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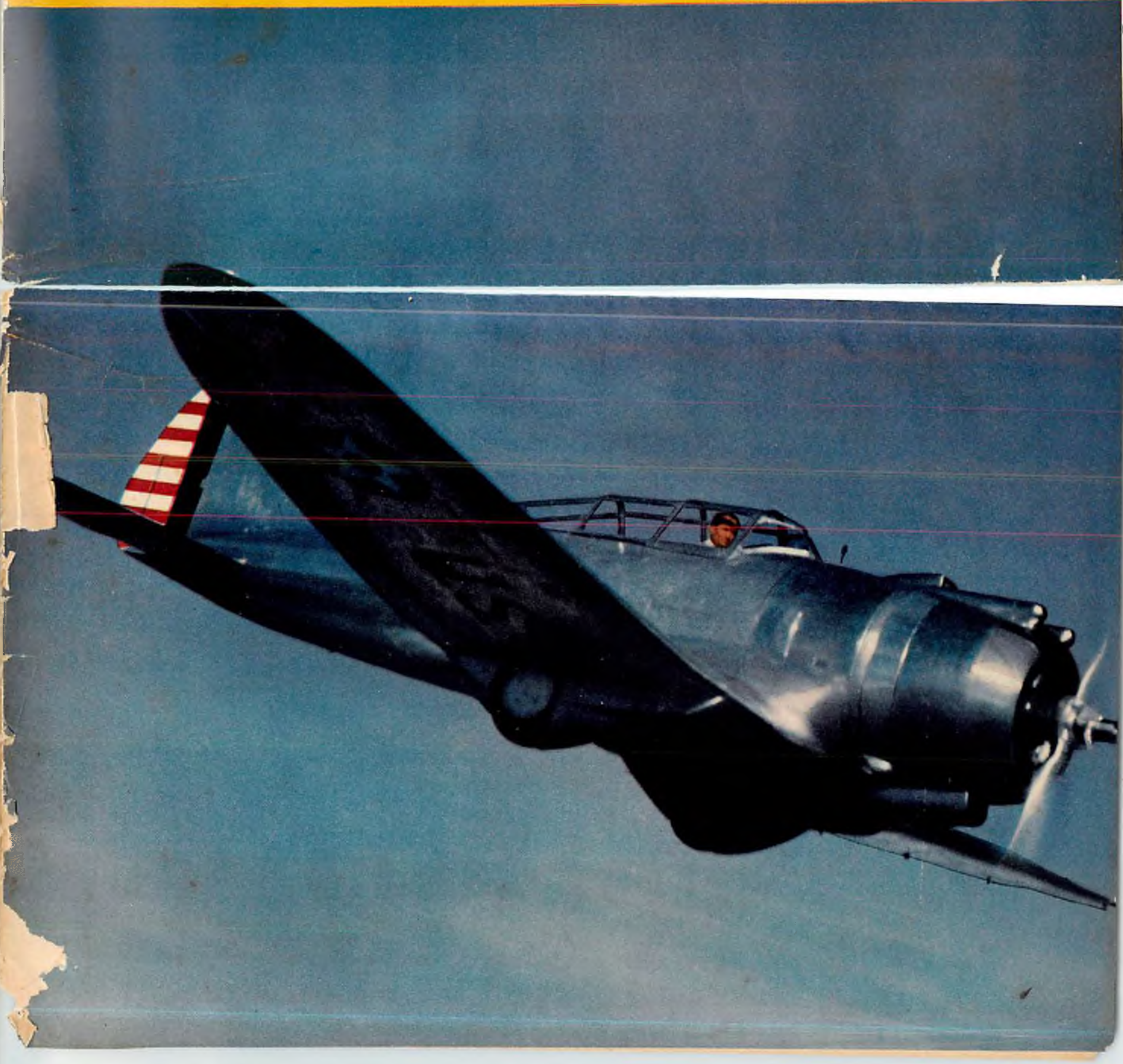

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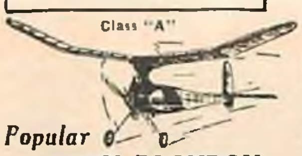

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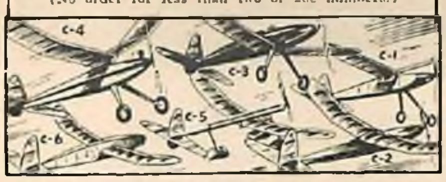

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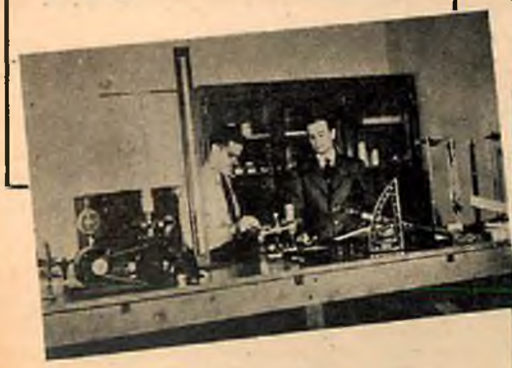

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FEATURES

DEPARTMENTS

MODEL SECTION

Monthly publication issued by Street & Smith Publications, Incorporated, 79 Seventh Avenue, New York City. Allen L. Grammer, President; Henry W. Ralston, Vice President; Gerald H. Smith, Treasurer and Secretary.

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Question: I would like to know if there is a school giving aviation plastic material courses. C. B., Wichita, Kans.

Answer: Sorry, but we do not know if courses in plastics are available. Suggest that you write to the Civil Aëronautics Authority, Washington, D. C.

Question: I would like to have a photograph of the cockpit of the Bell Airacobra. If you don't have this, could you give me some information about it? W. C. C., Gallipolis, Ohio.

Answer: Sorry, but we don't have any photographs of the Airacobra's cockpit and doubt if it can be obtained, nor can we supply you with and data regarding it.

Question: What information do you have on any planes other than the Bell P-39 having the motor behind the pilot and driving a tractor propeller? Does the Westland F7/30 powered by a Rolls-Royce Goshawk engine belong in this category? Do you have any information on a twenty-four-cylinder engine built in four banks of six cylinders each which might be similar to the V-type engine? M. L. B., Jr., Washington, D. C.

Answer: Yes, the Westland F-7/30 belongs in this category, as does the Koolhoven F.K.55 midwing monoplane powered by a Loraine Sterna engine driving two co-axial propellers. This ship was built in Holland. Regarding the twenty-four-cylinder engine, the only one we know about is the Napier Dagger H type twenty-four-cylinder, air-cooled engine built by D. Napier & Son, Ltd., in England.

Question: Could you give me the qualifications of an air hostess? Does one have to be a registered nurse? R. S. I., Whittier, Cal.

Answer: A hostess must be single, between the ages of twenty-one and twenty-six, be between five feet two inches and five feet five inches tall and weigh between 100 to 125 pounds. She should be attractive. Most air lines require her to be a registered nurse, but the Pennsylvania Central Airlines, Pittsburgh, Pa., hire girls who are not. Suggest that you get the pamphlet "Airline Hostess" obtainable from the U. S. Office of Education, Washington, D. C.

Question: Would you please tell me the requirements for an aviatrix, education, height, weight and health? How much does it cost? E. H., Bronx, N. Y.

Answer: You can get all this information by writing to the Civil Aëronautics Authority, LaGuardia Field, Jackson Heights, N. Y. There is no particular requirement regarding education, weight and height. The cost depends on the type of license you want and on the amount of flying you do. The average cost is about ten dollars per hour.

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Answer: For all this information write to the Pan American Airways System, Chrysler Bldg., New York City.

Question: What is the operation cost of the Hammond Y and the Great Lakes powered by the Cirrus 90? What is the performance of the Great Lakes? Are the Le Blond 70 and 90 in-line four-cylinder engines? What is the seating capacity of the Sikorsky amphibian powered by the Pratt & Whitney 300-h.p. engine? M. K. J., Punxatawny, Pa.

Answer: We do not know the operating cost of these two airplanes. The Great Lakes had a top speed of 110 m. p. h. and cruised at ninety. Both the Le Blonds are five-cylinder radial engines. The Sikorsky is a four-place amphibian.

Question: Between the British Spitfire and Hawker Hurricane, which one has the higher speed? What is the speed of each? What is the armament of each? Do you know where I could get pictures of each? J. F. Y., Laredo, Tex.

Answer: The Spitfire has a top speed of around 365 m. p. h., the Hurricane around 340 m. p. h. Both ships are armed with eight machine guns, four in each wing. We do not know where you can get photographs of these ships.

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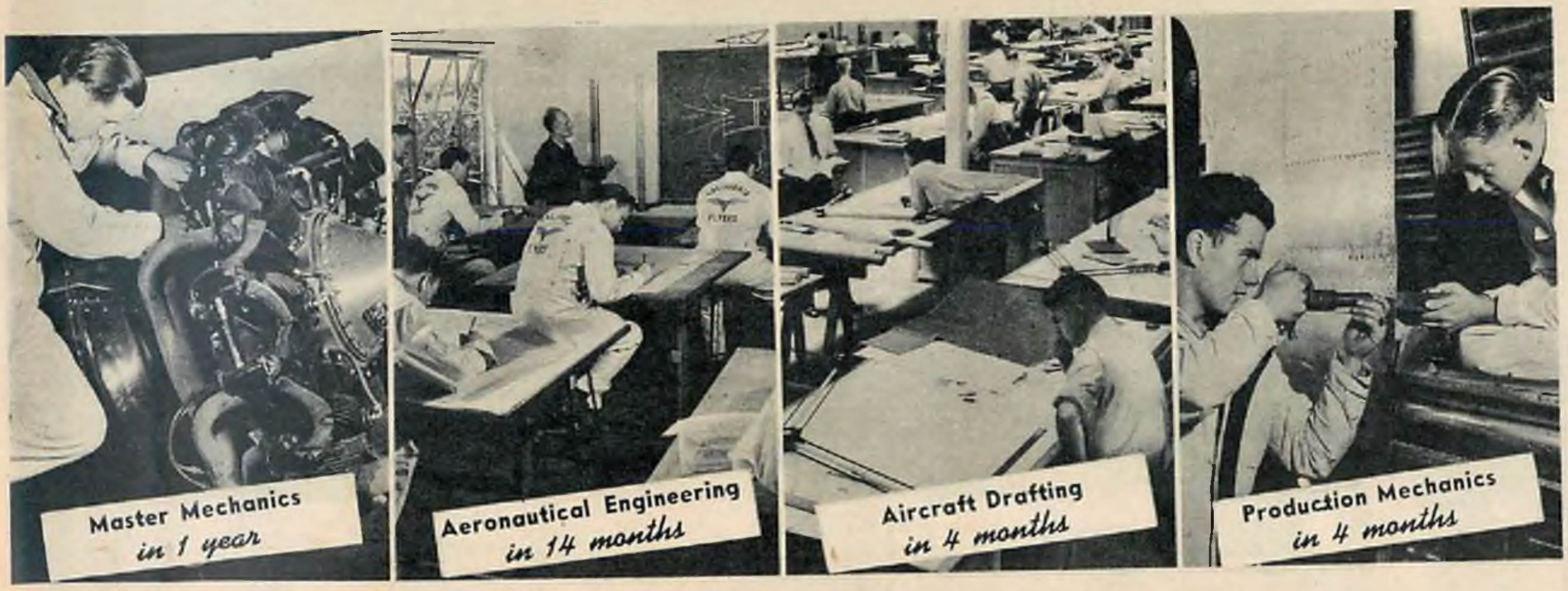

