interest and service in providing for the needs of private owners. Consideration will also be given to the practical possibilities offered in exchanging publicity as an authorized representative of the private flying division for a reasonable members' service discount in the case of specialized accessory services. Thus it has been pointed out that the increasing use of radio equipment and the growing variety and specialization in instruments call for specialized and experienced radio, instrument and propeller check and maintenance services. It is felt that there may be a practical basis for designating representatives known to give a high standard of service to private owners as "authorized" service representatives with a reasonable discount from standard rates to be given members in return for the publicity received through such designation.

The practicability of encouraging discounts for members in return for publicity and approval on various articles and services of interest to the private owner will be thoroughly and completely investigated.

Members will have the opportunity of subscribing for the leading aeronautical publications at special rates under association arrangement now in operation.

Other ways of giving helpful service to private owners are to be studied, and the organizing committee will be glad to receive suggestions.

In addition, it is believed that the private flying division, through judicial use of official approval of service organizations and through designation of accredited representatives, can act to reward outstanding service to private fliers and can stimulate standards of service for private owners. Further, through the development of reasonable discounts in return for publicity and increased business, it is believed that this new division can be mutually helpful both to the owner and to organizations allowing such discounts.

Finally, it is believed that by encouragement of membership affiliation of all private owners and pilots with an organization concerned with the promotion of private flying nationally, the group influence of numbers so obtained can be used in support of private flying development needs and governmental aid programs for the private owner. In this regard it will be the definite policy of the new private flying division to encourage the affiliation with it of all organizations, both national and local, now active in the field of private flying. Thus the 99s, the Seaplane Flying Association, the National Intercollegiate Flying Club, the Soaring Society of America, the Licensed Airmen of America, and aviation country clubs and other organizations will be invited to name representatives to a group conference to work out details looking toward co-ordination and group effort.

The flying activity which will be encompassed under the program of this new private flying division of N. A. A. will parallel, from the nongovernment viewpoint, the phases of flying activity now covered in the private flying development division of the C. A. A. Thus activity will be concerned not only with the private owner who flies purely for his own pleasure, but with the pilots and operators of planes used by industrial organizations for executive transportation and good will, and with that segment of flying which falls under the general heading of miscellaneous and nonscheduled flying.

AIR RESERVE ASSOCIATION LOCATES AT N. A. A.

Through the co-operation of N. A. A., the Air Reserve Association of the United States, composed of flying officers of the air corps reserve, has established its national headquarters at the offices of the National Aeronautic Association. Office facilities have been contributed by N. A. A., while the neces-

sary clerical assistance is being furnished by the Air Reserve Association.

The new headquarters will be under the supervision of Captain Brintnall Merchant and the writer, also an air reserve officer, in co-operation with the A. R. A. president, Lieutenant Al Near.

The broad purpose of the Air Reserve Association is to support and assist in the development and maintenance of an adequate air corps reserve for the United States. It has initiated and supported many worth-while measures along these lines.

HOWARD C. KNOTTS, GENERAL COUNSEL TO N. A. A.

"Lieutenant Knotts' flying showed the greatest disregard of danger."

So said the British Royal Flying Corps in citing Howard Knotts for his World War record, which bagged him eight German airplanes and the unofficial title of ace. And since the War, Knotts has shown the same courage in furthering what he believes to be right in air legislation. He had a major part in drafting the Civil Air Regulations now in effect.

Knotts was a youngster at Harvard when the big scrap started back in '17. Like many another in his class he forsook his history books and English tomes for the study of aerodynamics and machine guns. He was one of that little group who were assigned to the British Royal Flying Corps for training, and it wasn't long before he had the gold bars of a second lieutenant on his shoulders and the wings of a military aviator on his chest.

Although it was late in 1918 when he got to France, he soon began a series of victories which stand as one of the brightest pages in America's wartime aviation record. When he returned to the United States he had won the Distinguished Service Cross, the British Distinguished Flying Cross, and a number of citations.

General Pershing has spoken of his "distinguished and exceptional gallantry in action." British military records report that "over and over again he did not hesitate to fly very low in spite of fire from the ground, thereby bringing back valuable reconnaissance material and seriously harassing the enemy's movements during their retreat."

Although the War ended his career as a military pilot, he has since been active in civil aviation. Receiving his law degree in 1921, he has become one of the country's outstanding authorities on air law. He was long a consulting expert for the bureau of air commerce.

He was chairman of the aviation committee of the American Legion, Department of Illinois, for seven years. He was secretary of the Illinois Aërial Navigation Commission, 1929-1931, and was coauthor with Fred Fagg of the Illinois Aeronautics Act. For seven years he was aviation supervisor of the Illinois Commerce Commission. Serving as delegate from Illinois, he performed distinguished work on the National Conference on Uniform Aeronautic Regulatory Laws called by the secretary of commerce in 1930.

Knotts is big and blond, and has a lazy grace that can instantly become quick and decisive action. Two decades after the War, even in loose-fitting civilian clothes, he still has a military bearing. Possessed of an engaging personality, he wins friends with his first handshake.

FULLER SETS INTER-CITY RECORD

Frank W. Fuller, Jr., west coast sportsman pilot, averaged 297 miles per hour in a flight from San Francisco, California, to Phoenix, Arizona, a distance of 653 miles.

He covered the distance in 2 hours, 11 minutes, 58 seconds, flying at an altitude of 15,000 feet. He took oxygen through one of the latest type oxygen masks developed by Dr. Lovelace, and commended the mask for its reliable functioning throughout the entire trip.

The pilot said he was assisted by high winds, although they were not directly in the line of his flight.

FORMATION FLYING

(Continued from page 25)

they are rugged individualists who simply can't help being jittery when they are crowded.

It is an old custom at the army flying school to find a place for the more competent fliers who simply don't take to formation flying quite as readily as the others by assigning them to observation units, where the formation work is not quite so important and difficult, or to bombardment units where all maneuvers are comparatively slow. But in making such assignments many other factors are considered, so don't assume that all bombers or observers are necessarily inferior in formation-flying ability.

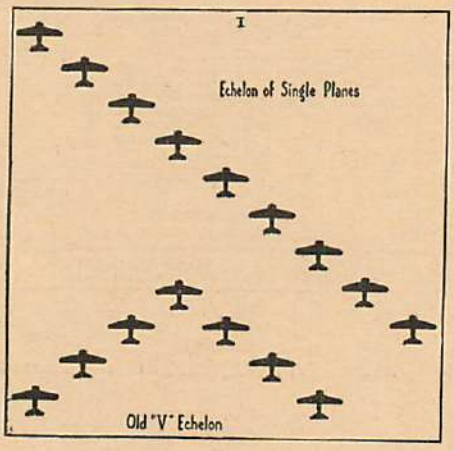
The students who soon overcome the tendency to shut their eyes and wait for the crash or else to pull away violently when another plane looms in front of them will begin to learn formation flying rapidly, but they must still go through many months of formation training and practice. They must develop correct and decisive reactions to fit every possible situation, and these reactions must be so habitual that they are automatic. In the strain of real tactical maneuvers there is often no time for thought.

Pilots with only a few months' formation experience can scarcely be trusted to practice together without detailed supervision. This is particularly true when they are flying the latest combat planes, which also require considerable experience to operate efficiently. Consequently, even in the tactical units many pilots who are already able and experienced are kept busy as flight and element leaders for formation practice. Since so much time and effort are spent in practicing it, formation flying must be very important. Why is it so important? In the first place, why is a formation?

To many people formation flying is purely a show—just an aërial parade. Others know that it has a military purpose, but fail to recognize that a formation is, first of all, simply the most effective system for maneuvering a large number of planes over the same area at the same time. It is also the best system for moving several planes from one place to another under one leadership. Even the larger birds, such as geese and pelicans, usually travel in fairly symmetrical formations. Where mere haphazard flying might result in a chance collision, a formation is organized for safety and control. Each pilot merely watches one certain plane or one small section of the formation. The leader and the system take care of everything else.

The plan and pattern of a formation can be seen to greatest advantage when the planes are almost directly overhead. Its vertical dimensions cannot be judged from this angle, and planes crossing one above the other appear to escape collision by a miracle. From any side angle, however, most formations appear to be a haphazard jumble. It's like watching a football game from the end zone—you can't see the play for the players. That's why most real action pictures of formation work are confusing, and why most of the neat-looking pictures you see are made of carefully posed stack-ups and lines which are useless for anything but show and pictures.

It may be reasonable to wonder why planes don't just follow each other nose-to-tail, since such a string would be the simplest possible formation and apparently the easiest to maneuver. This column-of-single-planes arrangement is sometimes used for special purposes, such as a long diving and bombing attack on a narrow target. But there are two reasons why it is awkward unless the



planes are a considerable distance apart. There is the propwash to consider—the invisible vortex of turbulent air that whirls along for several hundred yards behind each plane and makes flying in that area extremely difficult. And there is the simple fact that the easiest position to judge from and maintain steadily is one to the side, as well as to the rear, of the plane ahead. This is usually called the "wing" position, and it is the most convenient for the flier, man or bird, because any loss or gain in distance is more noticeable from this angle than from the direct rear.

The pilot in a wing position is literally looking over the shoulder of the man ahead. And he can follow almost any maneuver if he knows how, and provided the plane ahead does not change speed too rapidly. This arrangement was employed by the birds long before man was able to discover its advantages. The birds, however, still have two important advantages over planes, advantages that enable them to string out in great numbers in one continuous line, at this "looking-over-the-shoulder-angle," and still maintain their ability to maneuver without mishap. When planes are strung out in this manner they are all right as long as the leader flies straight ahead, but when he starts to turn many difficulties arise.

A few planes, up to about eight or ten, may line up in this simple and birdlike manner, about forty-five degrees to the rear of the leader, and still maneuver passably well. This is the "echelon" (French for "step") formation that is still frequently used. But with even a few planes in echelon, those toward the rear have their troubles on every turn. If the leader turns away from the echelon they find themselves being left behind on the outside of a wide circle, and they must all hurry over to the inside of the turn in order to keep up.

When the leader turns toward the echelon there is even more trouble. Birds can slow down very easily when they are "headed off" on the inside of a turn. But planes, especially the latest and most streamlined ones, are very reluctant about slowing down, no matter how much the throttle is reduced. The Number Two Man, when the leader turns toward him, must reduce his throttle setting to stay behind. The Number Three Man must reduce his throttle more than Number Two in order to stay behind *him*, and so on down the line until the men toward the rear have to cut their guns completely and do everything but loop in order to keep from running over those turning in front of them. At best they can only slow down enough to enable them to cross to the outside of the turn, since planes can't mark time and turn on a pivot, like soldiers at drill, while the line swings around. The problem is for each man to accomplish this cross-over without overrunning and completely losing sight of the plane ahead. Once on the outside of the turn, there is no more danger of overrunning, but the throttle must now be opened wide in an effort to keep up.

Every pilot who has ever practiced this maneuver has endured moments of mental agony during a typical "stack-up" on this kind of turn, moments when he has lost sight of the plane beneath and knows that the man above is overrunning too. The strain comes in trying to decide whether to take a chance on hitting the fellow below, or to pull up a little and take a chance on being struck by the plane above.

The single-plane echelon was once

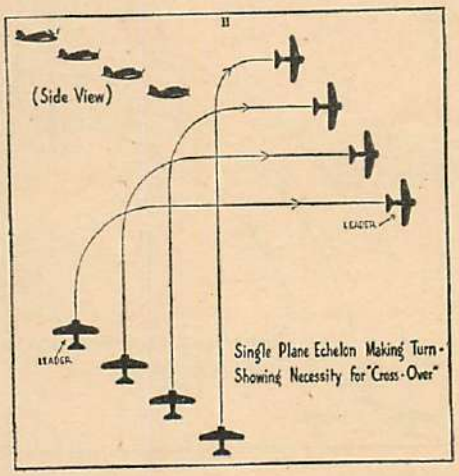
flown a great deal more than it is today, and it is now used only for special purposes, such as for allowing planes to "peel off" for individual attacks or landings; for long, straight attacks at low altitudes; or for training, show and photographic purposes. It is never used where rapid maneuvering is necessary, since under those conditions with modern planes it would be awkward and dangerous for a nine- or even a six-plane flight. In the employment of the latest military types for formation work, it was expected their greater speed range would prove an advantage. This advantage, however, is more than offset by the fact that the newest planes cannot change speed as *rapidly* as the older types. A heavy, compact, slick piece of machinery doesn't slow down right away merely because you cut the throttle. And when sudden acceleration is desired, high-compression engines and high-pitched propellers are mighty slow about understanding what you mean when you push the throttle forward. Unless you anticipate most maneuvers and start using the throttle ahead of time, you may find yourself at times coasting right on ahead of your position and at other times being left considerably behind.

Even before the latest designs introduced new problems in formation flying, the awkward length of long echelons and their tendency to "crack the whip" resulted in efforts toward improvement. At first, in the effort to organize formations more closely behind one leader, the birds were imitated still further. Instead of the "step-back" on just one side of the leader, the length of the echelon was shortened by placing half of it on the other side and forming a wedge or V. But with planes on each side of the leader, crossing over was impossible, and not more than five planes could manage a turn when this pattern was used. Although it made possible a more compact formation, it was never satisfactory and was even more awkward than the single long echelon.

Since designers could not build planes as flexible and maneuverable as birds, pilots demonstrated the superiority of human gray matter by working out a formation system which would be a little too complicated for birds to organize. Unable to swing a long line of planes around turns without scattering or piling them up, the problem was partially solved by grouping them in small, V-shaped "elements" of three planes each. Obviously, three such elements can be bunched more closely and controlled more easily than nine independent planes in a row. Organizing the formation into elements makes it a little more complicated in appearance, but this system has important advantages and its plan of operation is simple enough.

Each three-plane element is, of course, a little formation in itself, but it can maneuver just as smoothly and almost as rapidly as a single plane. Remember that trouble accumulates on a long-echelon turn because each plane must change its speed more rapidly than the one ahead. But the plane next to the leader can always stay in position, without the necessity of crossing over on turns, because the leader flies at a constant speed. The element system takes advantage of this fact by assigning two wing men to follow each element leader, one on each side, and giving them the job of holding that position through all maneuvers. Each element leader flies fairly close to the element ahead, but his first duty is to look out for his wing men by making the necessary maneuvers smoothly and gradually, so that they can "stay with him."

In order to avoid rapid changes in speed, the elements must cross over during turns of ninety degrees or more, but the three element leaders in a nine-plane flight can accomplish this without crowding and still maintain a fairly compact formation. Sometimes it may be necessary to cross just above the tails of the wing men ahead, so the elements usually fly on different levels, stacked-up toward the rear. When an extremely compact formation is desired, such as for defense against air attack, the third element may draw up beside the second, forming a V of elements. This formation was formerly used more than today, and it has the disadvantage that during a turn the second and third elements must cross over in opposite directions. But well-trained pilots are capable of assuming any formation while in flight. The leader of the first element is also the flight leader, and he may shift or change the formation at any time by means of a few simple wing signals.



Despite many experiments with "string," "flat echelon," "extended echelon," and other types of formation (some of which experiments have been quite hair-raising, I can assure you!) the common element type is still the basic military formation. It is both compact and flexible, and it has many advantages useful in combat. The elements can fly at any desired distance from each other, can maneuver almost as speedily as a single plane, and yet can join very quickly when concentrated fire power is desired. The two-plane element, now used by some pursuit units, is more maneuverable but less compact, while the opposite is true of the four-plane element sometimes employed by bombardment.

Big-plane bombardment today does not echelon its elements like everybody else, but flies them "in column," one behind another. This necessitates "stepping up" or "stepping down" to avoid propwash, but it eliminates the necessity for crossing over on the turns, which would be very difficult for big planes. Furthermore, the big ones are much steadier, even in propwash or very rough air, and they can fly nose-to-tail much better since there are no motors directly in front of the pilot to obstruct his forward view. The column of elements is more useful for bombing purposes, since few targets are much wider than three bombers. Bombardment also practices various special formations intended to insure complete bomb coverage for targets of various sizes and shapes. Due to the better visibility, the size and steadiness of the planes and the necessarily slow maneuvering, the formation work of bombardment units is often the smoothest and neatest of all.

Of course pursuit does the most rapid and spectacular maneuvering, and some of its trickiest work is almost as fascinating as fireworks when performed at a comparatively low altitude. Pursuit planes cannot work as low as attack formations, due to the fact that all their fighting maneuvers involve climbing and diving for hundreds and thousands of feet. Even their dives at targets on the ground must not come too close, since several hundred feet are required for the pullout. Consequently, the approach of a pursuit formation does not produce the overwhelming effect of an attack formation roaring overhead at seventy-five feet, but its long dives and steep, turning recoveries are well worth watching. Due largely to lessons learned from the Spanish War, there is now a recurrence of emphasis on training for dog-fighting (individual combat), which had almost been forgotten. The modern fighting plane has become so fast and complicated that even the most skillful formation flier cannot keep in formation throughout a strenuous air battle. It seems now that such battles must eventually break up into a mêlée of individual dogfights if they continue long enough. Nevertheless, the side that can hold its formation longest throughout rapid and effective maneuvers will have the advantage, and good formation fliers

in very maneuverable planes stand a pretty good chance even against speedier equipment.

Another advantage of the element system is the fact that it permits a certain amount of teamwork even when the formation is partially broken up or scattered. Even though the elements should become separated from each other, it is often possible to keep the elements themselves intact, and three planes in formation are usually more effective than three planes flying individually. Also, this system permits placing the most experienced and capable men in key positions as element leaders and relieving the wing men of all responsibility except just to keep in place and obey the signals. Sometimes this gets to be a little tiresome, and junior pilots long for the time when they will have enough experience and seniority to become element leaders.

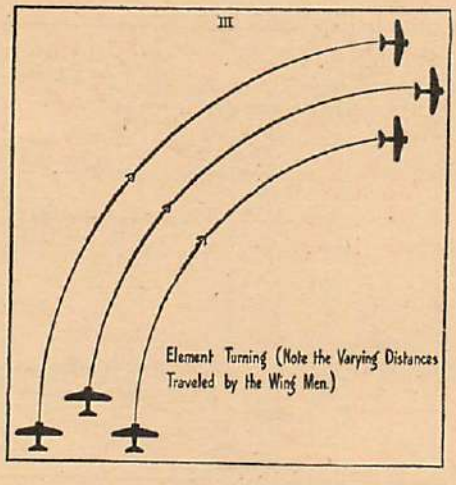
It is a tradition that "a wing man isn't supposed to think," but this is not entirely true. He doesn't need to know a lot about tactics or navigation or even about what is going on as long as he can stay with his element leader wherever he goes, and his first duty is to do just that. But he must also learn enough to be able to take care of himself in emergencies, or even to take his leader's place if that envied individual is forced to drop out of the formation. And each element leader would be just about one third as important without those trusty wing men on each side. No formation can be better than its wing men, for the instant the leaders try to do something the wing men can't follow the formation goes to pieces.

One of the problems of military flying arises from the fact that younger men make the best formation fliers. The ability to fly good formation seems to decline more rapidly than general flying ability after a man passes middle age. The older man may be the possessor of valuable knowledge and experience, but he inevitably lacks the quick reactions and smooth muscular control necessary for good formation work. The increasing complication of planes and maneuvers since the War is gradually overcoming the brave tradition that each flight commander must fly the lead plane in his own formation.

The army maintained such traditions longer than the navy, and still insists that its older air corps officers continue to fly as long as they are physically fit for duty, even after they can no longer lead formations. But there are rumors that this policy is to be modified somewhat, and already the expectation that senior commanders will pilot their own planes in the key positions of large combat formations has been abandoned. The improvement in radio control has made possible the direction of large formations from any position in the formation, or even from the ground. Furthermore, it is now expected that the faster fighters will be manned almost entirely by younger men, and the bombers are becoming so large that they need experienced senior officers to command and co-ordinate the work of the whole crew of gunners, radio men, bombers, navigators and pilots. Aviation has developed so far that executives are needed in the air as well as on the ground.

Despite the fact that formations are becoming bigger and bigger and that even the leader of a formation is now subject to radio control, there is little possibility of the individual pilot becoming a mere cog in a military machine, like most soldiers on the ground. An airplane can always move in any direction at any time at almost any speed, and anyone who handles such a versatile weapon must always be resourceful and aggressive, and capable of working out his own problems.

Formation work is like football in a great many ways. It involves plans and



Element Turning (Note the Varying Distances Traveled by the Wing Men.)

systems of attack, shifts and deception, careful timing and co-ordination, and most important of all—endless practice in the running of signals. Each pilot, like each player, has his own job to perform for each type of maneuver, and he must learn to do the right thing at the right time without a moment's thought. And watching formation flying from a distance or from the ground is like watching a football team run through its signal drill. If you know something about the fine points of the game you can begin to size up the team. So the next time you see a formation at work, either in the air or on the screen, it will be interesting to judge it on the basis of a few simple fundamentals.

Are the planes evenly spaced? In a well-flown formation the wing men are all about the same distance from their element leaders, and the elements in each flight are all about the same distance from each other. This makes for more accurate maneuvering, because when these distances are standard the flight and element leaders know how to figure them in advance of each maneuver, and they know just how much margin of safety between planes and elements they can count upon at all times.

It is possible and often quite easy to fly closer than the standard distance. Many observers (and many young formation fliers) have the idea that the men who fly closest are demonstrating the greatest skill. This is wrong, since it is really easier to fly good "tight" formation than good "loose" formation. Getting too close tends to make the formation ragged and awkward almost as much as getting too far behind or too far to one side.

Are all the turns and other maneuvers performed smoothly and evenly? Almost any formation flier can keep his position as long as the leader goes straight ahead, but the poor ones always have trouble on the turns. Often the leader is to blame. He should do everything as smoothly and rhythmically as a good orchestra leader. He must be so logical and consistent in all his maneuvers that the element leaders can almost read his mind, for after they learn his style of flying they should be able to guess just about how far and how fast he is going to turn in every situation. Any unexpected, sudden or jerky maneuvering on the part of flight or element leaders puts the wing men in a sweat, makes them fight the controls to avoid collisions and often forces them out of position. Many good leaders fly a wing position from time to time just to keep from forgetting how difficult it can be and how important it is for the leader to think first and always of the men behind him.

It is usually easy to discover whether the leaders or the wing men are to blame for irregularities in the formation, simply by noticing whether it is always the same wing men who get out of position. But remember that the tail end of the formation always gets the beating, due to the fact that any movement up front is somewhat increased by each succeeding plane, until the tail-enders must sometimes use all their ingenuity and control to compensate for it.

Even though you are not familiar with all the changes of position that occur during a turn, you can easily tell whether they have been properly performed by noticing the position of the planes after level flight is resumed. Are they still evenly spaced? Or is a certain amount of jockeying and catching up necessary on the straightaway? Only the best formation pilots, following the best leaders, can roll out of each turn exactly in place. And no matter how perfect most formations have appeared to you until now, you will always be able to discover minor errors. For the completely perfect formation flight will never be made—at least, not over this earth.

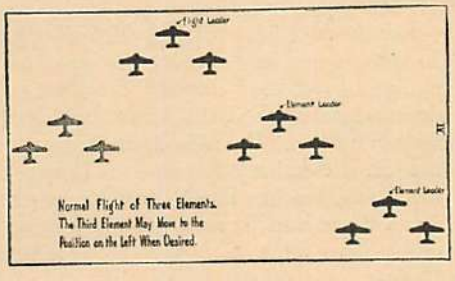
If you are fortunate enough to witness the take-off and landing you may discover other fine points of technique. A few years ago it was possible to assemble planes very carefully on the field in preparation for a formation take-off, and there was always a lot of taxiing and turning and dust-blowing while everybody got into position on the ground. This practice is now being abandoned in favor of quick individual take-offs followed by assembly in the air. Most fields today have runways, and it is usually advisable for heavy planes to stay on them, even though they will accommodate only one plane at a time. Furthermore, take-offs are no longer the simple matter of pushing the throttle and holding the plane in a climb. Landing gears must be retracted, propellers shifted, shutters closed and other little cockpit tasks performed which do not contribute to good formation flying; and tightly baffled cylinders can be kept cool only in flight. Any time spent in maneuvering for position on the ground is likely to cause overheated heads and trouble when maximum power is demanded.

Assembly in the air may be performed while the leader makes one or two wide circles around the field and his men climb one after another to catch up by cutting across inside the turn. Or the leader may proceed straight on his intended course at reduced speed until his formation is in place. In either case, the assembly should be performed smoothly and evenly, with a minimum of violent maneuvering or unduly steep climbing, and you may be sure that the pilot who delays the formation by failing to close up promptly is considerably embarrassed. One of the most common reasons for such delay is some fellow failing or forgetting to raise his landing gear!

A formation landing is practically a final examination in formation flying. From the pilot's standpoint an individual landing seems simple and easy by comparison. Even when a narrow runway makes individual landings necessary, formation pilots must maneuver to string out and take the proper distance from each other as they approach. This distance must be uniform, for it must be as short as safety considerations will permit, which means that each succeeding plane will begin its landing about the time the plane ahead has slowed down sufficiently to turn out of the way.

Landing in groups of three, six or nine planes greatly shortens the length of time required to get the formation down, and a mass landing is usually performed when the size and condition of the field permit. A good formation landing means a great deal more than just getting the planes on the ground without bouncing them. Small bounces are relatively unimportant. Remember that the wing men cannot take their eyes from their leader—not even to look at the ground! They must stay in fairly close, too, for veering away would put them directly in the path of someone else or even outside the field. All this requires a carefully planned and skillfully executed approach. Bringing the outfit in for a landing is one of the greatest problems for any leader, and one which few leaders can solve to the satisfaction of everybody in the formation.

From any position on the ground you



can see for yourself how they are making out. Is the approach smooth and steady, with all the planes on the same level and spaced about evenly since the last turn? Formations of modern planes usually require three or four miles of straight approach to get squared away. Some time is required merely to reduce speed from one hundred and eighty to eighty miles an hour. Speed must be reduced slowly and steadily, the angle of descent must be high enough for safe clearance and yet low enough to guard against overshooting and against the possibility of some wing man stalling his plane too far above the ground. At the same time the leader must judge and place his landing so accurately that the last man, whom he cannot even see, will be well inside the boundaries of the field. To be able to do this dependably under all conditions requires hundreds of hours of practice, both as a wing man and as a leader.

Various trick formations are sometimes used for special training purposes and for exhibitions. The commonest and one of the most difficult of all non-maneuverable trick formations is the "line," the side-by-side and wing-tip-to-wing-tip arrangement that looks so simple. Here the entire formation draws up in a single line on the left and right of the leader while he flies straight ahead. This line-up is absolutely inflexible, since nobody but the two men at the ends can turn at all without causing at least one collision. As you've noticed in pictures of this type of formation, everybody is looking toward the leader, trying to keep the line straight and close without hanging a wing tip. Rough air, which makes any type of formation look wabbly, makes this one almost impossible. Any outfit that can fly a good line, even under the most favorable circumstances, is certainly well drilled and capable of handling tough assignments. Every man in it must be able to fly straight ahead while looking over one shoulder, and always keep the proper distance front to rear, up and down, and side to side.

And that's about all there is to any kind of formation flying. No matter what may be the formation's purpose and plan, each pilot's problem is simply to control the speed and direction of his plane rapidly enough and correctly enough to keep his proper distance in each of the three dimensions. His special training and skill are necessary because he must move and control his position in all three dimensions at once.

AIR ADVENTURERS

(Continued from page 35)

be drafted for short training periods into the gun turrets of our bombers, or to act as navigator-observers in the bomber compartments. Some will become radio operators on observation planes, while others, the "naturals" of military aviation, will be shunted into important positions as fast as the jaws of war gobble up the "brains" of the organization.

These are the facts as culled from sane statements concerning the plan. There will be no partiality shown for the college-trained man, but those who have already spent their own good money for flight training and are *bona fide* students at recognized schools or under registered instructors will get some deserved preference. Anyone between the ages of eighteen and twenty-five, provided he can display a reasonable degree of physical make-up, a fair education, and prove he is capable of learning to fly, is eligible for this free government training.

Air Adventurers naturally are interested, for most of them have been heading for such a plan for years. We can only advise you to be a little patient with those who have undertaken this great scheme, prepare yourselves for the job by reading everything you can get your hands on in aviation, which, of course, means Air Trails above all, and watch closely the straight-fact announcements of the plan through our pages. We promise to run the matter down thoroughly, cover every detail, and see that the rules are clearly defined. Stay with us and we'll see that you all get your deserved break.

Don't worry, the plan is sound even with its limitations, and it may be the saviour of American aviation, and we are hoping that all Air Adventurers will stay with us and see the thing through to the finish.

Your Flight Commander,

ALBERT J. CARLSON.

AIR ADVENTURERS NEWS

And now for the business of the month. And what a business! Boy, how the letters pile up, and we must advise you birds that if your letter is not quoted or mentioned the first month after you write it, it is because of the pile of mail that comes in. Then, again, you must realize that we have to get out Air Trails some weeks ahead to keep up with the mechanical problems of the publishing business. So don't lose heart if your letter does not appear in a certain issue. Remember most of those that do have been waiting their turn, too.

Our lead letter this month comes from M. E. Hartley, of P. O. Box 561, Beaverton, Oregon. Hartley has been in close touch with Air Trails for some time, and we have been interested in his ship known as the Sky Craft, which he and a few friends have been working on for the past few months. They were much encouraged, they say, by an article written by Arch Whitehouse in the last July issue devoted to the ideal primary trainer, and now they have at last produced their first model. The plane is a low-wing braced monoplane with side-by-side seating. It uses the Velie engine, and although test flights have been made, no actual performance figures are available as yet.