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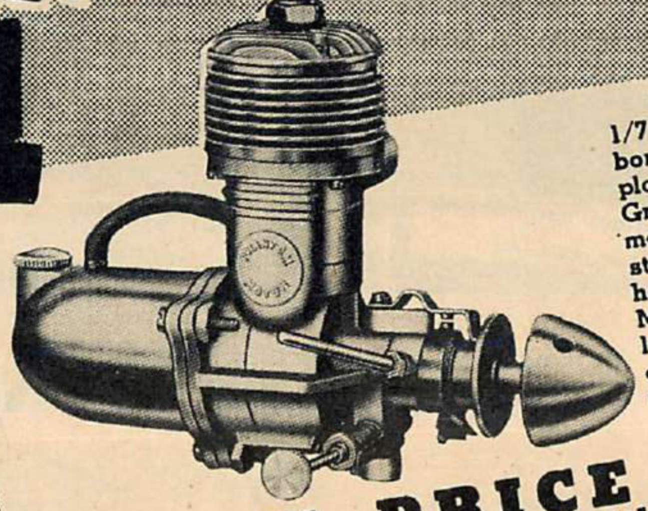

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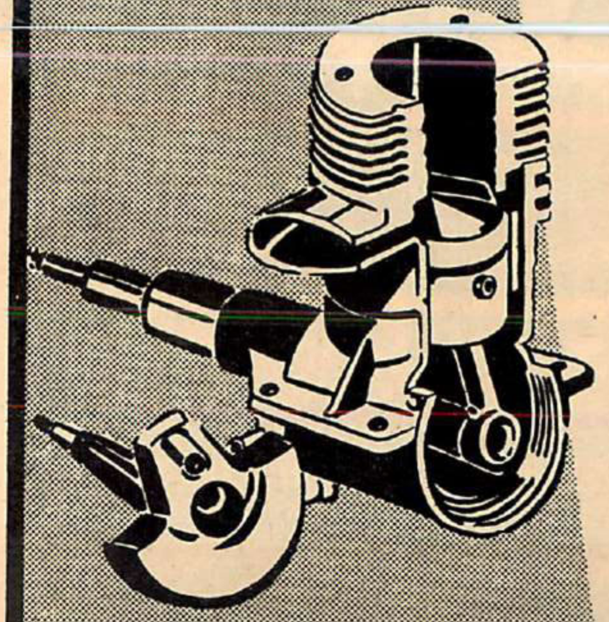

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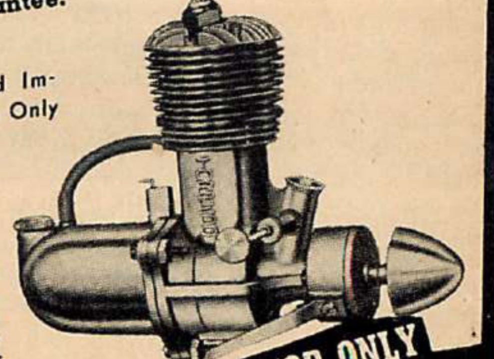

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Military Training for qualified Civil Air Training Pilots (Qualifications—Extent of training—Pilot Status at Completion of Course.)
Ground Training
Field Regulations for Flight—Inspection of Plane Before Flight
Safety Measures in Air
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Pilot and His Parachute
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Glossary of Aviation Terms

Meteorology, Navigation and Instruments

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Navigation Instruments
Navigation Regulations
Flying by Automatic Controls
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The Link Trainer
Radio Navigation
Contact Flying
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Flight Instruments
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Airport Aids to Flight
Notes on Sextants
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The Water and Chemical Cooled Engine
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Test Flights
Flying Boat Operation
Flotation Gear
Multi-Engine Aircraft
Military Procurement and Production
Lightning and Aircraft
Acceptance Tests of Airplanes—Civil
Acceptance Tests of Airplanes—Military
The Aircraft Industry
Naval Aircraft Factory
Naval Design and Research
Army Maintenance
Navy Maintenance
Stratosphere Operations
Trans-Oceanic Operation

Operations, Communications, General Applications, Military and Civil

Army Aviation Careers
Naval Aviation Careers
Civil Aviation Careers
Aircraft in National Defense
Defense Against Aircraft
Dive Bombing
Dog Fights
Army Expansion Program
Naval Strategy
Airline Operation
Airport Management
Air Traffic Control
Night Flying and Airport Lighting
Application of Model Experience to Airmanship
Air Show Organization and Management
Plane Rental Service
Production Engineer
Airline Maintenance
Sky Writing
Government Civil Service

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W. W. Davies, Research Engineer, United Air Lines
John E. Younger, Prof. Mech. Eng., U. of Maryland
L. R. Parkinson, Prof. Aero. Eng., No. Car. State College
Benjamin F. Rufner, Prof. Aero. Eng., Oregon State College
Major Augustus Post, Pioneer Balloonist—Gordon Bennett trophy winner
Nils Henrik Randers-Pehrson, Assistant Chief, Div. Aeronautics, Library of Congress, Washington, D. C.
Commander John W. Iseman, formerly Bureau of Aeronautics, U. S. Navy
[illegible] Pioneer trans-Atlantic pilot
Col. John H. Jouett, Pres., Aero. Chamber of Commerce of America
Steadham Acker, Manager, Birmingham Municipal Airport; Chairman, National Air Carnival.
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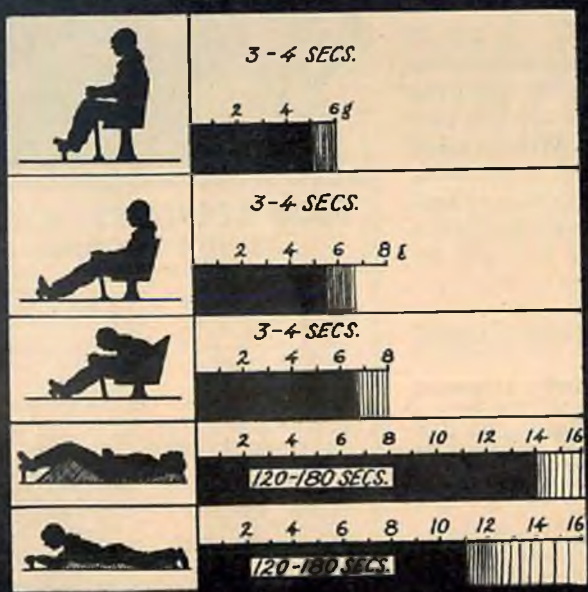
PRONE PILOTS

New experiments are going on with the pilot lying flat. Can these, aimed at greater speed and maneuverability, revolutionize ship design, fighter tactics?



More "G's" for a longer period of time may be withstood by pilots as their position changes from sitting to prone.

EVER since the beginning of World War II the demand for speed, speed and more speed in fighting planes has brought aëronautical scientists face to face with two thorny problems, to wit, how to get more speed without increased power (i. e., reduce wind drag), and how to overcome the tendency of many pilots, under the impact of these new terrifying bursts of speed, to suffer acceleration collapse.

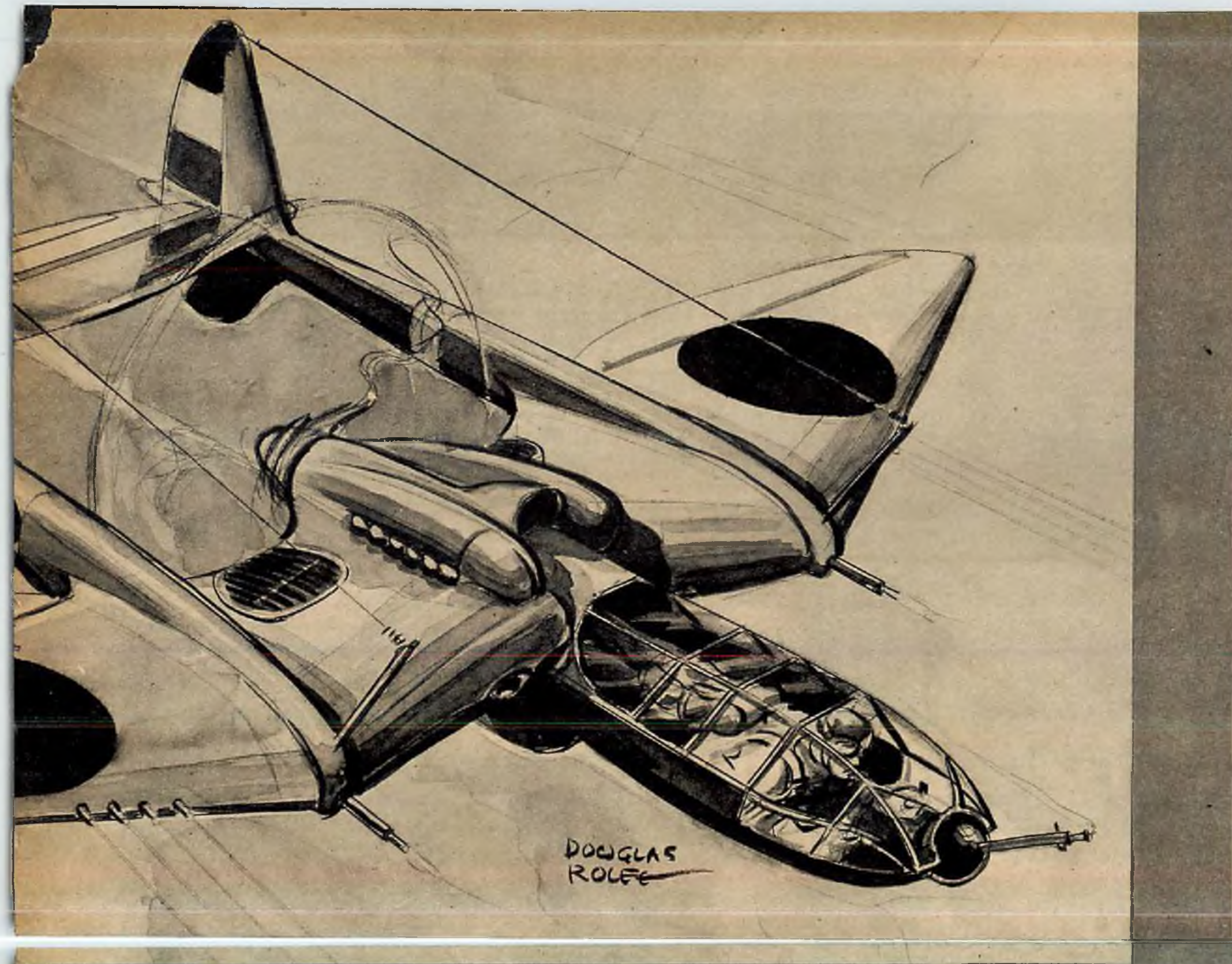
Tackling each problem separately, the aircraft designers and the military medicos have been up a collective tree for very simple reasons. The first, because the more they streamlined a ship to cut resistance the more they cramped the quarters of the occupants, thus decreasing efficiency; the second, because the more they dissected the physical blackout question the more they realized that they faced a law as immutable as that involving Newton and his falling apple.

Now word comes from Germany that researchers have provided what appears to be a common solution to both problems, namely, of all things, prone flying.

And why not? It's logical. Birds fly that way, and make a pretty good job of it. Why should man alone attempt the operation sitting upright? Why should he, of all life that takes to flight, poise his vertebrae contrary to the air's slipstreams? He doesn't swim or go sledding that way. And the same law is operative, for the drag of a body, it seems, is a minimum when the body's greatest dimension is along the line of flight. Hence, applied to an airplane, this would mean that a man flying on his belly would permit the ultimate in compact, streamlined designs. And, as to how such a posture overcomes the physical blackout the answer is equally as simple: in the present upright position of flying the centrifugal force acts approximately parallel with the principal blood vessels, with the result that in flight acceleration the blood has a tendency to leave the head; in horizontal poise, the centrifugal force acts in the direction from chest to back, thus approximately at right angles to the main blood vessels so that there is no sudden displacement.

It all seems very simple and raises the question, why didn't someone think of it before? The fact is that flying flattened out is as old as the hills. Daedalus, the legendary ancient Greek, and his son, Icarus, escaped from their Crete hoosegow with wings fashioned of wax and feathers. And Da Vinci, father of aëronautics, made a refined study of bird flight and from his analysis designed a small model to test his theories. Even the Wrights' first glider and airplane featured the pilot lying along the line of flight.

Undoubtedly, the upright position employed in steering the automobile and the low wind resistance in the comparatively slow speeds of early aviation were responsible for the parlor-car posture of flying prevailing today. For it was not until the small compact warplanes of 1939-40 requiring 400-500-mile speeds and tremendous maneuverability came into being that a thought was given to prone flying. It is known that Great Britain and the United States as well as Germany have been conducting experiments in this flight posture for some time. Apparently the Nazis, with their vast, visionary research in-



Future fighter? With pancake engines assured, even our artist's conception of a prone fighter may become tame by comparison with reality.

stitutions, got the jump on the others in any practicable application of the principle.

As early as last spring reports reached America that important experiments were being made in Stuttgart and other centers. And this January London dispatches stated that a new Heinkel fighter had been perfected with a two-man crew that was lodged prone-fashion in the wings. The craft, it was added, had in this way considerably reduced the air resistance, enabling a 430-mile top speed. Power was reportedly provided by two engines anchored in the wings and driving propellers through extension shafts. The same dispatch went on to state that the new British Supermarine Spitfire was equal to the speed of this latest Heinkel. No indication was made of the pilot's posture beyond the mention that the ship's body was shorter.

As in many other developments in aëronautics, the facile glider has been used in the latest tests. The results obtained apparently have been as edifying as if powered planes had been employed, particularly in demonstrating the advantage of a smaller fuselage in reducing air drag. It was shown for example that a fuselage of sixteen square feet in cross section was needed to contain a pilot in upright position as against a cross section of one four square feet for a pilot lying prone. By decreasing the fuselage seventy-five percent the wind drag in consequence was cut considerably.

Moreover, the decrease in cross section operated against two other components of drag other than the eddy currents primarily referred to in the above. One is skin friction, which depends upon the total area of the fuselage exposed to the air stream rather than to the cross section itself. This friction is naturally diminished by the proportional reduction of the total fuselage area through chiseling down the cross section. The other component consists of the paradoxical interference arising from the conflicting flow patterns of the fuselage and the wings. Obviously, the smaller the fuselage the less effective is this resistance.

Now, before considering definite advantages of the prone-pilot position, especially in the military field, let's go back to the simple explanation of the principle of centrifugal force in upright and horizontal flying to see how it works out in practice. Have you ever spiraled tightly for thirty minutes? If so, you have experienced anything from a slight dizziness to a severe case of nausea as well as vomiting. Here's what happens: the centrifugal force increases the weight of all parts of the body. Your pants press harder on the seat, your arms feel heavier, and your blood becomes weightier. The blood being heavier, the heart cannot pump the brain with sufficient blood.

It is this same reduction of blood supply to the brain which causes dive-bomb pilots (and sometimes fighter pilots in dog-fight maneuvers) to black-out. The only difference between dizziness due to spiraling and blacking out due to pulling out of a dive is simply the magnitude and duration of the reactions. In an airplane flying at forty miles an hour, a pilot's blood during a turn in twenty seconds weighs one and five-tenths its normal weight, whereas a dive-bomber pilot's at *(Turn to page 55)*

WE BOMB BY NIGHT

Suppose your B-17 Flying Fortress was ordered to make a night attack on an enemy city. Here's a cockpit account of what would happen.

BY JOHN R. HOYT

SUPPOSE your commanding officer were to say to you: "Pilot Jones, take off from Chicago tonight and fly to Washington, D. C. There will be no moon, no lights, no radio, and we don't even know what the weather is like in the enemy's territory. After you find the city—which incidentally the foe has blacked out—you must bomb only military objectives, such as the air base at Anacostia, the Navy Yard, or the airport. In order to find them quickly you must memorize an air map of the city so you can locate them immediately. Any delay on your part will increase the hazard of antiaircraft fire and enemy aircraft."

As Pilot Jones you would, of course, say, "Yes, sir."

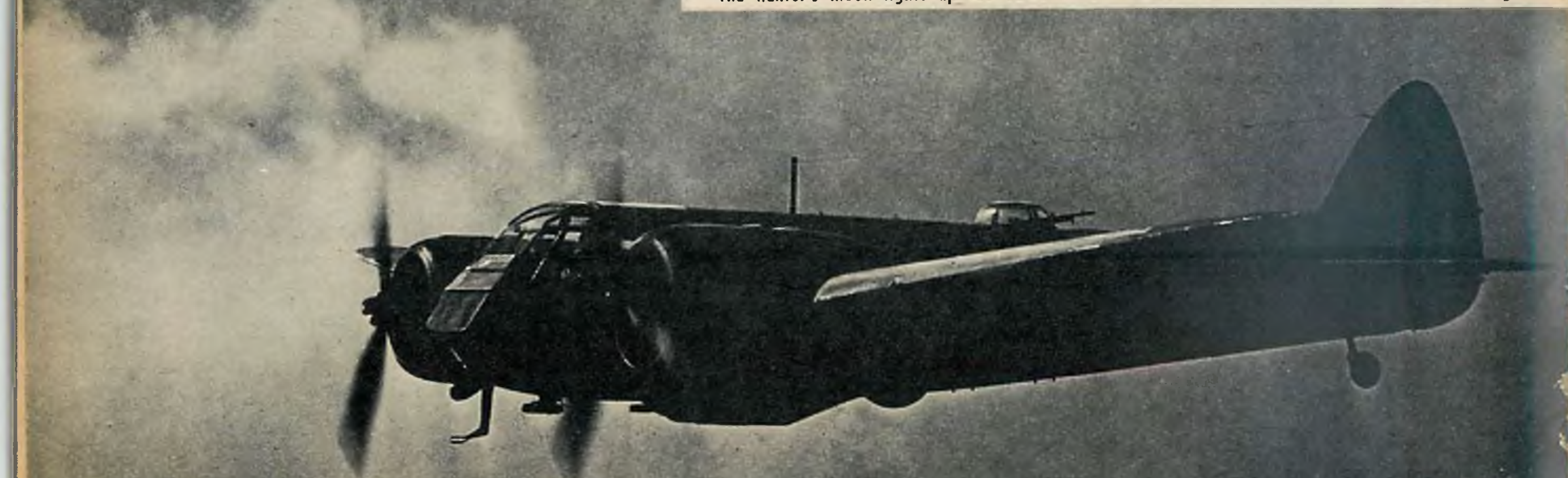
"But that isn't all," the C. O. would reply. "After you bomb your objective, you must return home. You realize that we can't turn on the radio beam, the markers, or the floodlights. The enemy may be waiting upstairs for just such a tactical blunder, and would bomb us if we showed a light. You must, therefore, find us in the dark and *land in the dark*."