Monte La Barge, of Wakonda, South Dakota, is a wow on military aviation, and he writes some grand stuff about his opinions. He believes in attack aviation, and is positive that planes attacking infantry do more to their morale than any form of attack. He has been working on an instrument that will warn a pilot when he is approaching the ground.

William Robusch, of Salem, Ohio, wants to start a flying club but does not know how to go about it. It's a long story, Bill, but for a thin dime Air Trails will send you a small booklet written by Arch Whitehouse that tells all the details and the steps to take. Send in your double jitney and the secret is yours. This goes, too, for any other members who are interested in such a plan.

David McClure, of St. Petersburg, Florida, sends in ten coupons and the names of ten new members, which is realizing ambition, if we know ambition when we see it. David is connected with the St. Petersburg Recreation Department and teaches model airplane work down there, and he promises more news of his gang later on. We'll be waiting, Dave.

Tel Salmon, of Quesnel, B. C., sends us a post-card photograph of the CF-BDX, the Canadian Fleet airliner, landing at the close of the initial flight from Vancouver. In it may be seen Ginger Coates, noted Canadian airman who inaugurated the line. They're going ahead up there in British Columbia.

Charles Sawyer, of Greenville, Maine, clicks for his lieutenancy with a grand air shot of the Maine State Air Meet taken with a Voigtlander "Brilliant" over Augusta, also a neat picture of his Jeep II, which has flown for thirty seconds on several occasions.

Robert J. Young, of Chilliwack, B. C., tells us of a hair-raising flight staged by a berserk Aeronca which resulted in a crash a short time ago. According to Bob, this plane appeared over the city, flying between telephone poles, dodging the high school, skimming the bank, and then finally hit a sign on top of a service station and crashed. Neither of the crew was hurt badly, and they later explained that their rudder bar had jammed and caused all the confusion. We'd say it caused confusion!

F. A. Dixon, of The Fad Shop, Winona, Minn., is a new member and has a woodworking shop in town where all the lads get together and build their models. At present he has nineteen boys making gas models, so you can bet they have some fun and kick up a swell racket. Dixon would like to correspond with a few foreign model builders and hopes in this way to make new contacts through Air Trails.

L. Hirshfield, of Cape Town, South Africa, is a new Flight Lieutenant on the strength of his effort and work on a new Quaker Flash gas job.

Another new member is Ian Glen, of Wainwright, Alberta, which is about a hundred and fifty miles from any airport, but Glen is taking a course in aeronautical engineering from the Brisbane Aviation Co., of Vancouver. He's working out on models just now, and promises us some pictures of Canadian aircraft.

We have a pile of Photographers this month. Among those who have come through with award pictures are Harold Hallaway, of Long Beach, Cal.; Bob Adatte, of Bound Brook, N. J.; Bill Lipford, of Richmond, Va.; Thomas Ledford, of Cheyenne Agency, So. Dakota; Ceil Dennis, of Buhl, Idaho; John Hardaker, of Holyoke, Mass.; Henry Stone, of Forest Hills, N. Y.; Edward McLoughlin, of New York City; Irving Vogel, of Norwich, Conn.; and Bob Tarr, of Summerfield, Kansas.

Miss Phyllis Hirsch, of Philadelphia, who calls herself an Air Adventuress, takes us to task "for always writing to boys and never to girls." What she means, of course, is that we consider the male side of the club too much, and never consider that we have many young ladies in the organization. So from now on we want our readers mentally to consider everything we say as being delivered with our mind on both men and women, but we do feel that we have used all the letters our girl members have written in and have made as much of them as has been possible. However, from now on, you girls watch out. We're out to get you in large numbers.

Howard Johnson, of Los Angeles, who heads what he calls the Flying Johnson Family, has sent in coupons and dimes for the whole Johnson family, which is a swell way to cover the territory.

And that closes the issue for this month, but stay with us. We'll be seeing you next month with a lot more letters and details on the club activity.

NATIONALS FUSELAGE WINNER

(Continued from page 45)

snugly.) The 1/8" square leading edge and 1/8 x 7/16" tapered trailing edge should be attached to the ribs as soon as possible along with the tips, which are made of 1/8" sheet balsa. The rudder does not have a spar, but instead has a husky leading and trailing edge with four husky ribs. The leading and trailing edges are 1/8 x 3/8" stock, and the ribs 1/16 x 1/8". The root rib is 1/8 x 3/4" and should fit snugly in the slot formed by the two center elevator ribs.

After the cement holding the parts together has thoroughly dried, cover the tail and rudder surfaces. Water-spray the surfaces and, after drying, apply a coat of thin dope. Make sure that the surfaces do not warp. The final operation on the surfaces is the attachment of small hooks, made of straight pins, to the tail surface leading and trailing edges. These hooks are used in order to hold the rubber bands which attach the tail to the fuselage.

PROPELLER

The propeller is carved from a block 1 1/2 x 2 x 16", shaped as in the drawing. The propeller is carved in the usual way, with 1/8" under camber. Finish the propeller, after cutting in the blade shape with fine sandpaper. Dope the blades to a smooth finish. Cement the metal guard to the back of the propeller and the freewheeling device on the front. The freewheeling device is merely a 3/8" length of 1/4" diameter aluminum tubing, with a notch filed in it for the 1/16" diameter steel wire shaft to catch on when the power is on. The propeller shaft has a washer soldered on it in order to have a bearing surface for the rubber tensioning spring.

ASSEMBLY AND FLYING

Insert the rudder in its slot in the tail surface and attach the surfaces to the fuselage with rubber bands. Place the wing on the fuselage and secure it with rubber bands. Insert the twenty strands of 3/16" brown rubber 44" long into the fuselage and attach it to the rear plug and the propeller shaft.

After completely assemblying the model, put about a hundred turns in the rubber and then allow them to run out. This will bring the tensioner into play. Slide the wing to the point where the model will be slightly nose heavy when held at the trailing edge of the wing. Glide the model. If it dives, add negative incidence to the *elevator* till it has a flat glide. If it stalls, add positive incidence. Warp a little right turn into the rudder. Put about fifty turns in the rubber and try flying the model. Add negative incidence or right rudder thrust, as the case may be, until you have a steady climb in rather tight spirals. After the model is correctly set, put the winder to it and watch it head for the clouds.

ABOUT LEO BAILEY

Leo Bailey is one of the reasons for Akron's usual success at the Nationals. His record certainly shows that he "more than does his share" to keep Akron up with the front of the line.

Leo has been a rather consistent winner in the Akron contests. His heart, apparently, is entirely in rubber models, as he has flown in all events except gas. Last year he won a scale-model event and placed high in many other contests. In spite of his local record, Leo has only dabbled in the Nationals events. The '38 Nationals is the first in which he has entered with a vengeance. As a result, his ship won the Senior Fuselage Event with a flight of 23 minutes and 35 seconds.

The General Tire and Rubber Company has found Leo Bailey indispensable as a draftsman. Leo, however, hopes to be an aeronautical engineer some day. He was twenty-one on July 29, 1938, (just after the contest), and has been building models for the last ten years. Because of his age, in all future Nationals he will be a strong contender in the Open Class events.

THE ZIPPER

(Continued from page 47)

permanently in place. The rear hook is attached to the fuselage as shown in Section A-A. It is held to the sheet by cement.

The wheels are cut from 3/32" sheet stock as indicated on the plan. Both the pants and the landing-gear fairing are optional.

WINGS

The wing is simple in construction. It is constructed in one unit. The ribs are cut from 1/16" sheet stock to the form illustrated in Section B-B. The trailing edge is notched to allow for the ribs as shown. The leading edge is 3/32" square stock shaped to the contour of the rib. The wing is constructed as a straight panel. It is then bent upward from the center to form a dihedral angle with a one-inch rise at the tips. W-1 and W-2 are glued in place. These members give the proper angle of incidence.

TAIL UNIT

The tail-unit construction follows along the same lines as the wing. The ribs, however, are of 1/16" square stock. Both the leading and trailing edges of each unit, horizontal and vertical, are sanded to shape after the surface has been removed from its jig.

Both the rudder and the stabilizer are attached to the fuselage in one unit. The stabilizer is maintained at zero-degree setting.

PROPELLER

The propeller is carved from a medium-hard balsa block. Its shape is outlined with a hard pencil as shown on Plate 2. The propeller is first blanked to shape. It is then carved. Actually, there is little that can be said as to the manner of carving a propeller. Experience seems to be the best teacher. In finishing the propeller it is of utmost importance that it balance. By inserting a pin at the hub the balance can easily be checked. Care should be exercised to maintain the shape of the blades alike. After the propeller has been finally completed, it is suggested that it be given a few coats of banana oil and resanded to a smooth surface.

COVERING

The complete model is covered with superfine tissue. The wing is covered on one side only, as are the stabilizer and rudder. The paper is doped to bring it taut. If water is used to shrink the paper, extreme caution should be taken not to apply too much water. Otherwise the wings and tail surfaces might be completely warped out of shape.

FLYING THE MODEL

The propeller is attached to the front shaft, which passes through the nose plug. The hook on the shaft should be made small enough to pass through the hole of the nose block. The propeller rotates against several washers, as illustrated.

The model is powered with four strands of 3/32" flat rubber. The wing is held in place by a rubber band, as indicated on Plate 1.

The wing is located approximately one half inch back of the second vertical member. The model is first glided. It should assume a very flat glide. If it tends to dive, the wing should be moved slightly ahead; if it tends to stall it should be moved to the rear. After the proper location is found the propeller should be given about fifty turns and the model launched. Readjusting may be necessary in the same manner as in gliding. Experimenting with different settings of the wing will result in the best flights.

With the model adjusted, the propeller should be wound to its full capacity and launched into the wind.

MODEL MATTERS

(Continued from page 43)

Currently, the Stix, Baer & Fuller Co., sponsor of local activity and club work, has started a membership drive which it is hoped will gain two hundred and fifty quality members to tone up local competitive talent.

It was not so long ago that St. Louis entrants at the Nationals provided top-notch competition for the finest builders in the land. If St. Louis is relinquishing its well-deserved position in the sun it is to be lamented. The competitive spirit of other cities should make the coming Nationals one of the hottest ever. Let's hope St. Louis will be up there again with this year's winners.

Following is the club activity program for the coming season:

April 15th: classes; dramatizing membership campaign; Merchants-Exchange Scale Contest; old-timers to speak. April 22nd: classes; questionnaire regarding aviation, with simple questions about the membership drive; old-timers to speak. April 29th: classes; Forest Park Stick Type Contest; membership drive closes at 5 p. m. May 6th: awarding of prizes; announcement of coming contests and activities to assembly. May 13th: Forest Park Gas Model Contest; classes. May 20th: classes. May 27th: classes. June 3rd: classes; Forest Park; Fuselage Model Contest (with particular attention paid to weight instructions). June 10th: classes; announcements of eliminations; former champions to speak regarding the experiences at previous Nationals. June 18th: National eliminations at Parks Air College. June 24th. classes; preparations for Summer School. July 1st: farewell to National representatives; opening of Summer School Arts and Craft Division. July 5th-9th: Nationals at Detroit; classes. July 15th: classes; Balloon-busting Contest, 9th floor; Boat Regatta, Forest Park. July 22nd: Forest Park, gas models; classes, gliders. July 29th: trip to airport, afternoon; classes. August 5th: classes; final announcement on Mississippi Valley Contest. August 13th: Eighth Mississippi Valley Model Airplane Contest. August 19th: Summer School closes; display of work; exhibit opens August 21st. August 26th: class work; Boat Regatta, Forest Park; gas contest, Forest Park; performance event. September 2nd: class work.

A lecture course, "Refinements in Model Building," will run for ten consecutive weeks and then be repeated. The chief instructor will use any device he may choose to clarify his lecture. The lecture will begin at 9:45 a. m., Saturdays, and will last no longer than fifteen minutes. Following is the schedule: 1. The Story of the Stix, Baer & Fuller Model Airplane Club. 2. Contests and How to Participate. 3. Covering Odd-shaped Wings and Bodies. 4. The Importance of Correct Balance. 5. Microfilm and Indoor Models. 6. Proper Launching and Flying of Model. 7. Selecting the Correct Amount of Power. 8. Carving a Propeller and its Relation to the Correct Power. 9. Getting the Most Results from Rubber Power. 10. Introduction to Gas Models.

CONTEST CALENDAR ADDITIONS. EAST PATERSON GAS MODEL MEET. May 21st, Cherry Hill, East Paterson, N. J. N. A. A. sanction. Entry fee, 25 cents, payable at field. Official flights between 10 a. m. and 5 p. m.

HORNELL AERONEERS GAS-MODEL MEET. May 21st, Hornell Airport, Hornell, N. Y. Duration event on 30-second motor run for models of at least 10-ounce wing loading. Cash prizes and merchandise awards. For information write John Washburn, 5 Main St., Hornell, N. Y.

FLINT GAS BUGS CONTEST. June 4th, Bishop Airport, Flint, Mich. Duration event, large and small bore, payload event. Write Flint Gas Bugs, Y. M. C. A., Flint, Mich.

LITTLE NATIONALS. June 17th, 18th, Gary, Ind. Sponsored by Bram's Community Service Stores. N. A. A. sanction. Gas model consistency event, rubber-powered event (outdoor cabin or fuselage), exhibition contest (scale model). Approximately $250 in cash prizes, plus bonuses, and awards and trophies. For rules and entry blanks write to Bob Roberts, Contest Director, Bram's Community Service Stores, 4490 Broadway, Gary, Ind.

METROPOLITAN MODEL AIRPLANE COUNCIL. With an entry list of more than a hundred of the most active gas-model builders in the Greater New York area, the Metropolitan Model Airplane Council held its first N. A. A.-sanctioned outdoor gas-model meet of the 1939 season at Creedmore Field, Long Island, and despite unfavorable wind conditions some excellent times were made by the contestants.

The large motor event drew the most entries, and after preliminary test flights it soon developed into a duel between Sal Taibi of the Brooklyn Sky-Scrapers and Henry Struck of the Queens Model Airplane Club. Struck, flying a Brown-powered ship of his own design, a six-footer with inverted motor and single-wheel landing gear, got off first to a flight of 3:18. Taibi launched the Forster-powered seven-footer of his own design a few moments later and did 3:29. On his second flight Struck's craft did 5:04, but was washed out for the day after landing in a tree. Taibi's second flight, the longest of the afternoon, was timed at 6:04, the plane flying out of sight over the eastern boundary of the field.