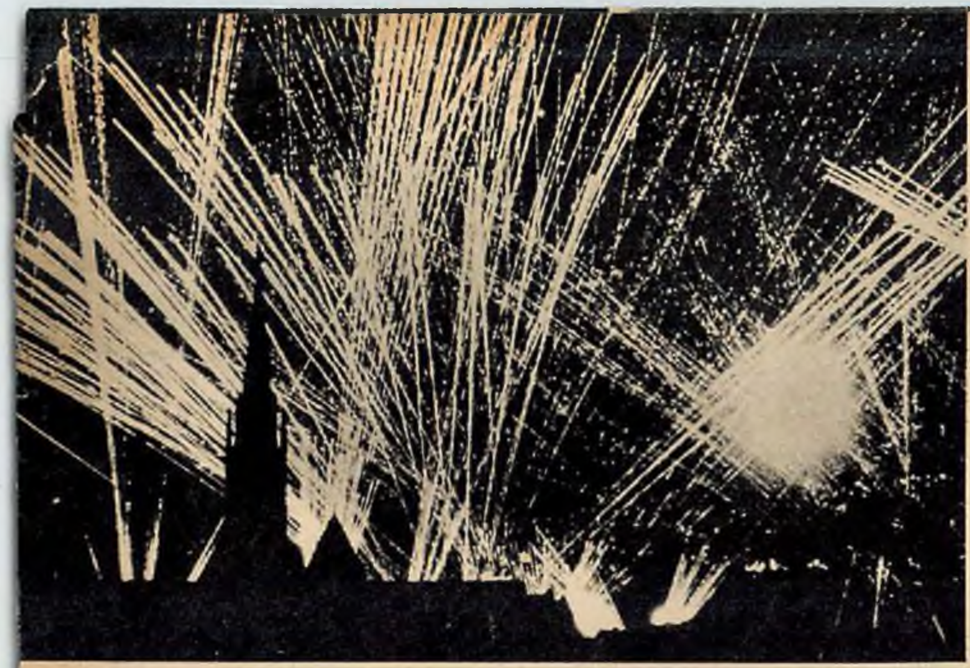
The assignment—the idea of a *night bombing attack*—sounds impossible. Yet those instructions are almost identical with those given to aviators who are flying the twenty B-17 Flying Fortresses which have been transferred to Great Britain. They fly from the home port to a point 600 miles away, without a landmark, radio or beacon to guide them. And they get back—sometimes!

Before taking off, the huge, 44,000-pound fortress is loaded with ammunition and bombs. One by one the incendiaries and demolition bombs are hoisted into the belly and secured into the racks from which they will be dropped. Over 9,000 pounds of it, including the ammunition, is carefully hoisted aboard.

At the same time a gas truck comes alongside and pumps 1,700 gallons of fuel into the huge, riveted-and-welded aluminum tanks—over five tons of liquid energy. With this load of fuel

The hunter's moon lights up the hunter. This British Blenheim bomber heads for a far target.





Reception committee. This barrage of tracer shells and antiaircraft fire awaits the bomber.

Big boy, but not for long. This B-15 will soon be outdone by others.

the four-motored fortress can fly three round trips from London to Berlin! Or, if the captain prefers, extra loads of bombs and ammunition can be substituted for the gas and only one trip made.

The crew climbs aboard in the darkness: copilot, navigator, bombardier, radioman, engineer and gunners. Nine men, all told, are required properly to man this giant flying fort on a war-time mission. While they are getting aboard, the pilot has obtained the latest wind data from the aërologist—figures on the direction and velocity of winds aloft. Without such data the plane would drift many miles off course during the three-hour flight.

Giving this data to his navigator, the pilot climbs into the nose and signals the engineers to "start engines." One by one the starters whine, the clutches seize, and the props turn over. One by one the mammoth 1,200-horsepower Cyclones come to life, roaring and throbbing as the pilot tests them on each magneto to check the proper working order.

He eases the throttles forward and the big plane taxis down the runway. It is dark, so dark that it is almost impossible to see, but he manages to stay within the tiny, dim red lights that mark the take-off area. Before he reaches take-off position, the navigator gives him the compass heading computed from the plane's speed, the wind and the true course desired. If the wind does not change, they will arrive at the objective in three hours. The copilot sets the clock on the panel and checks his wrist watch.

Blue flame spurts from the exhaust. The four engines roar in unison, and the heavily laden ship lurches down the runway reluctant to take the air. The runway is dark and the pilot flies straight for a tiny light that marks the end of the runway. Halfway across the field he eases back on the yoke and lifts the Flying Fortress into the air, climbing slowly into the dark, starless sky. The copilot flips a switch that lifts the landing gear and tail wheel; he adjusts the throttles and propeller pitch settings. The throbbing of the propellers eases down to a gentle moan as they become synchronized, and the long hop of the night bombing attack has begun.

In the blisters, the gunners take position, alert for a possible surprise attack from roaming enemy pursuit planes. The radioman tunes his loop on the enemy broadcast station, hoping to obtain a check on the drift before the station goes off the air. Such a check will be valuable because a few degrees of drift will mean a large error on a 600-mile jaunt.

The bomber climbs rapidly, gaining altitude at the rate of 1,500 feet per minute. In order to keep the navigation accurate, the pilot must climb at a constant speed, and after leveling off at 15,000 feet he must cruise at exactly the speed used in computing the heading to fly. The pilot quickly checks his instruments: rate of climb, altitude, airspeed, air temperature. Compass, turn-and-bank, directional gyro, clock. Everything in order.

They thunder on. The pilot wonders about the reception committee that is usually on hand to welcome visiting pilots. He resolves to be modest—if possible, he will elude them. He knows that it is the first run over the target that counts; after that the antiaircraft guns and pursuit planes will be making the air too hot for comfort.

He stares from the darkened cabin to the still blacker darkness ahead. At 15,000 feet it will be hard for the enemy to see and hear him. If they find him, the bomber is theirs for the asking—it has no armor, little speed, and inadequate armament. Newer models will eliminate the blisters and use flat gun turrets, heavier guns and a power-operated turret in the tail. And he knows that his gunners will be picked off easily, as statistics show that three gunners die for every pilot *(Turn to page 60)*

Bomber's foe. Looking from a rear gunner's seat we see a Vultee Vanguard attacking.

Egg department. Practice makes perfect, and so these practice bombs.



Now I lay me down to leap. With hand on ripcord, the jumper drops earthward fast.

John Jones, PULL! The jumper repeats name and word PULL, then yanks the ripcord. 'Chute is leaving opened canvas pack.

What, no beers? If he drops the cord he buys for the crowd. Here pilot 'chute is opening.

GOING DOWN!

"How'd I look? I was great, huh?" Well, you silk-sailors sure struck a lot of attitudes.

Going home headfirst. Note left hand on second 'chute ripcord just in case.

She's opening, I hope, I hope! Grasping second 'chute used in training, this jumper awaits yank of first canopy's opening.

This chap puts his whole soul into his jump. Opened pilot 'chute pulls out main 'chute.



Two-man classroom. Far above the earth the instructor and student work out their individual problems in a Ryan all-metal PT-16 trainer.

DODOES ARE MY JOB

A "civilian" instructor in the new army air corps program tells his side of the story.

BY WILLIAM P. SLOAN

THE clock on the dispatcher's board shows a quarter to one, and there is a slight note of expectancy in the usual casual conversation as the instructors come dragging into the flight office after lunch.

On the bulletin board is a new list of sixty-five names, the roster of flying cadets, Class 41-D, assigned to the air corps training detachment, Ryan School of Aëronautics, San Diego. Idly we scan the list, wondering audibly if this Jones is any relation to the Jones in 40-A, or if this Brown will be the headache that Brown in 40-D was. Soon all thirty of us are crowded in, perching on the edge of the table, stools, or the desk, hashing over the possible merits and defects of the new gang of dodoes.

As the air begins to get blue from the smoke of final cigarettes, we can see the cadets marching double file from the hangars. Already there is a noticeable change in the manner of these men, who a few days ago came drifting down to the field in twos and threes, dressed in civilian clothes looking like the average run of males on any American campus. They come to a smart halt and do a "left face," their backs to the long row of low-wing Ryan training planes on the line in the background. Hastily we douse our cigarettes and march out to meet them.

With slight variations, this same scene is being enacted at eight other civilian training schools strategically located throughout the United States, and by the time this appears in print will also be taking place at new branches of each of these nine schools. Before the new air corps training program was launched in July of last year, all primary training of flying cadets was conducted at one center—Randolph Field, Texas.

With the inception of the program several rather radical changes took place. All primary training was thereafter to be given at carefully selected civilian schools, using civilian instructors under the supervision of army air corps officers. To standardize instructional methods as closely as possible, each school sent its best available pilots to Randolph Field to take the rigorous flight instructors' course.

From every State in the Union the instructors came, leaving their various operations to accept something that looked more secure. Commercial-school pilots, barnstormers, crop dusters, small private operators and charter pilots were all put through the mill in usual army style. The number of eliminations among the instructors was disheartening, but those who made the grade received the coveted Certificate of Proficiency and returned to their schools to pass the knowledge on to an incoming horde of eager fledglings.

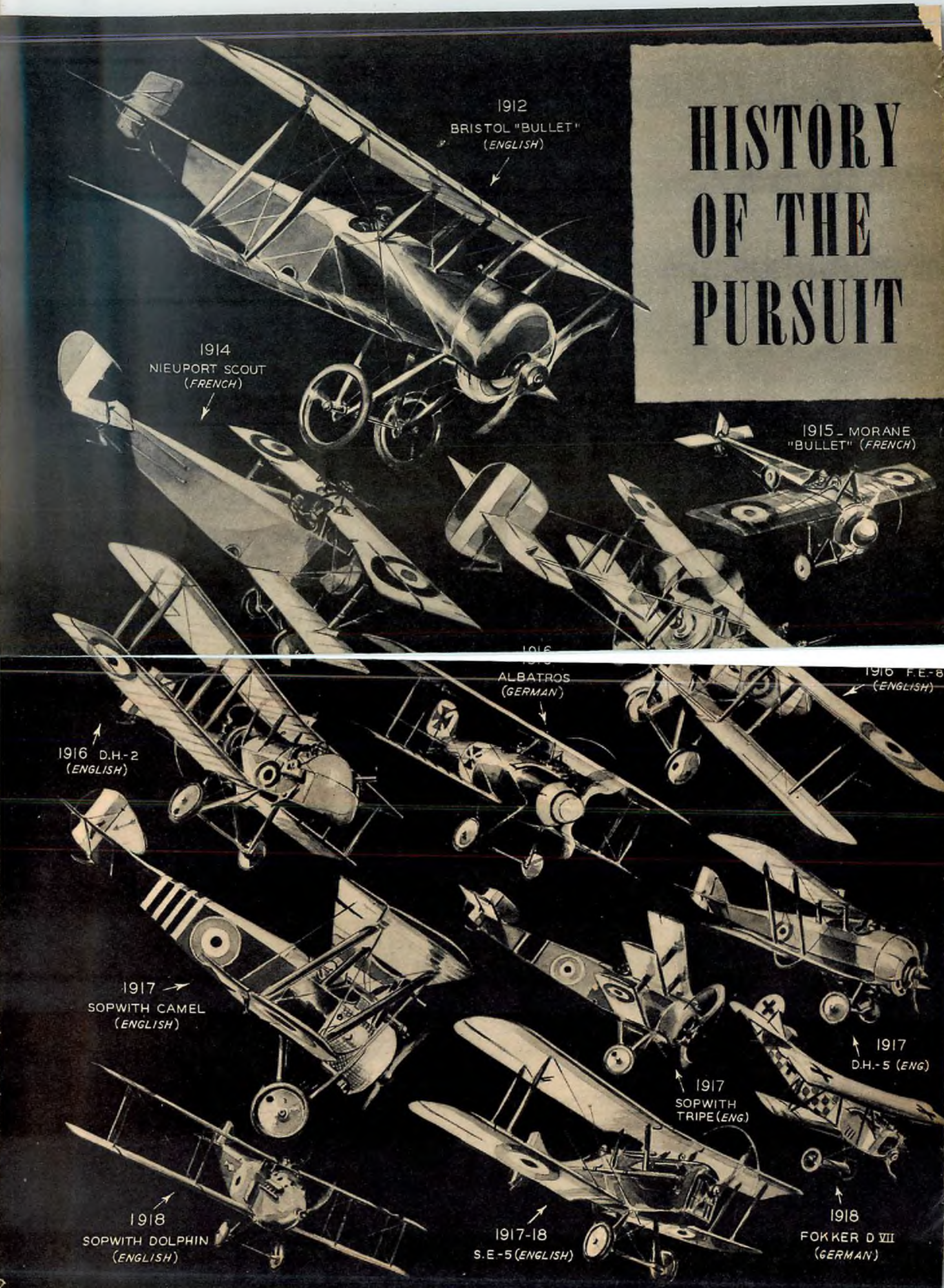
But to get back to our cadets. The detachment commanding officer, Captain John C. Horton, is addressing them now. When he finishes, Paul Wilcox, senior Ryan flight instructor, begins assigning the students to their instructors. Generally this is done according to size to simplify the job of parachute fitting. My name is called, and four cadets step from rank and follow me to my ship, the one in which they will receive their elementary instruction.

From the moment the instructor shakes hands with his students, their flight training has begun. Each one of them has passed an exacting examination, and the flight surgeon has pronounced them as near perfect physically as a man can be. It is up to the flight instructor now to determine the cadets' aptitude for flying, and to lay the groundwork necessary to build competent military pilots.

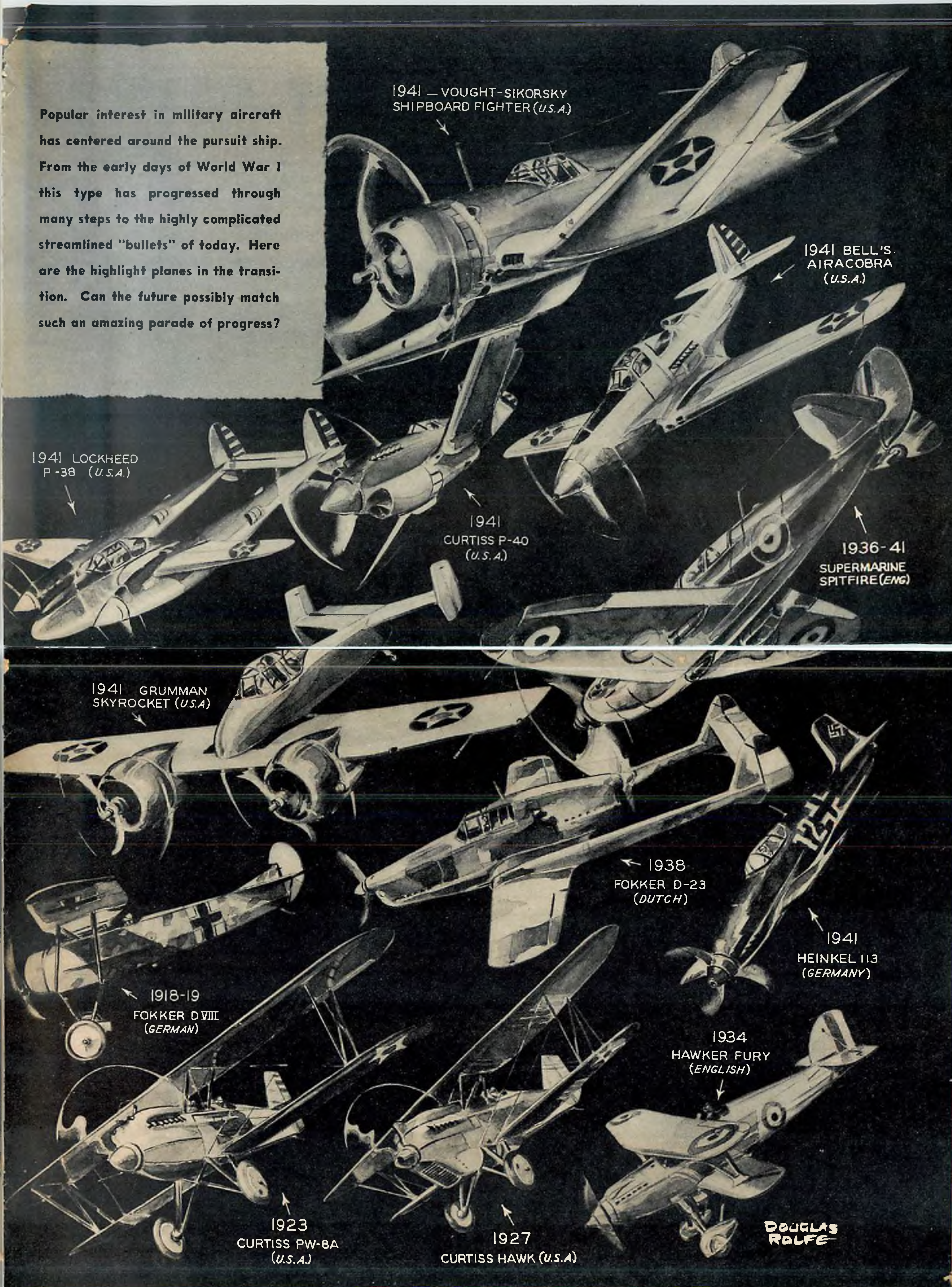
The first step in the flight training program is the preliminary phase. Primarily its purpose is to acquaint the student with the equipment he is going to use. Helmets are inspected to assure a snug fit. Goggles are checked to see that no air can seep in and impair vision. The cadet is issued a parachute and told how to wear it, carry it and use it. He is placed in the cockpit of the plane where the controls and instruments are explained and is shown how to start and stop the motor. In short, all this gives him a chance to become accustomed to the feel of his tools.

Secondarily, it gives the instructor an opportunity to "sound out" his men and prepare their minds before *(Turn to page 53)*