Due to wind conditions few fliers completed three flights. John Tourville, of the Kee Wee Club, had three flights in a Brown-powered Heath Monarch, his longest flight being three minutes five seconds, and his total time of 4:19 giving him third place. Magnus Anderson, of the Richmond Flying Club of Staten Island, flying his Brown-powered Thor, did 3:49 on three flights for fourth place, and Tony Bacchi of the Sky-Scrapers did 3:29 on two flights for fifth place in a Brown-powered job of his own design. Other place winners in the large motor event were Edward Beshar, Frank Leghorn, Irving Pearlman and G. Grathwhol. Beshar, Pearlman and Grathwhol used Browns, and Leghorn a Forster.

The small-motor event was featured by the performance of a tiny Buccaneer with Ohlsson power, flown by Joseph Raspante of the Majestic Model Club, who did 4:48 on three flights, his longest being 2:07. Raspante was the only man in his class who had three flights. J. F. Condon, of the Kresge Aero Club of Newark took second place with an Eaglet powered by a new Bantam. His total time for two flights was 2:17. Gilbert Rose of the Metropolitan Model League took third with an Ohlsson-powered ship, and Leon Shulman of the Sky-Scrapers took fourth with another Ohlsson job. Fifth was Philip Sagona, of the Sky-Scrapers, whose ship was powered by a Phantom.

The Brooklyn Sky-Scrapers, who made such an excellent showing at Creedmore, have elected the following officers for the 1939 season: Philip Sagona, president; Leon Schulman, vice president; Gordon Murray, secretary; and Saul Strassburg, treasurer. The club has adopted the slogan, "Brooklyn's Most Active Model Aero Club."

SEATTLE GAS MODEL CLUB. Ted Britcher, of the Boeing Airplane Co., was re-elected president of the club. R. D. Megordon was named as senior adviser. Contest directors for the coming season are H. T. Weeks and Professor Loughrige of the University of Washington. Other officers: Richard Scheerer, vice president; Howard Fuller, secretary; Fred Herold, treasurer; Lloyd Owens, corresponding secretary.

S. G. M. C. is a member of the Northwest Gas Model Association. The association plans to send five members to the National meet this summer. Plans have just been completed for a series of elimination contests. Modelers of the Northwest who are interested in competing for the trips should contact Lloyd Owens, 4553 West Othello Street, Seattle, Washington.

GALT, CANADA. Galt, Ontario, is a model-minded city largely through the efforts of its No. 1 model citizen, John T. Dilly. He's practically as well-known below the border as he is in Canada. A national meet would not be complete without him. As secretary of the Galt Model Airplane Club he has worked out an interesting monthly report of the club's activity and Canadian model news in general. The following Canadian records have been tabulated by the Galt Model *Aircrafter:*

INDOOR

Baby R. O. G. (30 sq. in. or under). Junior: Don McIntyre, Guelph, Ont., 7:05; Senior: Ernest Houslander, Hamilton, Ont., 8:34; Adult: Thomas G. Harris, Toronto, Ont.

Stick Hand-Launched (30-150 sq. in.). Junior: Bert Norman, Vancouver, B. C., 10:15; Senior: Harry Burrows, Toronto, Ont., 17:14; Adult: Thomas G. Harris, Toronto, Ont., 20:37.

Fuselage R. O. G. (30-150 sq. in.). Junior: Clarence Dunn, Hamilton, Ont., 7:07; Senior: Ernest Barrie, Galt, Ont., 13:46; Adult Thomas G. Harris, Toronto, Ont., 12:00.

Flying Semi-Scale R. O. G. Junior: Terry Algeo, Winnipeg, Man., 2:14; Senior: Jim Templeton, Toronto, Ont., 4:13; Adult: Albert Levy, Toronto, Ont., 4:14.

Glider H. L. (30-100 sq. in.). Junior: Donald Gray, Vancouver, B. C., :32; Senior: Ernest Barrie, Galt, Ont., :33; Adult: Bill Doe, Vancouver, B. C., :30.

OUTDOOR

Stick H. L. (100-200 sq. in.). Junior: Fred Bower, Toronto, Ont., 8:15; Senior: Roy Nelder, Toronto, Ont., 9:12; Adult: John T. Dilly, Galt, Ont., 4:21.

Wakefield Models (average of three flights). Junior: Melvin Welsh, Toronto, Ont., 1:14; Senior: Robert E. Milligan, Toronto, Ont., 4:56; Adult: Lavalle Walters, Windsor, Ont., 2:21.

Gasoline Engine Models (30-second power shut-off). Senior: Douglas Ireland, Edmonton, Alta., 2:59; Adult: J. D. Kennedy, Toronto, Ont., 4:02.

Editor's Note—The drawing of the New Four-Cycle Engine in the February issue included lettering which read "EXHAUST: opens 35° ahead top center, closes 4° past bottom center." This should have read "EXHAUST: opens 35° ahead bottom center, closes 4° past top center."

ACADEMY APPOINTMENTS. The following individuals have been recommended for the position of State Director or Associate State Director in the various States:

New York: Harry Copeland, Syracuse; Pennsylvania: Bob Allen, Pittsburgh; Ohio: H. M. Jellison, Akron; Missouri: Bob Sommers, St. Louis; Illinois: Frank Nikimken, Chicago; California: Barney Snyder, Los Angeles; Michigan: Arthur Vhay, Detroit; Massachusetts: Albert Lewis, Boston; Louisiana: Roccos Glorioso, New Iberia; North Carolina: Allan Booton; Maryland: John G. Lacey; Indiana: Bert Pond, Robert Roberts; Virginia: Philip W. Pepoon; Connecticut: Alfred Schmidt; Georgia: Cappage; Florida: Bob Carr, Timpone, Jacksonville; Wisconsin: Conrad Hansen, Jr., Beloit; Arkansas: H. A. Thomas, John Worthen, Little Rock; Nevada: Wm. R. Woodard, Reno.

These men must be experienced in model aeronautics activity as leaders and contest directors, and must be members of the Academy of Model Aeronautics before they can be appointed. It is hoped that the model builders in each State will assist the academy president in making appointments by voting in favor of the suggested individuals or by suggesting others who are fitted for this position. In the larger States, where activity warrants it, two directors will be appointed. No State Director will be appointed in an area which is covered by an academy officer who will act in the capacity of State Director. Model builders in each State are asked to write to the secretary of the Academy of Model Aeronautics, 429 Seventh Avenue, New York City, either approving the nominee in their State or recommending another individual who in their opinion might be suited for the work. There are no nominations from many States. Builders in these States are particularly asked to send in their suggestions without delay.

Edward Roberts, president of the Academy of Model Aeronautics, has announced the appointment of the following committees:

National Conference: Albert Lewis, chairman, with academy officers making up the rest of the committee. National Contest: H. M. Jellison, Arthur Vhay, Harry Copeland, Bob Sommers, Frank Nikimken, Wm. Berry, Nathan Polk. International Co-ordination: Gordon Light, Frank Zaic. Radio-control Model Committee: Clinton De Soto, Joe Raspanti, Bruno Marchi, Pat Sweeney, Philip W. Pepoon. Publications Committee: William Enyart, chairman; Charles Grant, Paul Lindberg, Philip Zecchitella, C. B. Colby, Wm. Winter, D. C. Cooke. Rubber Model Committee: W. Tyler, Carl Goldberg, Louis Carami, Gordon Light, Hewitt Phillips, Joe Kovel, Henry Struck, James Cahill, Henry Stiglemeyer, Roy Wriston, Frank Zaic. Scale Model Committee: Roger Hammer, Bob Crawford, Victor Fritz, H. M. Jellison, Percy Pierce, Henry Struck, Alan Booton, Nelson V. Johnson. Membership Committee: Shall consist of the officers of the academy and the State Directors in each State. When appointments become final, all applications for membership of the academy will be cleared first through the State Directors, who will aid in carrying on the work of the Academy of Model Aeronautics in each State.

As approved by the Academy of Model Aeronautics, the academy president hereby requests that the N. A. A. groups on the West coast elect a vice president who will serve as the academy official in their territory. The matter of nominations and elections is left entirely up to the clubs concerned. The individual elected should be thoroughly experienced in model work and have the respect of the model builders in his area. Executive ability and a little free time to devote to academy work would help a lot.

GAS MODEL LIABILITY INSURANCE. There has been increasing demand from model fliers for some kind of insurance to cover possible lawsuits in case a model, by accident, should hit some unwary person or damage property. An example often cited is the chance of collision with the windshield of a car. The car owner might sue the flier for loss of a windshield and cuts by flying glass, or a spectator at a contest might "get it in the neck."

The N. A. A. and the Academy of Model Aeronautics have arranged a policy of insurance under which fliers of N. A. A.-licensed models may buy, for only one dollar per year, a reasonable amount of insurance to cover these risks. Arrangements were made for modelers by Brown Crosby & Co., Inc., of New York, insurance brokers for many well-known airplane manufacturers and operators. The policy was placed by Brown Crosby with Aero Insurance Underwriters, whose claim agents are located all over the United States.

The insurance covers legal liability. That means the insurance company will defend any lawsuit brought, and pay any verdicts up to the policy limits, which are $500 for personal injury and $500 for damage to property, $1,000 in all.

The insurance plan will begin to operate as soon as five hundred applications are made. When and as the number insured increases to a large enough number, the costs may be reduced and benefits increase. The coverage protects the model flier and his parents, if he is a minor.

Application may be made with pay-

ment to N. A. A., DuPont Circle, Washington, D. C., or through the local club, who will send it along to N. A. A. Certificates of insurance will be issued to modelers when the policy takes effect, the original master policy being held by N. A. A.

The insurance will apply only while models are being flown in accordance with Federal, State, and N. A. A. rules and regulations.

Model fliers are urged to take advantage of this low-cost protection at once for their peace of mind. This is real recognition of the importance of model fliers to the aviation industry by the same insurance company covering air lines, commercial operators, private fliers and other big ship owners.

Don't wait for the next fellow to send his dollar in; send yours today. Five hundred applications must be made before the insurance becomes effective. Send in today and get your fellow modelers to do the same, so that everyone can get the protection this insurance will afford. Many flying days lie ahead—make them safe.

THE NEW POWER MODEL RULES. The Power Model Committee, consisting of Elbert Whethers, Barney Snyder, Irwin Ohlsson, William Atwood, Michael Roll, Roy Marquet, Maxwell Bassett, Alan Booton, Bob Somers, Philip Pepoon, Bob Allen, and Bob Forster, approved the power-model rules recommended by the Academy of Model Aeronautics at the meeting held in New York last November, with the recommendation that there also be an open class. Rules which go into effect immediately are as follows:

Class A: Models having a wing area up to 225 square inches. These models must use engines having up to and including .20-cubic-inch displacement. **Class B:** Models having 226 to 450 square inches of wing area. These models must use engines having up to and including .30-cubic-inch displacement. **Class C:** Models having 451 square inches of wing area and over. These models must be powered with engines having up to and not over 1.25-cubic-inch displacement. **Open Class:** Models of any wing area and any engine power providing they conform to the general power model rules.

Models in all classes shall conform to the following rules: In official contests the motor run must be no greater than twenty seconds from the instant the model rises off the ground. Models must weigh at least eight ounces per square foot of wing area. They must conform to the N. A. A. fuselage cross-section rule, and their total weight must not exceed seven pounds. The scoring time will be the *average* of three official flights.

There has been some delay in announcing these rules in full, due to some apprehension on the part of several academy members as to their satisfaction. A power-model committee was therefore appointed to study the rules and make recommendations if it was felt these were necessary. Nearly ninety percent of the committee felt that these rules were ample with the added classification. So these are the new power rules for 1939.

If academy members or model builders feel that these rules could be improved upon, they are asked to write to the Power Model Committee chairman, Maxwell Bassett, 66th Avenue and 11th Street, Philadelphia, Pa., suggesting changes which will be studied by the Power Model Committee and presented before the next academy meeting for consideration of the 1940 rules. This applies also to other rules and committees. Model builders are invited to submit their suggestions regarding any rules to the committee in charge of the particular model classification.

The complete 1939 rules governing model aeronautics in the United States will soon be available at the N. A. A. office at DuPont Circle, Washington, D. C. In requesting these rules, send a self-addressed stamped envelope or a five-cent stamp.

MORE ON ADMIRAL MOFFET CONTEST. The American International Contest for the Admiral Moffet trophy will be held in connection with the American National Model Airplane Championship Meet in Detroit, Michigan, July 5th to 9th. The following rules will be in effect:

Models in this contest shall be of the cabin type with built-up, closed fuselage, and shall resemble man-carrying aircraft. The minimum area of the maximum cross-section shall correspond to the formula $L^2/100$, where L equals overall length of the model, excluding the propeller. Full-size drawings of maximum cross-section shall be submitted. The fuselage shall be of approximate streamline form and have not less than ninety percent of its surface area covered. Outriggers and booms may be used on fuselage-type models.

The fuselage shall be a structure which supports the motor, wings, empennage, and landing gear. Any type of power is permitted except gas. When rubber is used for motive power it shall be contained entirely within the fuselage.

Models in this contest shall have a wing area of not less than 100 square inches and not over 200 square inches, and shall weigh three ounces for every 100 square inches of wing area.

Models must be of the rise-off-the-ground type, with a landing gear that permits them to take off from the ground from a standstill under their own power. The landing gear must be strong enough to support the model while taking off and landing, and its usefulness must be demonstrated by gliding the model from a height of at least four feet, landing without damage and without nosing over. The wheels shall turn freely and shall be of a diameter of no less than 1½ inches.

Only one model is permitted for each contestant. The winner is determined by the best one of three flights.

Each country may be represented by a team of six members. Foreign entries, except Canadian, may be flown by proxy if the owners are unable to attend.

The six highest duration flights made by Canadian entries and the six highest duration flights made by United States entries in the outdoor rubber-powered cabin contest will comprise the Canadian and United States teams for the Admiral Moffet International Contest, and only members of such teams are eligible to compete in this contest. Foreign entries must reach the Contest Director at Hotel Fort Shelby, Detroit, Michigan, not later than July 4th.

THE NATIONALS. Plans are nearing completion for the Twelfth National Championship Model Airplane Meet, which will be held under the direction of the Detroit Metropolitan Council of Exchange Clubs, July 5th to the 9th. Some twenty-eight exchange clubs in the greater Detroit area are acting as sponsors of this year's National meet.

The events will be practically the same as those of last year. There will be an indoor stick contest for Class A to D models, an indoor cabin contest for Class A to D models, the Admiral Moffet International Contest for cabin models of one hundred to two hundred square inches, and Wakefield International Competition Eliminations to determine the American team of six. There will be an outdoor flying scale model contest for scale models not over two hundred square inches of wing area. At the present time the National Contest Board has not definitely decided to schedule an outdoor stick model contest and another outdoor cabin model contest (Stout); these two events have been held in the past National meets. The power-model contest will consist of the four events for the new power-model categories established by the academy.

Rules and contest applications will be available the latter part of April or the early part of May. Detailed rules will be announced in this magazine as soon as possible.