HISTORY OF THE PURSUIT



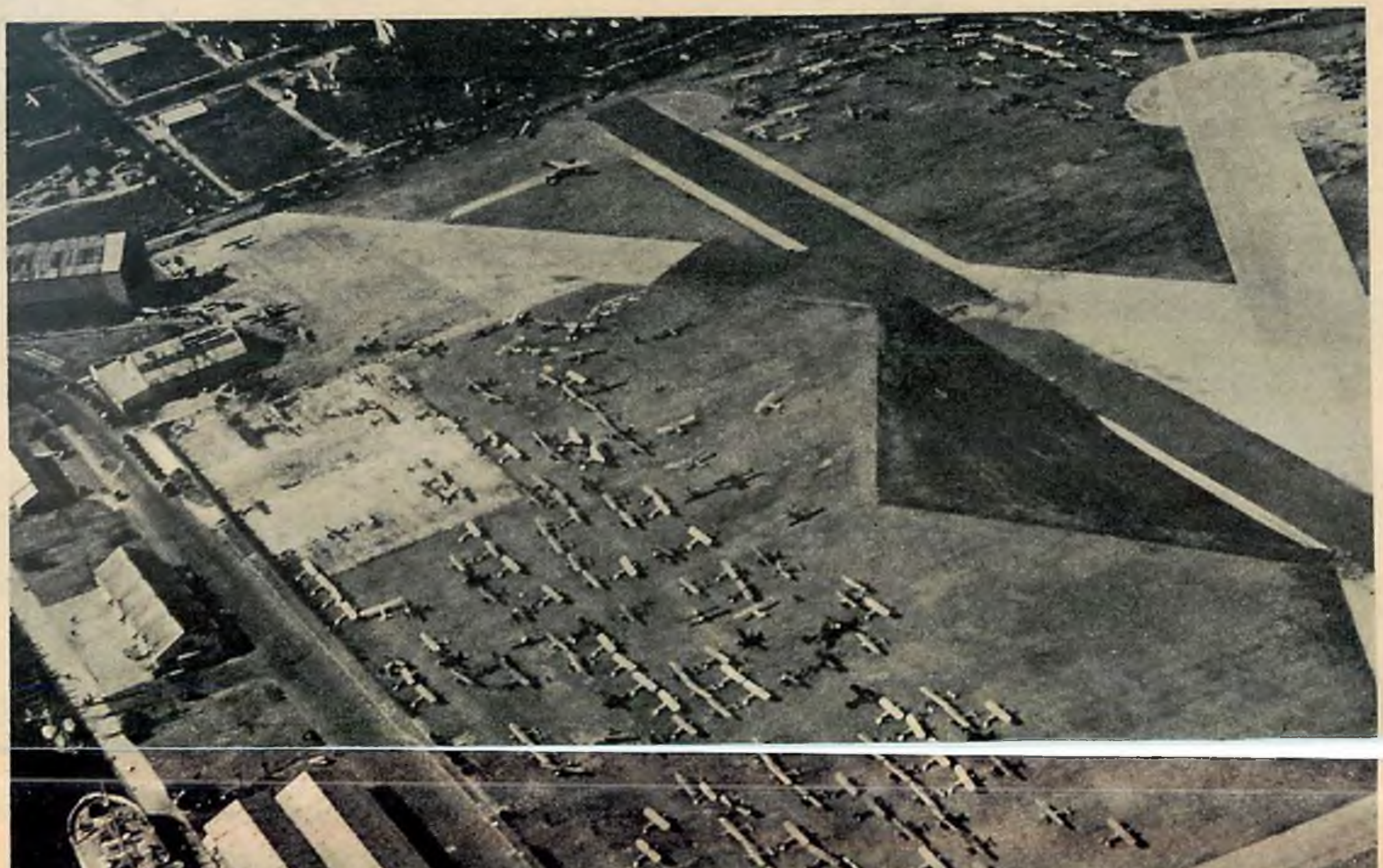
Popular interest in military aircraft has centered around the pursuit ship. From the early days of World War I this type has progressed through many steps to the highly complicated streamlined "bullets" of today. Here are the highlight planes in the transition. Can the future possibly match such an amazing parade of progress?



DON'T GROUND PRIVATE FLYING

In case of a national emergency, will the light plane be grounded? What will be the fate of C. P. T. program? An officer of the Private Fliers Association considers.

BY WILLIAM. W. BRINCKERHOFF



Grounded for fun. These hundreds of light planes were part of the 1940 cavalcade to Florida meet. Let's keep them all flying!

Easy thar! As a training medium the light plane is tops. By keeping private flying alive and growing, pilot reserves are assured.

THERE is an increasing fear spreading throughout the country that private flying will be grounded—yes, stopped—for the duration of any national emergency declared by the president, or during a war period, should this country be so unfashionable as actually to declare war. Further, the papers are full of discussion of delays in our military aircraft production, and priority has already been extended to the military over the air lines in equipment procurement. An added reason often given for a temporary end to private flying is that of an extension of "priority" to include the facilities of the builders of private ships. Will the National Defense Commission decide to assign to Piper, Luscombe, Taylorcraft, Aeronca and others the job of building tails, ailerons, perhaps other parts for our thousands of combat and training planes, using their entire facilities to the exclusion of our light planes? And if so, what would be done to supply the civilian demand for these ships now running to thousands of units annually? The pessimists reply that there will be no demand; that the flying schools will either be taken over by the army and navy, or else they will be grounded, and private fliers will not be allowed to fly. Such are indeed possibilities, but not, in the writer's opinion, a very real probability.

In the first place, let us examine the "priority" question. Assignment of subassemblies to light plane manufacturers is, of course, a possibility, but so long as there continues to be a number of subcontractors willing, equipped, and anxious for more work (and their number increases daily), there should be no real *need* for this step. Nor will light plane builders, in this writer's opinion, be asked to switch over to building complete military aircraft because the steel-tube, spruce and fabric light airplane is not built in a factory either with equipment or experience required for construction of all-metal, stressed-skin, high-performance ships. The popular misunderstanding on this point reaches into the flying fraternity itself, and wants clearing up.

Most important consideration, however, in assaying the future supply of light aircraft, is the future of the Civilian Pilot Training Program. Originally conceived as a method of stimulating private flying through free flying lessons to college students, training of civilian pilots has been expanded, even overexpanded, on the basis of military necessity. On this point has grown a raging controversy with much informed opinion on both sides. It is argued that we must have a tremendous reservoir of civilian pilots whose physical, psychological and mental qualities assure their ability to be transformed into military pilots in a short time *(Turn to page 56)*

Private flying on the beam. Many instrument ratings are held by expert private pilots whose planes are also two-way-radio equipped.

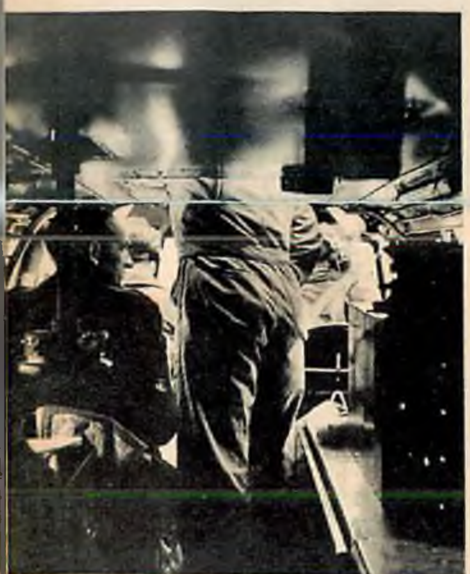
Change for the better. The modern light plane as well as private pilot is a credit to aviation. Here's the new Monocoupe in flight.

With thousands of private pilots training yearly at their own expense, we are assured of a huge reservoir of military pilot material.

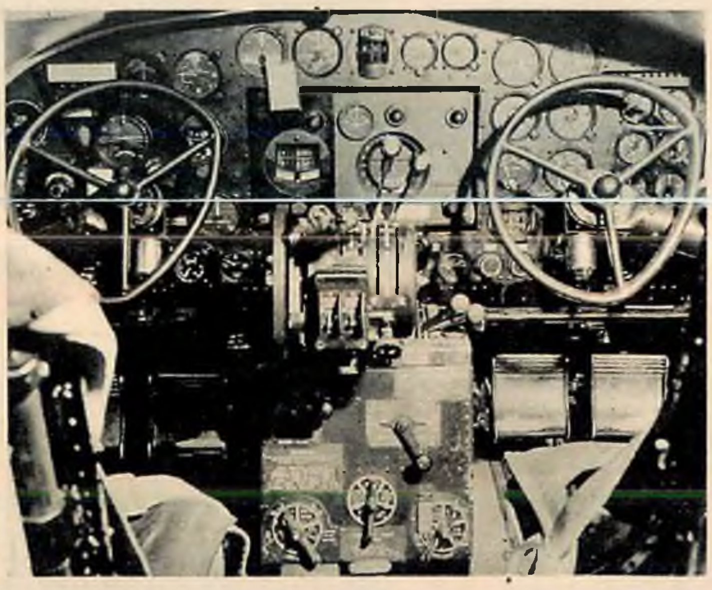
INSIDE THE "EGG" CRATE

What's it like aboard a U. S. Army B-18A bomber? Here are the quarters, both living and working.

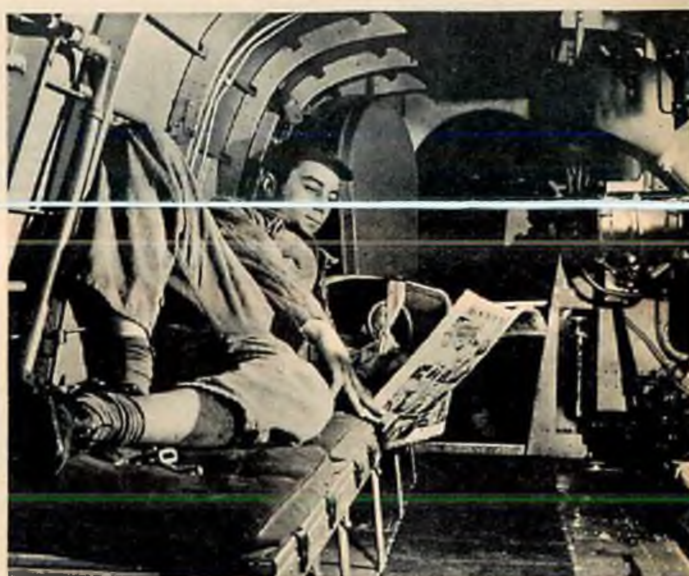
All present and accounted for. Before take-off, flight engineer checks 40 items, crew. Captain receives list from engineer.



Roof trapdoor aids poor visibility in taxiing bomber.



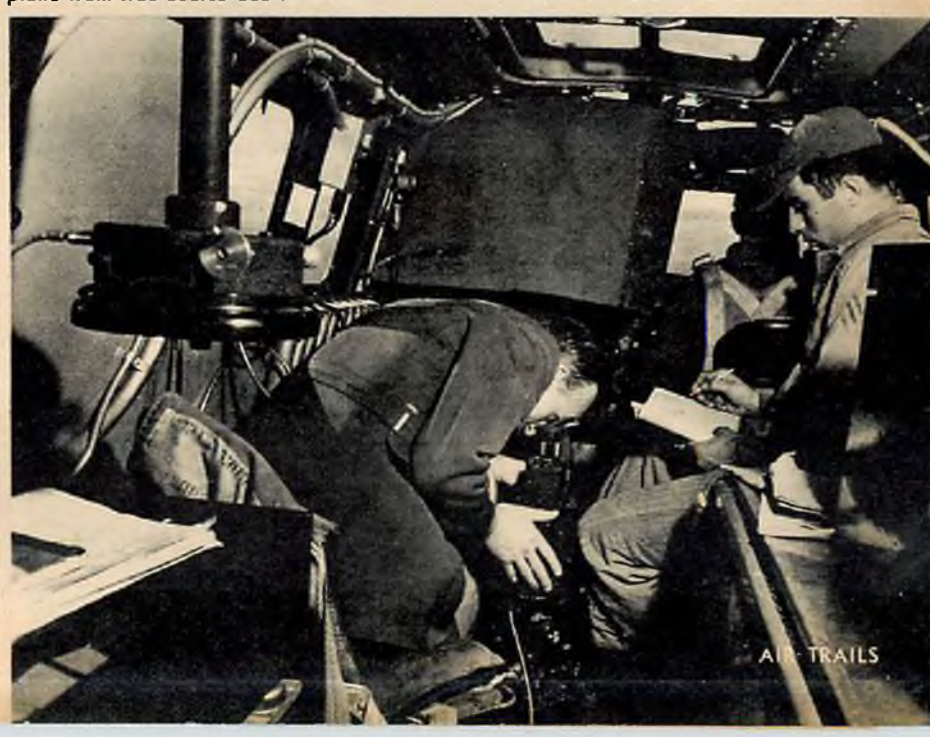
Bomber's instrument board contains automatic pilot unit in center, throttles below, and about forty other dials and switches.