Irwin Polk, meet manager of this year's Nationals, has requested the cooperation and support of the model industry in making this year's meet a greater success than any previous one. The National contest is the most important activity in model aviation. All manufacturers and members of the industry are urged to lend their support by cash, merchandise, or trophy donations. In view of the fact the exchange clubs of Detroit are bearing the full burden and financial responsibility of the technical conduct of the meet, it is no more than fair that the model industry lend its support by co-operating in the matter of prizes.

The Fred W. Megow trophy and plaque will again be presented to the club which accumulates the greatest number of points in the meet. The Akron N. A. A. Chapter won the Megow club trophy last year.

The point system will be as follows:

1. Indoor stick model event.
2. Indoor cabin model event.
3. Outdoor flying scale model event.

The following points will apply:

	1st	2d	3d	4th	5th	6th	7th
Radius of 100 mi.	16	5	4	2	2	1	1
" " 200 "	17	6	5	3	2	1	1
" " 400 "	18	7	5	4	3	2	1
" " 700 "	19	8	6	5	4	3	2
" " 700+"	20	8	7	6	5	4	3

4. Gas-powered model event. Class A, B, C, or Open.
5. Radio-controlled model event.
6. Moffet International cabin model event.
7. Wakefield International Contest Eliminations.

	1st	2d	3d	4th	5th	6th	7th
Radius of 100 mi.	22	7	2	2	2	1	1
" " 200 "	24	9	4	3	3	2	2
" " 400 "	26	11	6	4	4	3	2
" " 700 "	28	13	8	6	5	4	3
" " 700+"	30	15	10	8	6	5	4

GLIDING AND SOARING

(Continued from page 33)

Silver "C" prior to June 24, 1939, are eligible for the National Championship.

The question of participation by foreign pilots was also raised. It was pointed out that foreign participants have so far won most of the big prize money which, in the hands of American soaring pilots, would go toward construction or purchase of sailplanes and equipment, and thus help the movement in this country. It was recommended that foreign pilots be excluded from cash money prizes and be eligible only for trophies and similar awards. The final decision will rest with the contest committee.

It was recommended that the government establish a Motorless Flight Institute, preferably at Elmira, for the purpose of training instructors, supervising the construction and manufacture of sailplanes and gliders, organizing clubs and schools, furnishing basic training for high-school boys, and providing glider instructors to clubs and schools. This organization would be separate from the S. S. A.

Ben Shupack, radio expert of the Airhoppers Gliding and Soaring Club, suggested that the S. S. A. ask the Federal Communication Commission to provide a glider radio band of 60-61 megacycles, around five meters, with an output not to exceed twenty-five watts, for the purpose of safer instruction and communication between the sailplane pilot and his crew. Shupack also suggested that the examination for a radio operator on such a band be similar to the third-class radio telephone operator's test. These recommendations were adopted for presentation to the F. C. C.

All in all, the Second Planning Conference was a great success, inasmuch as very definite and concrete work was accomplished, and prospects for the coming season look bright indeed.

CLUB NEWS

Elery Clark, of the Clark Glider School, Hartford, Conn., has sold his Mead utility to a glider club formed by the members of Marine Reserve attached to the VSM3R Squadron. Clark is going to use his Cadet for student training and airplane tows, as well as for investigation of suitable soaring sites along Connecticut ridges.

Al Valliere, of Hartford, Conn., has started assembling his Albatross sailplane. Unlike others, he does not contemplate bringing his ship to the Elmira contest this year, as he wants to be thoroughly familiar with it before entering competitions.

The Ithaca Glider Club, organized recently, now has eleven members and owns a Franklin glider purchased from Udo Fisher. Fisher, a member of the club, brought a Goeppingen sailplane with him on his return from Germany. Five of the club members are powerplane pilots.

The XYZ Glider Club sold their Haller Hawk senior sailplane and are now looking for a Grunau Baby, or a Goeppingen-Wolf.

From California, Jay Buxton sends us an interesting letter on gliding activities in the Land of Sunshine. The Southern California Soaring Association has been increasing at the rate of two or more members each week. It is now incorporated, and Gus Briegleb, manufacturer of Briegleb gliders, puts out a large mimeographed page of news each month.

Douglas Hugill, Bob Bailey and Birch Wilson, of the Curtiss-Wright Institute, are building what will probably be the first strictly all-metal sailplane in the United States. If practical experience counts for anything, this ship should be outstanding. All three boys are active glider pilots, and Wilson has every kind of aeronautical license, including free ballooning. Hugill lays out tooling at the Northrop factory, Bailey is an engineer at Vega, and Wilson runs the sheet-metal department at Curtiss-Wright. As a school project, building the ship has full co-operation of all departments. The ship is expected to be finished in time to enter the Elmira contest. The engineering will be very complete, in accordance with C. A. A. requirements, so that a license may be obtained.

The Associated Glider Clubs of Southern California have been working hard on their Torey Pines soaring sites. Runways facing all possible wind directions have been graded, and a comfortable clubhouse has been built. This active bunch has a large abandoned World War field available for training of student members.

Stan Corcoran made a seven-hour flight in his Cinema at Frankfort, Michigan. Stan is instructor for the Frankfort Soaring Society. Seventeen members so far have joined the society, and all of them are already flying due to Stan's excellent training.

Jay Buxton and his pretty daughter Lucretia have been keeping the Transporter busy flying passengers. Lucretia appears in the Grantland Rice Sportlight, "Champion Airhoppers," in which she demonstrates her flying skill.

THE LATEST IN RADIO CONTROL

(Continued from page 41)

valid reason except that it seemed a good idea. It is, of course, entirely demountable. The fin is permanently attached to the fuselage.

The elevator and stabilizer assembly is fitted into the fuselage by the simple process of sliding it into a slot left between the main longerons and the side stringers of the turtle-deck. It was found desirable to brace the stabilizer by running fine steel wire tautly from tip to tip via the top of the fin.

The three rudder hinges consist simply of 2″ lengths of ⅛″ aluminum rod, threaded $^{6}/_{32}$″ at one end, bent at right angles. These project from the fin to which they are fastened by nuts, *à la* curtain-rod holders. Small aluminum tabs on the rudder engage these rods. The rudder horns are of $^{1}/_{32}$″ aluminum sheet, bent in teardrop shape for greater strength, riveted to the rudder spar. Each is about four inches long.

The four elevator hinges are U's of the same aluminum rod, bent around short lengths of $^{3}/_{16}$″ aluminum tubing which slides smoothly over the rod. The ends of the U's are threaded and fastened to the elevator spar with nuts; the pieces of tubing are clamped by small plates of sheet aluminum riveted to the stabilizer spar—and the hinges are complete.

LANDING GEAR

At the start of this article the statement was made that the design of a craft of this type brought up many new problems. Not the least of these was the landing gear. In all, three different sets of experimental landing gear were built and washed out before the lesson sank in. The present arrangement is based on detailed engineering calculations of the stresses involved, and seems to be all right. It is heavy, very heavy in comparison to smaller models, but of reasonable proportions when compared with full-sized ships.

The axles and front struts are made of ¼″ steel drill rod. The rear struts and shock struts are made of ¼″ 17S-T hard aluminum rod. (Why do aircraft folk insist on using the term "dural" when its base, "duralumin," was discontinued as a trade name by Alcoa five years ago?) Sheet-aluminum gussets are formed at the hub junctures and riveted in place. At the fuselage end each strut is flattened and drilled for a $^{6}/_{32}$″ screw, which ties into an aluminum cross rod on each side. This in turn is hinged inside a pair of clamped sleeves bolted to the fuselage. The shock struts are tied together with a wrapping of live rubber strip two inches wide and about two feet long, taken from a new inner tube.

The tires are size 2 x 10″ single-tube toy tires, of the sort used on children's bicycles and wagons. They are mounted on one-piece wheels turned out of basswood. Although heavy, tires and wheels of this sort are essential with a heavy ship; unfortunately, no adequate lightweight model wheels are currently available.

The tail wheel is a standard 3½″ gas-model type, supported in a U framework cut from $^{1}/_{16}$″ aluminum.

ENGINE

Something out of the ordinary is obviously required for the power plant of a plane weighing twenty-five to thirty-five pounds. Based on the former figure, performance calculations show that with $^{2}/_{3}$ horsepower available, a top speed in the vicinity of twenty-two miles per hour and a climb of about 300 feet per minute can be expected. Although not spectacular, such a performance is entirely satisfactory for an experimental "transport" of this type. Of far more importance than high top speed or rate of climb is low landing speed; this works out between fifteen and sixteen miles per hour for a three-point landing and about three miles per hour higher for level landing.

The problem of securing such an order of power could be solved in several ways. A two- or four-engined plane could be built to simulate a large transport or bomber, but this would multiply the possibility of motor trouble—and there are enough headaches without that!

So the co-operation of Forster Brothers was secured and a special two-cylinder opposed-type engine with $1^{1}/_{16}$″ bore and 1⅛″ stroke was built especially for this ship. The total weight of the motor is under three pounds complete, and it operates with a smoothness and freedom from vibration in great contrast to the ordinary one-cylinder engine. It delivers the required $^{2}/_{3}$ horsepower with ease, turning the 26″ propeller at 3,500 revolutions per minute. (For the twenty-five-pound weight a 24″ prop turning 4,000 revolutions per minute is believed somewhat better.) If necessary, the motor can be revved up to deliver in excess of a horsepower without difficulty.

One special feature of the motor merits comment, although its use is secondary in the present design. This is the throttle control, provided by including both high and low-speed intake jets to the common manifold, with a butterfly valve between them for speed control. Eventually it is expected that radio throttle control will provide an invaluable adjunct to smooth handling on take-offs and landings.

RADIO-CONTROL SYSTEM

The radio-control system used in this ship is based on the existence of three items of equipment which happen to fill specialized purposes admirably.

First of all there are the RK-62 vacuum tubes. These are a recent development directed specifically at the model field. The tubes are gas-filled triodes, similar to type 30s, possessing the same quality of tremendous transconductance at the breakdown point as their big brothers in the industrial field, but with the customary defect of "slide-back" reduced to a point where they provide relatively enormous plate-current changes with very weak signals when used in one-tube 56-Mc. super-regenerative circuits.

In fact, so sensitive are these tubes that they enable a one-tube receiver which is more reliable and consistent than the three-tubers believed to be optimum hitherto.

To give credit where credit is due, the RK-62 is a development of Robert Packard, an engineer with the Raytheon Production Corp., of Newton, Mass., and a radio amateur as well.

The second important item is the Sigma Model 2-A 8,000-ohm sensitive relay. This relay has two major virtues: sensitivity (rated at 12 milliwatts, it is reliable on ½ ma. current change, positive on 1 ma.) and weight (it weighs only two ounces complete). Of course, there are supersensitive relays that outperform the 2-A electrically, but they are sluggish in operation and affected by vibration as well as being bulky and heavy. The Sigma is truly ideal. It is made by Sigma Instruments, Inc., of Belmont, Mass.

The third item of major importance is the miniature d. c. motors used to actuate the controls. These motors were chosen from the available types after a thorough examination of the field as the best compromise between performance and weight. They are made by the Utah Radio Products Co. of Chicago, Ill. Having been designed for use in automobile radio push-button tuning systeems, they're rugged and dependable.

The motors weigh six ounces each. They run satisfactorily for a short time on two standard flashlight cells, although after a few minutes' operation flashlight cells do not have sufficient reserve for really positive starting. This is due to the fact that the motors take quite a bit of current—more, in fact, than is necessary to power the controls through the high gearing ratio. But experience with lighter motors indicates that at least ½-ounce-inch of torque is required

for reliable starting. This means over two amperes of starting current. Under such a load the internal resistance of the flashlight cells reduces the available power, so that more voltage is required. Adding another flashlight cell will increase the dependable life period considerably; alternatively, a heavier three-volt battery can be used.

These motors come supplied with a built-in clutch intended to eliminate overrun in tuning systems. In the present application the gear train is a sufficient brake, however, and the clutching action is eliminated, as will be described.

GEAR TRAINS

Obviously, when a motor turning some 4,000 revolutions per minute is used to operate a control system at the equivalent of perhaps five revolutions per minute, some speed reduction is required. Several possible methods were considered, but in the end the conventional clockwork-type gear train was decided upon.

The construction of such a gear train is shown in Figs. 2 and 3. The motor and gears are assembled as a unit on aluminum mounting plates. These plates must be accurately laid out and the assembly must be precise; otherwise the gears will tend either to bind or slip. Accurate drilling is a little difficult in sheet aluminum unless a drill press is used. For this reason light sheet brass may be found preferable.

The gears are standard clock wheels throughout. They were secured from the E. Ingraham clock factory at Bristol, Conn.; similar wheels can be ordered either directly or through a local clock repairer by specifying the number of teeth and approximate diameter.

Inasmuch as the Utah motors come supplied with a built-in pinion, the first wheel must match it. Since clock wheels do not correspond with gear standards, the nearest approach to the pinion, which is 96 diametral pitch, is a $\frac{5}{8}$" wheel of 93 diametral pitch (thirty teeth per peripheral inch). All the other wheels specified run twenty teeth per inch, with the exception of the last gear in the elevator assembly. Since this has a substantial load, it and the driving pinion are of the fifteen-teeth-per-inch size.

Before starting to assemble these gear trains it is wise to secure several sizes of drill rod up to $\frac{1}{8}$", corresponding with the various sizes of wheel shafts. The shafts that are supplied are often either too short or do not fit the associated pinion. In the case of all wheels except the last one in each train a pressure fitting on the shaft is sufficient. It is best to solder the driving gear, however, to insure against slippage.

The gear trains are assembled with spacers cut from $\frac{1}{4}$" aluminum tubing and bolts of threaded $\frac{1}{8}$" aluminum rod. In this way the weight is kept down to $1\frac{1}{2}$ ounce total per unit; gross weight for motor and gear box is $7\frac{1}{2}$ ounces.

Small brass collars are located on the shafts so as to serve as bearings running against the mounting plates, keeping the wheels centered. With light oil on all bearings the train should move so freely as to permit driving the motor from the slow gear next to the driver by finger pressure.

RUDDER CONTROL

In the rudder control assembly the motor is mounted vertically. Thus the clutch is operative unless it is held "in" permanently by a spacer on the drive shaft inside the housing.

Protruding ends of the gear-box assembly bolts serve to mount the motor assembly on the plywood bulkhead, located in the fuselage at the rear of the cabin. The driver gear is mounted on a $\frac{1}{8}$" shaft which is ground down at the rear to clear the next gear; the other end of this shaft extends through a 2" hole in the bulkhead. Driven onto this shaft by a forced fit is a brass collar, which is further secured by a light pin going through the shaft. A small steel arm is forced over the turned-down outer end of this collar, which is then swaged for additional strength. At the end of this arm a $\frac{1}{8}$" steel pin is threaded into a hole until it is tight, whereupon the end is peened down to lock it in place.

Although requiring some time and care, an assembly of this type is complete insurance against slippage or "turning loose" due to vibration. There are so many things that can go wrong with a radio-control system that no single detail should be left to chance.

The driving arm operates a small rudder bar, which moves the control cable along over pulleys and back to the rudder horns. This "cable" is actually fine steel or brass wire up to the pulleys, where it is tied into a short length of good quality casting line. The wire won't run over the pulleys while the fish line is prone to stretch, so neither will serve alone.

ELEVATOR CONTROL

In the case of the elevator motor the horizontal installation automatically keeps the clutch engaged. The assembly is supported in the fuselage by a narrow plywood crosspiece. The motor is braced against the rudder assembly to reduce horizontal distortion caused by twisting of this support.

The $\frac{1}{8}$" shaft of the driving gear is fitted with a brass collar and steel arm and pin in just the same fashion as the rudder assembly. The end of the pin is drilled to receive a small cotter pin. The end of a length of $\frac{3}{16}$" aluminum tubing, flattened and drilled with a $\frac{1}{8}$"

hole, is secured on this pin with washers and the cotter pin.

The far end of the aluminum control shaft (which may seem too large, but isn't) is also flattened and drilled. It is connected to a fork of aluminum sheet, the fork being in turn riveted to the center of the elevator assembly.

The entire arrangement is such that it translates the rotary motion of the motor and its gears to lateral raising and lowering of the "flippers." It really works, too. The chief precaution is to keep tolerances small so as to reduce looseness and wabble.

Checking with the drawings will show how the elevator control fork slides inside the open rear end of the fuselage at the same time the elevator is placed in its slot. To complete the assembly operation the bolt which links the control shaft to the fork is inserted through a small window at the side of the fuselage. Thus the ease of demountability of the empennage is preserved at all times.

RECEIVERS

As can be seen, the four one-tube receivers are grouped on a plywood chassis eight inches square. Beyond the constructional information available from the photograph and circuit diagram there is little to add, except perhaps in connection with the operating characteristics of the RK-62 tubes.

Apart from the tuning control there are two controls in these receivers—antenna coupling and filament voltage—and each must be adjusted carefully. To start with, however, the plate voltage must be right. RK-62s work satisfactorily with a straight forty-five volts on the plate, but some perform best with lower voltages. In that case the B battery should be opened up (an easy matter with the small portable types) and the proper tap provided. This should be made the subject of experiment.

With the correct plate voltage, the filament voltage can usually be set at 2.2 volts and forgotten. However, variation within the permissible range (2 to 2.6 volts) will affect the characteristics considerably and adjustment may be necessary for optimum results.

That leaves the really important adjustment—antenna coupling. First of all, the antenna should be the proper length. This means not less than three or four feet, with about five or six preferable. (In the present ship one antenna is run along the bottom of the fuselage, one along the top, and the other two along the wings. Antennas of neighboring receivers should be kept as widely separated as possible.) The antenna coupling condenser is then increased until maximum plate current change occurs (being sure to retune after each antenna adjustment).

The maximum plate current should not be permitted to exceed perhaps 2.5 ma. Under average conditions the optimum operating figure is about 1.7 or 1.8 ma. If all adjustments are correct, even a weak signal will cause a change to 0.5 ma. or less. If a sufficiently high grid leak resistance is used the cut-off can be made substantially complete; but then, unfortunately, the time constant becomes pronounced.

Although the receivers can be tuned with reference to the relays alone, it is much wiser to make provision for inserting a tuning meter in each plate circuit—even if this consists merely of jumper connections, as shown in the wiring diagram. In connection with tuning, a point to be remembered is always to tune up *after* batteries are changed, never before. Fresh batteries in place of old will often change the operation immeasurably.

Speaking of batteries, the types found most useful in connection with this installation are the Burgess T2FL for filament supply (3 volts, 8 ounces), the Burgess X30FL 45-volt 13-ounce B, and the Burgess T3BP (3 volts, 12 ounces), for the motor drive. Three standard flashlight cells (4.5 volts, 10½ ounces), are also suitable for the motor. The battery combination with the minimum feasible weight would be two pairs of flashlight cells for filaments and motors and the Burgess W30FL 8.5 ounces 45-volt B, a net weight of 1 pound, 6.5 ounces.

TRANSMITTER

Inasmuch as there are so many considerations apart from performance affecting the design of the multiple transmitter assembly, no detailed specifications will be given. Any outfit that will give a reasonably stable signal at four points in the 56-Mc. band will do. No particular power is required, although at least 5 to 10 watts input is recommended in order that antenna coupling efficiency need not be too important.

The transmitter originally used employed four RK-34s as self-excited tuned-grid tuned-plate oscillators, the plate tanks consisting of 24" long pairs of ½" copper tubing spaced about ¾", tuned with 35-uufd. midget variable condensers. Sliding taps connected to ¾-wave-spaced feeders and center-fed half-wave antennas.

This transmitter worked satisfactorily, but the interlocking of grid and plate controls and antenna coupling made it difficult to spot frequencies precisely when setting up in the field. So a new transmitter was built, using the RK-34s as push-push doublers with conventional low-C coil-condenser-tuned circuits. Driving them are four 6L6G's as elec-

tron-coupled oscillators on 14 Mc., doubling in their plate circuits to 28 Mc. Inductive coupling is used interstage. By using "bandspread" oscillator grid tuning circuits it is possible to calibrate the transmitters quite accurately. In setting up, then, it is necessary merely to load the finals properly and the frequency stays put.

The antennas used are of the cheapest "whip" type as supplied for automobile radios. They telescope to 24 inches and open to 52. Two 8-foot "masts" of 1 x 2" wood have simple fittings at the tops, permitting connection of four of these antennas pointing in as many directions. Feeders are connected to opposite pairs, of course, and run to the transmitter. The stakes are set in the ground as far apart as the feeder length permits, the feeders being kept taut.

For power supply either a 400-volt portable a. c. unit or a 300-volt genemotor for field use are available. The average load is 50 to 60 ma., although 100 ma. capacity is desirable.

The control box, about 4 x 4 x 6", is mounted on a light camera tripod. In this box are four telephone-type key switches, which have an "on" position each side of neutral. Only two of these switches are at present in use: One connects in either of two transmitters for rudder control "left" and "right," while the other controls the remaining two transmitters for elevator control "up" and "down." The "stick" nature of the handles on these switches makes visualization of the response easier than with any rotary wheel or key device yet tried. A 50-foot cable connects the control box to the transmitters.

OPERATION

There is nothing difficult in connecting up the various elements of the control system. The first thing to do is to make sure that all details of operation are clearly visualized at the outset. To simplify:

The relays are merely switches which serve to turn the control motors off and on. The receivers, on the other hand, turn the relays off and on. There is a little complication here in that the relays are actually "on" when the motors are "off," and vice versa, since the idling plate current of the tubes is higher than with signal. That is the reason for SW2 in Fig. 1—without it on the motors turn continuously whenever the receiver power is turned off.

The best tuning procedure is to set one of the previously calibrated transmitters at 56 Mc. and then tune one of the receivers to it. Repeat this procedure at about 57.3 and 58.7 as well as 60 Mc. SW2 can be left open during this tune-up procedure. Then, with all channels aligned, close SW2 and test each position on the control box several times for reliability. Move the ship around, even bouncing it a little, to make sure that everything is solid and tuned "on the nose."

Don't worry too much about getting the receivers and relays connected in the right order to match the markings on the control box. It is easier and more sensible to provide an accessible terminal strip in the control box itself so that the proper connections can be made there once the receivers have been tuned to respond to different transmitters.

In handling the controls the same basic precaution as in regular airplane piloting applies: Do not overcontrol. The control surfaces on this ship are relatively large and a very small movement will change the angle of flight considerably. Even though the total travel of both elevator and rudder has been kept small, it is more than can normally be used. The timing of the controls has been worked out so as to enable accurate setting of small angles of arc; yet the total transit time per quadrant of one to one and a half seconds enables quite rapid shifts in direction when necessary.

No ignition difficulties should be experienced. This is one of the beauties of the RK-62 tube circuit; utilizing u.h.f. and d.c. solely, it is not affected by low-frequency pulses such as ignition, et cetera, as are audio-frequency systems.

In fact, if sufficient care is used in construction and adjustment, no difficulties at all should be experienced. To date something like a dozen receivers have been built using RK-62s and each has worked reliably, while half a dozen gear trains have all proved satisfactory.

There is just one more point to be made: Don't overlook the radio-licensing requirement. The penalties mentioned in August Air Trails still apply—and on top of that the Federal Communications Commission is at present carrying on a vigorous campaign against violators. So if you're a modeler, hook up with a licensed amateur to carry on the radio end of the project. As for licensed hams, our recommendation is to seek the co-operation of a competent gas modeler.

Each will need the other for technical assistance, in any event. This radio-control thing is far more difficult and complex than either ham radio or modeling alone; and the tendency of devotees of either field to oversimplify the problems of the other is often fatal. Divide the work—and you'll both get a whale of a lot more fun out of it in the end.

Note: It is the author's desire to express appreciation and thanks to the following for their helpfulness in connection with this project: Ross A. Hull, Carl Scherer, Chauncey T. Mitchell, J. R. Forster, Byron Goodman and T. M. Ferril, Jr.

SELECTING YOUR GAS ENGINE

(Continued from page 51)

on, while on the Wasp they are brazed on. Since nothing has been heard from the Madewell Co., of late, it is safe to assume that the Wasp is replacing it. The Wasp also comes in kit form for $12.95, and is the first kit actually on the market in the small-engine class. It is exceedingly simple to assemble and comes already lapped.

Trojan. The Trojan has a roller crankshaft bearing. By an exclusive process an absolutely leak-proof seal is obtained at the crankcase. It now comes with twin exhaust stacks cast into the cylinder and an inclosed timer.

CLASS B ENGINES

Models for Class B engines are more plentiful. There are any number of kits on the market which would perform very satisfactorily with any one of the B engines. These models, being slightly larger, sturdier, and heavier than Class A models, could be built with less skill, and since some of them could be a trifle smaller than Class C models, many builders stress them to take either a C or B engine. Or by building them at the bottom of the scale, they can be made to perform with a Class A engine, providing they are light enough. Of the small ships, Class B models are at present more popular than A models. This is due to the fact that the power plants in this class are only a trifle heavier than Class A power plants, but develop a great deal more power. The ignition system is the biggest handicap in this instance inasmuch as the weight of the coil, condenser, plug and batteries is practically the same for all engines. The B, therefore, has an advantage over the A. Should a satisfactory coil be placed on the market which will operate on 1½ volts, it will be a real boon to model builders by making possible the use of only one battery. Better still, if it would be possible to produce a Diesel engine in miniature, it would do away with the weight and difficulties caused by the inevitable ignition system.

The choice of a Class B engine is comparatively simple. There are fewer of these than in other classes.

M & M. The M & M was the first to make its appearance in this class. This engine is a lapped job having a steel cylinder and piston and an entirely original breaker-point system. The crankcase is sand-cast. The needle valve is not of the conventional micrometer type. Instead, it makes use of a baffle-type needle.

Hi-Speed. The Hi-Speed was designed by Bill Atwood, and is a rotary-valve type; that is, it receives its fuel by gravity feed. The mixture is then drawn through a hollow crankshaft which acts as a valve. This type of engine will run only in one direction, and since it is gravity fed, it is not recommended that the engine be inverted because of the tendency to flood the crankcase when the motor stops. A special inverted model is now available for $13.25. The crankcase and cylinder supports are integrally cast of Dow metal. Dow metal is an exceptionally strong super-light alloy. The plug of this engine is offset, which goes for better firing and follows a practice adopted in racing engines. Its needle valve is on a side below the shaft bearing, and extreme caution must be used in flipping the propeller to prevent snapping off the needle valve.

"23." The Ohlsson "23" has been considered by many as the finest bit of engineering in the model-engine field. This engine is ruggedly constructed, having a ¼" crankshaft with a ball-bearing thrust bearing. The bearing surface of the shaft and shaft bearing are tapered. The prop pulling through the air tends to seat the shaft. As the shaft wears, the prop may be tightened on, thereby pulling the shaft forward and providing a perfect seal as the bearings wear. The intake and by-pass manifold are cast in an integral unit with the rear section of the crankcase. The steel cylinder is then forced into the casting and spot-welded to this unit, being sealed at the joint with a gasket.

New Bantam. A new Bantam which will be known as the Bantam B will soon make its appearance on the market. The cylinder, back of the crankcase, by-pass and intake manifolds are cast as a unit. A finned head is bolted on over a steel liner. The front of the crankcase containing the crankshaft bearing is screwed into the crankcase. The timer is fully inclosed as on the small Bantam. A novel feature is the twin exhaust stacks.

CLASS C ENGINES

Our first model engines were the size used in C Class, and designs and kits for ships to be powered by such engines are plentiful. These models may be built from spruce or hard balsa sufficiently stressed for continuous flying and are of a size to permit interesting experimentation. Strong winds and clumsy handling do not affect these models so much.

Forster Bros. Forster Bros. is one of the oldest firms in the model airplane engine business and have pioneered such features on model engines as rings, aluminum alloy pistons and ball-bearing crankshafts. The motors are made of aluminum alloys throughout with the exception of the shaft, which is made of steel, and cylinder liner, which is also made of steel. The new low-head-type gas tank permits the motor to run until the tank is dry with one carburetor setting. The Forster is rated at 1/3 horsepower at 5,000 revolutions per minute. These engines have flown ships up to fifteen pounds, and they are extremely desirable for experimental and radio-controlled models. Forster Bros. manufacture their own coils, which have an excellent reputation with model builders. This engine has an automobile-type timer and runs on a leaner gas-to-oil ratio than most engines. This makes for less fouling and easier starting. Forster Bros. engines are available in three models. The B engines are air-cooled and available with either side-lug mounting or radial mounting with bronze main bearing at $17.75, or with ball-bearing for $19.50. Their C model has a one-inch bore and 1⅛" stroke, and is available either air or water cooled, and has a 14.5 CC or .883 cubic inch displacement. Rough casting kits with bronze-bearing crankshafts are available air-cooled in either B or C models for $6.50. The same engine kits with ball-bearing crankshaft cost $7.75.

Brown Motors. Brown motors, designed by William Brown, who, together with Maxwell Bassett of Philadelphia really started the gas-model bug on its way, are produced in a modern, wonderfully

equipped plant. Practically all of the parts that go into the Brown Jr., motors are manufactured in their own factory, and even the $10 D models are test-run. All Brown engines have a remarkable weight-power ratio and have a well-established reputation for reliability. They are available in four models. The B, at $21.50, is a lapped job having a steel cylinder and piston individually fitted, micrometer needle valve and choke nut, and the Number 1 type coil. It is also cadmium-plated to prevent rusting. The C model comes mounted, ready to run on a test block, at $17, and has the same specifications as the B, except that it has an aluminum-alloy piston with two cast-iron piston rings and a baffle type of needle valve. It, like the B, comes with a Number 1 type coil. The model D, at $10, was one of the finest low-priced engines in the field. Like the C, it had an aluminum-alloy piston with two cast-iron rings and baffle-type needle valve. It, however, did not come cadmium plated, and was not mounted on a test block. A Number 2 type coil was included with this unit. The crankshaft was made of "Z" metal and has been found not to stand up as well as the chrome molybdenum crankshafts which are used on the B and C models. The M model is the same as the D, except that it has a micrometer needle valve and a choke nut and comes cadmium plated with a flywheel.