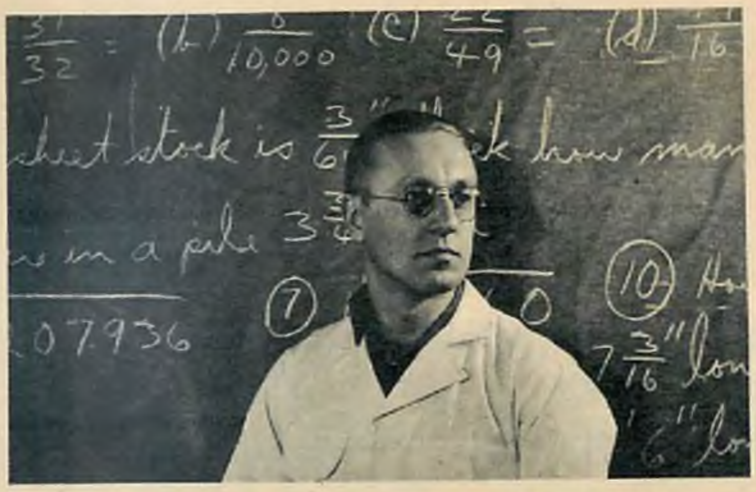


Crew member takes time out on bunk. Below floor is bomb bay, while at right is exhaust-driven heating unit for winter flying.

Radioman contacts home field by code. Drum above right hand is antenna reel. Wheel at right is for loop antenna. Far rear is retracted gun turret.

Getting the drift of things. Navigator peers through drift sight to calculate drift of plane from true course due to cross wind. Pilot uses canvas shield to cut down reflections.





Blackboard stuff, too. Neumann takes time out from weighty problems.

SHEET METAL STUDENT

BY GEORGE R. NEUMANN

Let him tell you about it, his three-months' course in a field popping with opportunity.

FOR three months I ate the finest food I could ever hope to absorb. No, this isn't an article on dietetics, because it's brain food I'm going to talk about. Food for thought, some call it, and here's hoping that your appetite is above par.

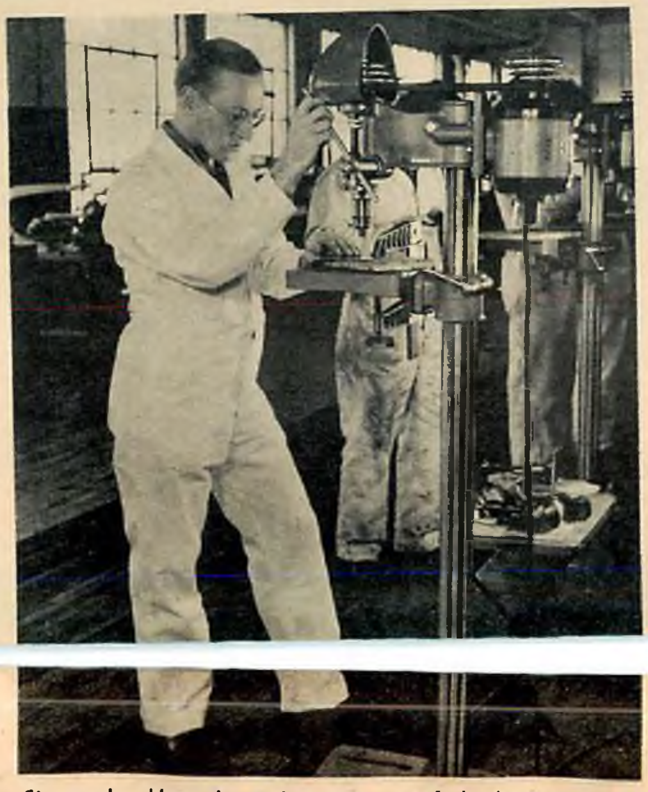
My "meals" started last October, first of the month, and I "gorged" until Christmas time. Perhaps this would be the moment to inform you that I'm speaking of the three months' sheet-metal course given at the Luscombe School of Aëronautics at West Trenton, New Jersey. The rather lengthy menu, which is to follow, was thoroughly enjoyed by yours truly as well as some eighty other hungry fellows. The table was well filled at each and every meal, this being one of the largest groups yet to invade the school.

The first taste, and rather pleasant, too, was learning the proper use of the tools in my box. (They said we were going to get the practical as well as the theoretical, and I learned they were right.) To learn the proper use of hacksaws, files, et cetera, my first project was to cut a piece of one-inch-square bar stock, approximately six inches long, and from it fashion the riveting dolly which would serve me in good stead later on. The finished dolly was to have one end cut at a perfect 45-degree angle and the other at a perfect 90-degree angle. After achieving these two angles by rough and draw filing, I had to round all edges to a definite radius. The final operation was to polish both ends to a gloss-smooth finish. Upon the satisfactory completion of my dolly I was ready to begin the drill block, or holder, to be used as a rack for the different sizes of drills in my tool box.

Here I took the next step in learning the proper use of drills and drill press. The third and final project made, before actually starting sheet-metal layout, was a drill gauge to be used later as a check on the drills I was to learn how to sharpen properly.

Before beginning the "main course" it might be well to touch upon the importantly related theoretical side—and I don't mean side dish. This is the "we practice what they preach" side. Perhaps the best example of both things together is to be found in my mechanical-drawing course. Here, from blueprints, I must make a regular three-view drawing of an actual plane fitting as it will look upon completion in the shop. From this drawing I must design, just as it is to look on the metal, a flat pattern layout of the mentioned piece. In addition to drawing I am also given a refresher course in simple mathematics as related to the airplane, and a short course in aircraft nomenclature. This will enable me to know, and term by their proper names, the many parts that make up an airplane.

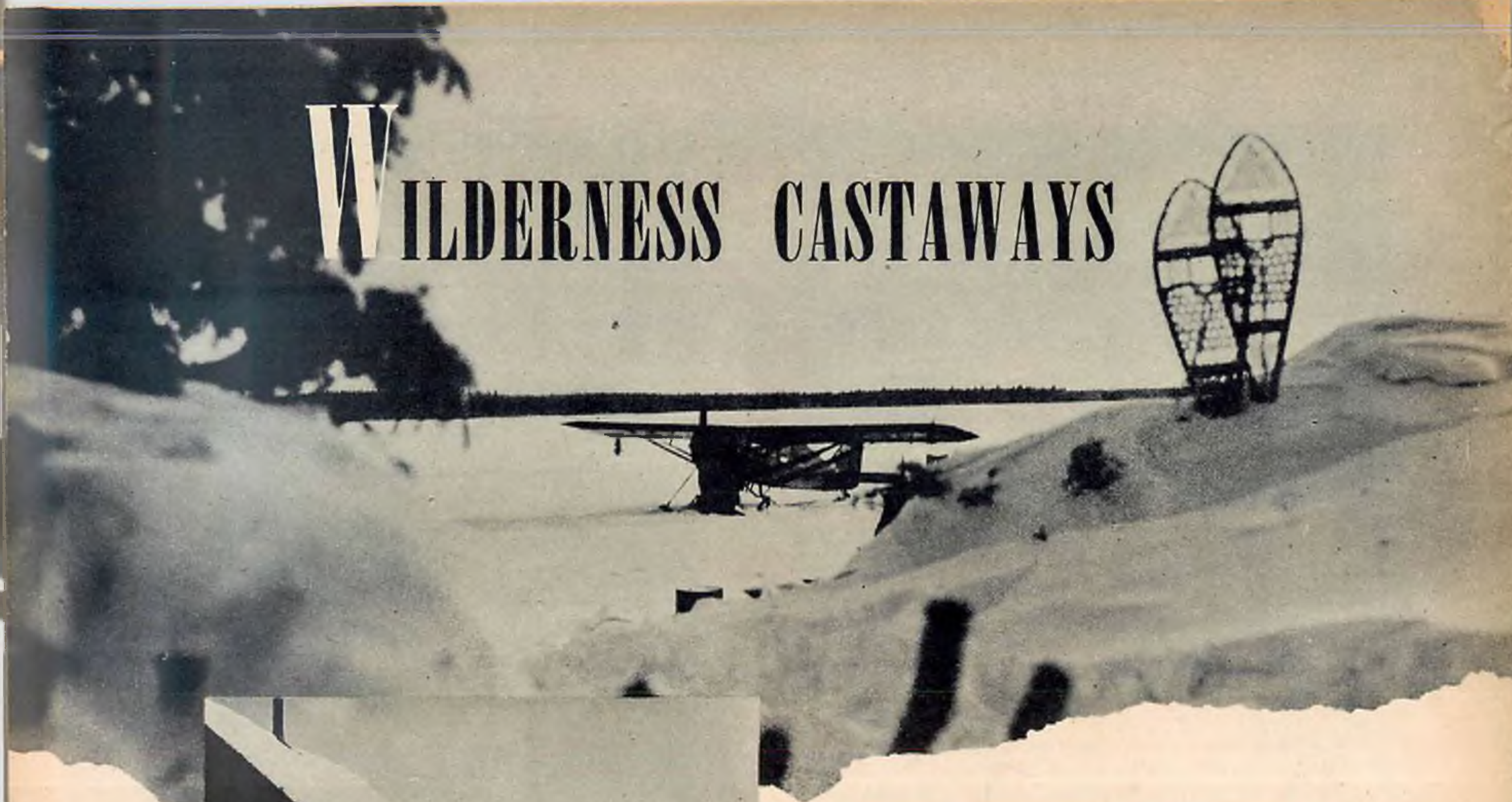
The term "pattern" as mentioned in my *(Turn to page 44)*



Shopwork. Here the author uses one of the latest types of electric drill presses in connection with sheet-metal course.