The Brown motors all use a two-piece spark plug of their own manufacture, and a two-piece gas tank with a filter. At present the Brown models are undergoing a change in design. The new engines will come through with an improved type swipe timer which is extremely simple and foolproof, and a new transparent gas tank. This timer has its points above the shaft, which goes for cleaner operation and less fouling caused by leakage of oil at the shaft. All models will have micrometer needle valves, and the shafts in the lower-priced models will be made of chrome molybdenum. The new D model will cost $12.50, the C $18.50, the M $16.50. The B remains at $21.50. The new timers and gas tanks will fit the old motors, and no doubt many Brown, Jr., owners will modernize their engines by replacing these parts.

Baby Cyclone. The Baby Cyclone engine has been continuously improved since its conception. The present model F resembles the original model of three years ago in appearance only. This is a rotary-valve-type engine and comes mounted on a stand of which the gas tank is a part. The remote-control needle valve is a great improvement, which prevents a lot of needle-valve breakage and makes possible the control of the gas away from the prop. The finned duraluminum head reduces heat temperature and acts as a spark-plug gasket. The cylinder is cast iron with duraluminum sleeve shrunk on. The piston is hardened and ground steel and precision lapped. The crankshaft is drop forged, hardened and ground of high-carbon steel.

Dennymite Engine. The Dennymite engine is available in three models. In the De Lux Air Stream the cylinder is of molybdenum iron and is streamlined, presenting a greater surface to the air, which allows for better cooling. The piston is made of the same metal lapped to fit. The crankcase is made of a special aluminum alloy and has an extremely large bearing. The timer is fully guaranteed and you can get a free replacement if yours ever fails. The carburetor has a spring choke which is useful should the engine be cowled. The De Lux model has an extra long "downdraft" exhaust stack and comes mounted on dural motor mounts. The Standard Air Stream comes with a regular exhaust stack and mounts, but without the spring choke. Specifications are the same as the De Lux. The Denny Special has the old round cylinder head and comes without the streamlined outside exhaust stack and spring choke, but with dural mounts.

Gwin Aero. The Gwin Aero is one of a line of engines produced by the Bunch Model Airplane Company. The Gwin has a steel cylinder and comes with a permanently fixed exhaust manifold. The manifold seems to be the only apparent difference between the Gwin and the Mighty Midget line. Both kits and engines are available in assembled form, upright and inverted, and in kit form, upright or inverted. There is also the Mighty Marine engine, which is like the Mighty Midget with a better bearing, and comes with a flywheel. A new addition to the line is the Speedway engine, which is like the Gwin Aero, and comes with a special flywheel. This engine is made especially for model race cars, which are rapidly gaining favor with model builders. All Bunch engines come with aluminum high-domed pistons and two rings. These engines in kit form have brought gas engines within the reach of the average model builder. They are extremely simple to assemble and have proven very popular and satisfactory. These engine kits have all parts fully machined within very close tolerances, and require little or no skill in assembling. The only work to be done is the soldering of the gas tank, which comes complete with all metal parts formed. They now come with a timer system which is greatly improved over the original. Another new feature is the welded finned head.

Gold Seal. The newest Gold Seal has undergone a metamorphosis so complete that one would never know it from the old 1938 model. It boasts a transparent tank, thereby saving a great deal of lost

EXTRA

NEW BAY RIDGE DIAMOND DEMON SETS NAA RECORD

Special to AIR TRAILS

CREEDMORE, L. I.—What is expected to be a new NAA record for Class B gas model airplanes was established here March 19, when Sal Taibi, 19, of Brooklyn, N. Y., flew a Bay Ridge Diamond Demon to first place in the small motor event at a contest sponsored by the Metropolitan Model Airplane Council. The Diamond Demon averaged 3 minutes 6 seconds on three flights, and on the third and final flight flew out of sight after eight minutes and 12 seconds, on a twenty second motor run. The record has been forwarded to the National Aeronautic Association for certification.

The Diamond Demon, powered by an Ohlsson 23, was designed by Jerry Stoloff and the meet was the first in which the plane has been entered. The ship has a span of 48 inches and weighs 22 ounces complete, ready to fly. Primarily designed for a contest ship, the Demon is unlike most ships of the type, having received much comment because of the simplicity of construction.

Other Bay Ridge ships also performed with marked success at the contest. The showroom model of the Thermal Magnet, which was built primarily for display purposes, took second place in the large motor event, averaging 2:51 on three flights, the longest flight being better than four minutes. Bay Ridge Mikes took third and ninth in the Class B competition.

More than 200 planes were flown by some 125 entrants in the meet.

* * * *

CONFIDENTIALLY

Bay Ridge didn't expect to announce the Diamond Demon for another month. However, we know model builders and we're sure you'll want to be the first in your locality to own this SUPER PERFORMER.

The Diamond Demon is every inch a record breaker and that brilliant red and yellow color job will gladden the eye of every builder. Complete kit, including airwheels but less motor.....$2.95 post paid. C.O.D. orders accepted.

OH YES!

The sensational BAY RIDGE REWARD OFFER of a Brown, Jr. "D" to every first place winner who flies a Thermal Magnet or Bay Ridge Mike to victory in a major meet, holds good for the Diamond Demon. A $5.00 voucher award to second place winners. All planes must be built from Bay Ridge kits.

Other kits: Thermal Magnet $4.95 without airwheels. DeLuxe kit.....$7.50
Bay Ridge Mike $2.50 without airwheels. DeLuxe kit.....$3.50

RUSH YOUR ORDER TODAY!

BAY RIDGE MODEL AIRPLANE and SUPPLY CO.

232A 45th St. Brooklyn, N. Y.

motion in cranking an engine with an empty gas tank. The fully inclosed oil-proof timer combination radial and lug mounting, and fully counter-balanced, tapered crankshaft, are another feature of the engines put out by the Ohlsson Co. Another feature that the Ohlsson possesses is the removable front section of the crankcase, which contains the main bearing. Thus, in the event that the crankshaft bearing wears out, the entire crankcase need not be replaced. While the Ohlsson has been extremely popular on the West coast, it is rapidly gaining favor with modelers in the East. The carburetor lock on both Ohlsson engines is an important feature generally overlooked by other engine manufacturers. It makes possible the holding of an adjustment at any speed.

O. K. The O. K. motor is the newest addition to the C Class. It is manufactured by the Herkimer Tool Co., and is available in three models. There is the De Lux O. K. at $21.50, which comes complete with coil, condenser, and exhaust manifold mounted on skids ready for operation. It also has a finned head for better cooling. It has a lapped-steel cylinder and piston, and is also available in standard models that come complete with coil, condenser and engine unit less exhaust manifold, but with machined finned head. It has the same specifications as the De Lux O. K. and sells for $17.80. The third of the series is the O. K. Special, which also comes complete with coil and condenser less exhaust manifold, and less machined finned head, but with a turned aluminum head substituted for it. It also has the same specifications as the De Lux. All three of these motors have a novel type of tank that snaps off from the needle-valve assembly for cleaning. The contact-point system on all three models is very simple and is of the automobile type. The cylinder and crankshaft on the De Lux and Standard are made of somewhat better material than the Special model. All O. K. motors can be supplied in a specially inverted design with a special crankshaft main bearing and tank for an additional charge of $1.50.

Syncro Ace. The Ace comes in two models, the Standard and the Special. The Special sells for $9.95 and uses the smaller B gas tank. The Ace derives its streamlined appearance from the commutator case and gas tank. It has a steel cylinder and an aluminum-alloy high-domed piston with two rings. The new Ace comes through with an improved cam and is a particularly rugged engine. It has an Oilite self-lubricating bearing and its timer places the points above oil fouling. The by-pass and intake manifold are bolted onto the cylinder as in the Gold Seal.

MAKING A SELECTION

In selecting your engine, regardless of what size model it is, you must consider the price, the power, the weight and simplicity of operation. Power is based on displacement; the best engine is one which develops the greatest power for its weight. Lasting qualities of an engine and long and trouble-free operation should also be factors of primary consideration.

The ignition system is more important than is generally believed. It has been found that more than seventy-five per-cent of the time faulty ignition is the reason for poor starting. Inasmuch as the plug has to fire through a mixture of gas and oil, it is important that the spark be hot, and fresh batteries and well-soldered ignition wires will help immensely.

Lubrication must not be overlooked. We run our engines at such tremendous speeds that the heat within them is terrific, and since, at best, lubrication is derived from a mixture of oil diluted by gasoline, it is important that this be of the viscosity which will provide sufficient lubrication. Always use the grade of oil recommended in the instructions, usually SAE 70.

Do not disassemble your engine at the slightest provocation. That is the surest way to get into trouble. The greatest difficulty in operating two-cycle engines is flooding due to improper needle-valve adjustment, which is due to turning over the engine in an effort to start it when the engine does not fire. By patient trial you can arrive at the proper location of the needle valve and timer—from then on it is usually easy sledding. A model gas engine is a delicate mechanism. Treat it right and it will repay you with many hours of sport. Above all, have respect for your investment.

Note: In the chart on page 53, the recommended propeller for the Ohlsson "23" is 9-11" diameter, while that for the O. K. engine should be 14-15" diameter, rather than 9-11" as stated.

C. A. V. U.

(Continued from page 8)

It should be mighty interesting news from many angles that Canada's R. C. A. F. has unloaded the first of an unnamed number of the new Hawker Hurricanes at Vancouver and has assembled them for test flying. This should give the R. C. A. F. pilots first-hand experience on modern English fighters just in case.

★ ★ ★

Speaking of Canada, North American Aviation is planning a factory in Vancouver in the near future, and Barkley-Grow has the same idea. Boeing's Canadian plant is already hard at work turning out Blackburn Sharks, the first of which will be test-flown within a few months.

★ ★ ★

Doggonit, Willie, can't you remember a thing? C. A. V. U. means Ceiling and Visibility Unlimited.

★ ★ ★

At last something is being done about the millions of "aviation writers" who have been a drug on the market and a headache to every editor. These so-called writers have had the uncanny ability of providing uninformed editors with some of the weirdest "authentic" aviation news ever inflicted upon an unsuspecting public. It has been the poor editor's job to attempt to weed out what was bona fide and what was not. Now, with the recent forming of the "Aviation Writers Association," dedicated to the authentic and accurate dissemination of aviation news, we feel that a fine step has been taken in the right direction. Devon Francis, of the Associated Press, is president; James Bassett, of the Los Angeles *Times*, and Maurice Roddy, of the Chicago *Times*, are first and second vice presidents respectively. Michael Froelich, of *Aero Digest*, is secretary-treasurer.

★ ★ ★

Here's something different in clubs. A mighty interesting letter from Cameron Warne, secretary and treasurer of the Canadian Parachute Club, of Toronto, informs us that this unusual organization has a membership of over thirty parachute jumpers. The club was originated last year by George Bennett, who is parachute instructor for the Canadian Flying Clubs Association. On Sundays the club members travel to various airports giving demonstrations of their ability and acquiring further experience. Every club member holds a 'chute packer's license.

★ ★ ★

We just discovered that friend Rickenbacker's Eastern Air Line has fifty-four "million-miler" pilots among his gang. Congratulations to this veteran air line. It is particularly interesting when you consider that each of these men has spent the equivalent of one year continuously in the air.

★ ★ ★

Eastern Air Lines rings the bell, literally, when planes take off and land at their airports. They have installed large Mission-type bells hanging from oaken arches near the passenger gangways. These bells chime once to tell the world when the crew is aboard, twice for the passengers to board the ship, and three times when an E. A. L. ship is coming in. The bell towers have already been installed at Newark, Miami, Jacksonville and Atlanta. A nice idea, and may their notes always be cheery ones.

PLANES OR PILOTS?

(Continued from page 29)

army co-operation work and coastal reconnaissance. These Lockheeds are actually advanced trainers for men who will be expected to take over the faster Bristol Blenheims and Vickers Wellingtons. If war breaks out in the meantime, of course, they will fill a real need as active service planes.

Another communication from Mr. Robertson informs me that the commissioners of the Civil Air Guard and the Air Ministry have agreed on a further step in which it is proposed that all holders of "A" licenses who have suitable qualifications should be broadly grouped in a provisional register. The first part of this group will be composed of members between the ages of eighteen and thirty who might be eligible as service pilots in case of war. Others in this group above the age of thirty will be considered as instructors or ferry pilots in case of war.

In the second group we find men over thirty and up to forty, who, because their age or physical condition disqualifies them as service pilots, will be considered for duty as observers, radio operators or aërial gunners.

Then a third group for those not physically suited for combat duties and including women C. A. G. members, will be retained for ferry work, ambulance flying or general communications work.

Thus we see that in spite of some arguments against the scheme, it is working and following a sound path.

This brings us back to the original subject, the matter of training men for the United States air services. It is most important now that we who consider ourselves in the light-plane field realize our responsibilities in the present pilot-training program. Young men and possibly young women who have had any training at all should follow the national air-training movement to the limit and register as soon as possible. The plan will require members who know a stick from a prop blade. Those with some air time will naturally get preference wherever possible, and those who apparently fill the bill as future service airmen will be hurried into special training schools and given advanced training.

Certain points must be fully considered before you sign your name to anything or apply for this training. You must first consider and record faithfully whether you are physically suitable for the work involved. You will have to take a medical examination, yes; but the ordinary medical may not bring out the inherent twists or fears you may have, and they may not be discovered until you approach an advanced portion of the training program.

Some people, for instance, are naturally "gun-shy." I have known pilots who could perform any maneuver in the air—but found it impossible to fire a machine gun. Phobias like this kind are not unusual. They are things that happen to the most ordinary persons. I knew dozens of men who could stand in a trench and fire a .30-caliber rifle for hours on end, but they wouldn't pull the trigger of a .45 automatic for all the tea in China. I met dozens of men during the War who applied for commissions in the flying services just to evade trench warfare. They had no intention of ever flying or ever going over the enemy lines. They used the service as a gag to evade ordinary service.

There are men to whom the thought of a gas mask will cause an immediate swoon. Men who stand up under terrible punishment in the ring collapse completely when given an ordinary injection for typhoid or smallpox.

Hundreds of men totally unfit for service flying will apply for the chance of getting the training, especially if it is free. Hundreds will sign up just to be in the gang, without any intention of ever going through with it and actually flying. And some will sign up, knowing full well that their finances, home responsibilities or other matters absolutely forbid their going even fifty miles away to take the training.

This business of applying for these posts is serious. It is by no means a picnic, and the sooner the full responsibility implied is understood, the better for all concerned. If for any reason you believe you cannot qualify, you should step down and give room to those who can. Do not attempt to join up on any false urge of patriotism if you believe there is anything in your physical make-up that will bar you once actual flight training begins. If you are holding a position that is absolutely necessary for your financial well-being, or that of those relying on you, do not take up the government's time, your own, or your employer's time, unless you are absolutely certain your employer will be willing to allow you a certain amount of freedom should it be necessary to train you in the advanced section of the program.

In other words, do not attempt to join up in this civilian training program unless you are certain you can go through with it.

On the other hand, if you know you can fill the requirements, you should seriously consider making an application. If you feel you are the type who would make a service pilot, if you have a reasonable amount of education that would

enable you to take up the various ground courses necessary, by all means sign up. If you feel that you would be willing to accept this free training, realizing that you may wind up a first-line service pilot, a bomber pilot, an observer, a radio man or a gunner aboard an attack ship, and are willing to take your chance on any of these all-important posts, by all means volunteer, especially you light-plane pilots who already know the fundamentals of flight.

America will need pilots, and plenty of them within the next year or so. They can only turn out about three hundred fully trained pilots a year at Randolph and Kelly Fields. The last class to come out of Kelly numbered something like a hundred and seventy-seven, and the class originally started with something like three hundred and forty-eight students, which gives you some idea how tough it is to find men who can fill the requirements.

I have no idea how broad the present mass training plan will be, but I am certain it will take much time, probably years, to fill the twenty thousand government coveralls, and we must realize that to perform this gigantic feat as quickly as possible everyone has to cooperate to the fullest extent. The bottle-neck of pilot training will not be helped any if we add more bottle-necks to the program by applying for posts when we know full well we are unfit to fill them.

But our readers may begin to worry about all this and ask just what the ideal candidate should be. This is a fair question, and perhaps we should attempt to answer it. It may help many a candidate to make up his mind.

Our ideal candidate for these twenty thousand cockpit jobs would of course be a composite person representative of the eighteen-to-twenty-five class. He would not be the accepted model of the young daredevil. Flying no longer requires this individual, and actually never did. He would be a normal person selected at random from youth interested in sports, for example. During the War the most skilled of the Canadians were men who had lived much in the woods and who were familiar with guns and weapons. The best of the British crowd came from the middle classes (not the universities), mainly from what we call the white-collar group. Most of them, as I remember, were motorcycle fans, and practically all went in for sports in a sane and happy-go-lucky manner. They were not champions at anything, but played for the fun of it, with very little stress on the winning or losing. There were very few of the so-called university men in the R. F. C., but there were many who had come from the engineering schools of the better-known manufacturing firms. I believe these are called industrial cadets in this country today.

On the basis of all this, then, we find that the representative airman, the type that learns to fly and to carry out normal military missions, is not the flaming soldier of fortune, the sensational daredevil or the famous champion. In other words he might be *you!*

It is my opinion that the greater part of the civilian group of service pilots will be drawn from what we now know as the light-plane crowd. There are probably twenty thousand men in this eighteen-to-twenty-five group who hold student permits or private licenses who should most certainly consider this new arm of defense. By now many of them know whether they want to fly, or whether flying holds any fears for them. They know now whether they have any natural aptitude for flying or whether they had better stay on the ground. There are many, of course, who are not fortunate enough to have been able to buy flying time or training, but they should not let this hold them back in applying if they honestly believe they are fitted for the job.

You who are considering applying for posts or places in the twenty-thousand-service-pilots scheme should write at once to the Civil Aeronautics Authority, Washington, D. C., and carefully state your qualifications, your desire to be appointed, and ask for full details and an application form when this material is ready.

Do not be frightened by the original statements made in the daily newspapers that candidates were to be selected only from the ranks of the colleges. This is not true. All who fit into the scheme regardless of their education standards will be given full opportunity to qualify.

What we want is pilots. The manufacturing companies can turn out the planes fast enough, or will, should the occasion arise.

WILLIE'S GOT A GOOD JOB NOW

(Continued from page 19)

listened to their talk, for he asked me to sit at the end of the table so I could see everyone. I knew from watching him in the schoolroom that Joe Tanner was good, but it did me proud to see those big-shot engineers asking his opinion. They threw their hands up and confessed it was too much for them.

"Tanner," said one of them, and I knew he was the chief engineer for Amalgamated Motors, "there's no rhyme or reason for these bearings going out. They stand up on every other motor. The bearing material is all the same, all made to government specifications and tested in every conceivable manner. But this isn't all. Today Lieutenant Stroud was killed when his motor failed in the air and he landed in a swamp. Yesterday another officer of the flying corps, flying the same type of P ship and from the same pursuit group, fell to his death through motor failure. The planes are perfect, they're speedy, the most deadly fighting machines ever built for any air service, but their motors fail. What's the answer? If we don't get to it soon it will ruin the company. The government even now won't accept any more motors until we get this wiped out."

"Gentlemen," said Joe Tanner, and he sure didn't talk like a roughneck mechanic then, "I don't know what does it, but I know how it is done, and more important, I know who is doing it. I think I'll have things cleaned up by tomorrow night. Leave us now, we've work to do."

As soon as they were gone, Joe Tanner got on the phone and talked to someone he called chief, and he says: "Chief, you'd better ground all the P-type planes for a few days so no more of the boys will get bumped off. Stand ready to pick up the men on our list as soon as I give the word, tonight or tomorrow. Sergeant Dunn and I may have to kill a man tonight, but I think we'll finish things."

"Say," I tells him when he'd hung up, "I'm only a corporal, I ain't no sergeant."

"You will be before morning," he says calmlike. Then he added, "That is, if you're alive."

I didn't like the way he said that, for he wasn't no guy to kid a fellow. It kind of made chills chase up and down my backbone. But he says to come along, we're going to the plant, and we goes out and gets in the little car he drives around. He sticks out his hand to turn the ignition switch, but stops, then reaches out again and then he stops again. "Oh, hell," he says, disgusted, "I guess I'm getting the jitters over this thing, but it's better to be safe than sorry."

He pulls the key from the switch and climbs out of the car. I watch him raise the hood and look at the motor with his flashlight, and I hear him swear softlike, though earnest. So I got out and looked, too, and don't see a thing. Everything looked regular to me.

"Willie," he says, and he's almost excited, "they've tampered with my motor. This is what I've been waiting for.

You stay here while I go telephone, and if anyone comes near the car before I get back, shoot 'em."

He said it like he meant it, so I keep my eyes open, and I reckon that's why I see the shadow slipping up behind the car. It being kind of dark, I let him come close. Then I turn and see he's got some kind of a club in his hand and has ideas of using it on me, so I let him have it. He stopped rather suddenlike, and I let him have a couple more. But he don't fall like he should have. Instead, he turns and starts to run, so I let him have the rest of the slugs in the back. This time he fell down, as I knew he must, for a man don't run very well with ten slugs through his heart. But he got up again and run away while I was fingering an extra clip into the butt of the little pistol gun. Joe Tanner comes running out of the apartment house and he stops when he hears me cussing that cheap little pistol gun that could only knock a man down. When I told him what had happened he said:

"Willie, I thought you could shoot."

That made me feel bad, for I liked this Joe Tanner, and he had seen me shoot. "Captain," I said, and he jumped and looked kind of funny, "I can shoot, and that man's got ten bullets out of this pistol gun sticking in his hide, three in front and seven in his back, all of them right over his heart, and I'll bet a silver dollar will cover all the holes."

"Why didn't you shoot him through the head?" he asks.

"'Cause it musses a man all up," I told him, "and besides, a hole through the heart is generally regarded as sufficient. At least down in Missouri, where I learned to shoot."

"Not these guys," he says, smartlike. "They're wearing bulletproof vests. Next time you shoot anyone around me try and knock their eyes out." He was sure a cold-blooded fellow, that Joe Tanner, but it made me feel better, for I knew I had put them bullets where I had been looking.

We didn't see anyone else around, and I guess anyone who heard the shots thought it was an automobile backfiring, and a few minutes later a tow wagon he had phoned for came along and hoisted the front end of the car into the air and we went swinging down the road. Joe was mighty careful how the men handled the car and wouldn't let them turn the front wheels, even. It was only a mile to the Amalgamated plant, and before we knew it the guards had halted us at the gate.

It didn't take long for Joe Tanner to get past the guards when he showed them some papers he had in his pocket, and the tow truck hauled the car right to the classroom where Joe taught things about motors. Then while I watched to see that no one tried to move the car, Joe got a dolly and put it under the axel of the front wheels, and we pulled and pushed the car into the shop. About a dozen guards took their posts outside the windows and doors. Then Joe Tanner got to work, and I got a chance to get my hands dirty.

"Come on, corporal," he said to me, and it sounded like he was mad. "Here's a chance for you to get that precious right hand of yours all covered with oil, and I'll find out if you really know anything about motors."

I shucked my street clothes and put on a pair of coveralls, and Joe tells me to lay that pistol gun down, as I wouldn't be needing it with so many guards around. We worked under a big cluster of lights right over the motor of the car, with all the rest of the room in darkness. About all I had to do was to hand him tools, and it was a sight to see the way that man went after things. He worked slowlike, as though he were afraid of breaking something.

"I had some fine wires on this thing," he told me. "I don't know what they done, but they broke the wires when they lifted the hood. I know whatever it is is in the cylinders. It's just got to be, for the cylinders got hot first."

And he went on talking sort of to himself while he took out the bolts that held the motor head in place. Then, carefullike, he raised the head and carried it to a bench and looked it over, but didn't seem to find what he was looking for. Then he looked into the cylinders, and I see him fish out something that he handled mighty careful, and he laid it on a piece of waste on the bench. He fished out four of 'em, and seemed to be tickled pink. They were little capsules about an inch long, and filled with some gray stuff. Joe Tanner started to whistle a tune, and then he sang a few words of a song I'd never heard, something about the optimist and the pessimist, and then he quits that and starts talking to me.

"Sergeant," he says, real joyfullike, "you've just seen the frustration of the greatest little scheme ever hatched, but I'm still wondering what it's all about. I know every man connected with it, how they do it, but *why* stumps me. These little capsules contain a chemical that's an improvement on thermite. The heat of the motor melts them and ignites the powder, and they generate enough heat to melt the walls of the cylinders; only the bearings, being softer metal, melt first and wreck the motor. It's so simple they just take out a spark plug and drop one of these little pills on top of the cylinder. What marvelous bombs they'd make! I guess we've got to thank the Angels of Peace for trying to wreck our air service."

I'd never heard Joe Tanner talk like this before, and he had me kind of goofy trying to figure out what he was talking about. Just then I happened to catch

some movement out of the corner of my eye, and I knew there was nothing in that room that had a right to move except Joe Tanner and myself. I didn't say anything, but I watched the lid of the luggage compartment begin to raise, and I knew it wasn't lifting itself. And my gun was across the room and my right hand covered with grease.

I done the best I could by wiping my hand on my coveralls, but I had to get across the room to where my little pistol gun was lying on top of my clothes. For all I knew, whoever was in that luggage compartment had a gun trained on my stomach, and it kind of made my flesh go goose-pimply to think of it, but I *had* to get that gun. That was my job, and Joe Tanner was depending on me.

"Say, pal," I says to him, and I ain't never called him pal before, "we're here all by ourselves, and there ain't no one to kick, so how about letting me take a chew of tobacco? Gosh, I ain't had a chew all evening. How about it?"

He stopped talking for a minute and looked at me queerlike, and I knew he was wise, for he knew I never used tobacco, even if I *was* from Missouri. "All right, Willie," he says, slow. "Take a chew if it'll make you feel any better, but you'll have to clean up your own mess, for if these guys ever catch you spitting on the floor they'll take you apart." In his double talking he was trying to tell me these people were dangerous, and I'd have to do a good job of it.

I moved over to where my clothes were, and did it feel good to get that little pistol gun in my hand; only I wished I had my old regulation .45. I was out of the cone of light, and I could see that the lid of the luggage compartment was down again, so I says to Joe Tanner, still doing double talk that I knew he would get: "All right, pal. I got my chew and everything's under control."

Joe Tanner sure wasn't dumb by a long shot. He'd been thinking while I was moving, and he'd figured right that the luggage compartment was the only place a man could be. He ducked to the front end of the car. "All right, sergeant," he says coollike. "What and where is it?"

I told him what I'd seen, and he laughed, only I hope he never laughs like that when he's mad at me. It was sort of brittle and cold, and not funny a bit.

"Sergeant," he says, a wicked grin on his face, "I'm going to put a blow torch on one of these capsules and see how hot it gets. I'll put it on the back end of the car. We might find out something."

I think he was bluffing about lighting that stuff, but it worked. The lid to the luggage compartment popped up, and a little guy tried to jump out, only he'd been cramped up so long he didn't jump very well, and fell. Before he could get up, Joe Tanner was on top of him, and I didn't have to use my little pistol gun after all.

Well, that was about all there was to it. Joe Tanner went to the telephone and talked with the man he called chief and told him to go ahead and round up everyone. Then he turned the little feller we'd captured over to the guard, and when we got the head back on the motor we went home, and Joe Tanner let me drive, for he had them little pills in a tin box and carried them mighty careful.

He didn't talk any while we were driving, but when we got home he says to me: "Willie, people think you're dumb because you still talk the way they do on Horse Creek, but I think you'll do to take along, so I'm going to get you transferred to the intelligence service of the army. You'll be a sergeant and you'll work with me. And Willie, I'm Captain Graham, and how did you come to call me captain that time?"

And so I tells him about the time I'd gone to the pistol matches and he'd been there in uniform and I remembered him; how, in fact, I seldom, if ever, forgot a face; and he says that's fine, and he's going to teach me how to wear a dinner jacket and eat with a fork, and if I'm as good at that as I am with a gun we'll go places.

And I ask him who are these Angels of Peace that's been causing all this worry and trouble, and he tells me all he knows about 'em, and maybe some things he guessed. Fact is, he said there was a lot that was way past the understanding of man.

Seems like they were a locoed bunch that thought the way to keep peace was to tear everything up. The P-type planes were just about the finest things ever produced for fighting, and with the new motors they'd be even faster and better, so they thought they'd start with them. There were only half a dozen of the guys, and they were scattered around the country in pairs. This guy Johnson we caught in the back of the car and who was the student that had asked me questions was the leader.

They didn't do anything to him because he was crazy as a loon, but they sent him to the bughouse for repairs. But everyone seemed to be tickled to death the crooks were all Americans, even if they were nuts, for that way they didn't have to let the politicians in on it, for *they* would have spilled the beans about this new stuff that's hotter than thermite. The way it is now, the army's got it all to themselves; that is, if they ever find out how to make it, and Joe Tanner tells me the chemists are working on it and they're going to put some of it in bombs and drop it on battleships.

But anyway, I'm a sergeant now.

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