Practice on modern planes with modern tools keeps student in step with the latest aircraft manufacturing techniques.

WILDERNESS CASTAWAYS



Dramatic accounts of what happens to airmen forced down and lost in the Canadian wilds.

BY JAMES MONTAGNES

"Airports" such as this are hard to find—let alone a lost plane.

Luckily for some downed pilots the cargoes often include groceries.

Marooned planes are often finally reached by dog power.

THE North woods are hard on those who travel by land and water, as well as for those who travel it by air. Yet for the millions of miles annually covered in that vast territory from north of the transcontinental railway line to far north of the Arctic Circle, few men fail to return, even if for some days or weeks they are marooned hundreds of miles from the nearest settlement of any kind.

Canadian aviators, during the fifteen years they have been flying the Far North to open it up to civilization, mainly in the form of gold mines, have learned many things about how to live in that country if forced down. The day has gone when airmen forced down started out immediately to find a settlement. Too many have gone to death that way, or arrived so badly damaged from the overland trip as to require months of hospitalization. Today airmen are instructed to stay with their plane, to build fires. For today rescue craft go out as soon as weather permits after a plane has failed to make its destination. And that is because most mines and air bases in the northland now have radio transmitters to keep in touch with civilization. Where there are no radio transmitters it takes longer for rescue to start out, for then the base must await the date of the airman's return to know if he needs help or not.

Today planes fly the northland on schedule, as they do on the intercity air lines far to the south. They do not clock as closely to the minutes as on intercity air lines, but a close check is kept on the arrival and departure of all planes on regular runs. It is on the special runs and the trips into mines and trapping quarters off the main air lines that most troubles occur. But do not think that the northland has airways with radio beacons marking the route, or that there are lighted airports, or radio beams. These features of flying have not yet arrived in the Far North where airports are lakes and rivers, where few planes are equipped with radio transmitters, though more have receivers than formerly, where the pilot is also the porter and often also the mechanic, where most planes fly with pontoons in summer, with skis in winter, where the change in seasons *(Turn to page 50)*

REVIEWING STAND ★ ★ ★ ★ ★

Daily grows the list of books on aviation.

Weather Prediction. By Major R. M. Lester, F. R. Met. Sov. (Chemical Publishing Co., Inc., $4.50.) This book is of particular interest to airmen. Written in nontechnical language, it tells the layman how to predict his local weather conditions with unusual success, explains how research is carried on in the upper air regions, and how various instruments are used in all phases of meteorological study. The weather map comes in for comprehensive coverage and the workings of international observers are explained in this connection. Also covered are how different types of weather form and develop, how climates are caused and changed, what weather conditions mean in connection with the operation of aircraft. Many charts and photographs help to make this weather book complete and understandable.

The Aviation Mechanic. By Carl Norcross and James D. Quinn, Jr. (McGraw-Hill Book Co., $3.50.) This is the most complete book on aviation mechanics ever published. Beginning with the importance of an aircraft mechanic in aviation and describing his duties, it tells the history of the modern airplane and explains the theory of aërodynamics and flight. The second part of the book contains a complete description of airplane construction, discussing materials and methods, welding, heat treating, rivets and riveting, sheet metal and fabric covering, all the way down to final assembly. Every step in the building of a light plane and large factory production is clearly explained in detail. Part III deals with aircraft maintenance and repair, the servicing of engines, the duties of an air-line mechanic and maintenance of military aircraft. The appendix contains a list of tools required for apprentices, factory work and air-line maintenance, as well as Civil Air Regulations for a mechanics certificate. The book is profusely illustrated with photographs and drawings clearly explaining how airplanes are built, how they operate and how they are maintained. The authors have done a splendid job of covering every subject a mechanic should know. Although the book is written primarily for the beginners, experienced mechanics will find a great deal of useful information in it.

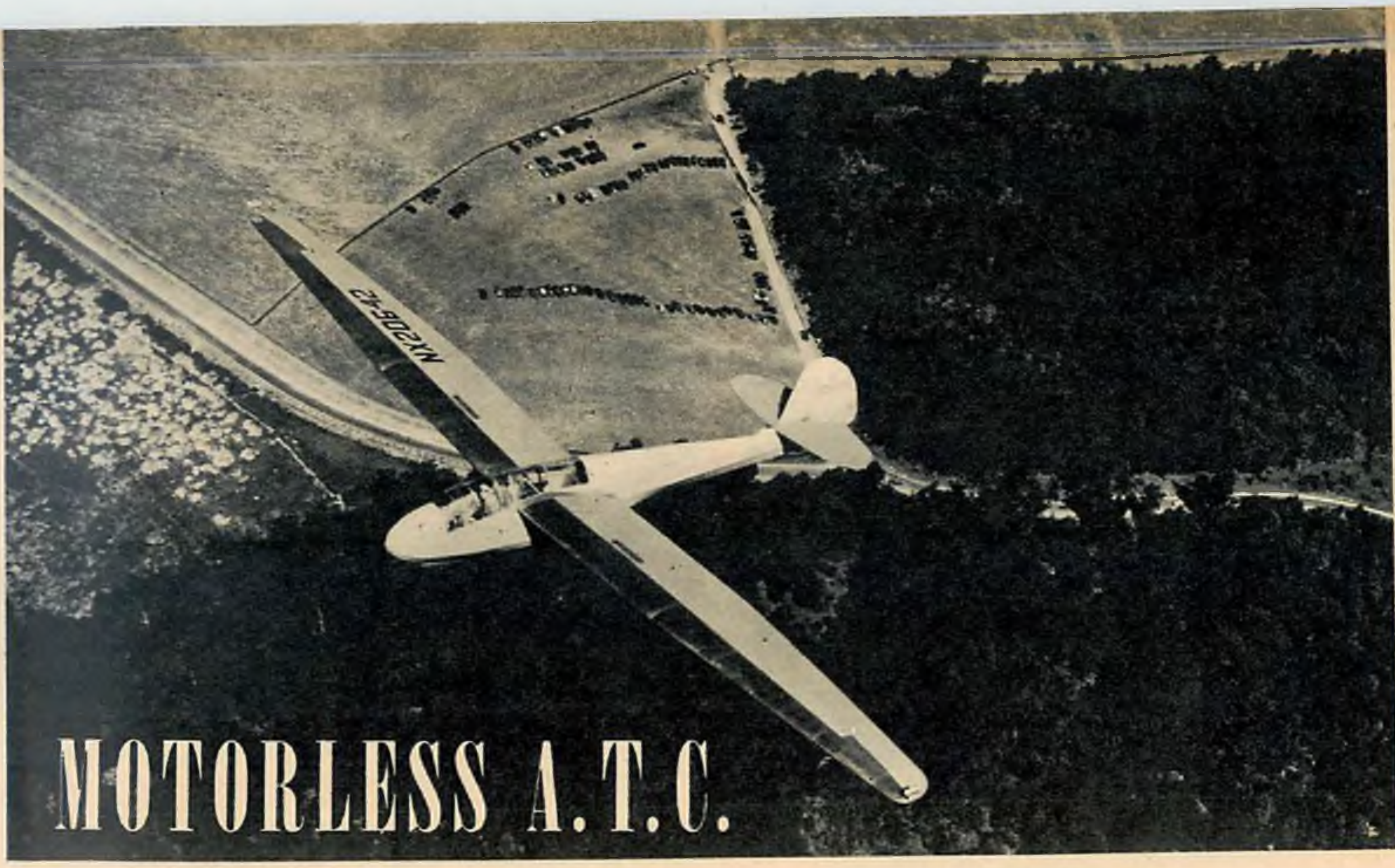
Aircraft Design. By C. H. Latimer Needham. (Chemical Publishing Co., Inc., $6.) This work is intended as a textbook for the serious student of aircraft design as well as the private aircraft designer and builder. Plentifully illustrated with diagrams, photos and figures, the chapters include such subjects as general princples of airflow, airfoil sections, types of aircraft, forces acting upon various parts of aircraft, control systems, stability, slots and flaps, dynamic loads, performance, propellers, parasite and interference drag, et cetera. Although not a book for the layman, "Aircraft Design" is a complete treatise for the serious student of aërodynamics and aircraft design in connection therewith.

Baughman Aviation Dictionary and Reference Guide. By Harold E. Baughman. (Aëro Publishers, Inc., $5.) At last there has appeared a complete and authentic aëro thesaurus for the use of student, engineer or layman. This 600-page book contains an astonishingly complete collection of aëronautical data ranging from nomenclature, maneuvers, lofting procedure, symbols and formulae, aëronautical occupations and licensing regulations, up to and including C. A. A. regulations, materials and shop mechanics. Also included are lists of aëronautical publications, organizations and publishers. This outstanding book will prove invaluable to aviation editors, librarians and anyone called upon to do research along aviation lines. Well illustrated with diagrams, photographs and charts.

Flight 7. By Robert E. Johnson. (Dodd, Mead & Co., $2.) This is the "story" of two young chaps who decide upon aviation for their career and go about attaining that goal in a businesslike manner. The reader follows them through aviation school, with all its attendant fun, work and excitement, meets famous aviation figures with them, shares their triumphs and let-downs, and finally goes to work with them for United Air Lines—which is logical enough, the author being one of that company's executives. Bob Johnson, by the way, has been associated with airline transportation for twelve years and has flown over 150,000 miles as a passenger. The last chapter of the book, which we will not give away, winds up with a bang—almost literally. Following the climax there is a comprehensive list of aëronautical occupations and their qualifications prepared by Boeing School. An absorbing book, "Flight 7" will be equally enjoyed by young and old.

Your Wings. By Assen Jordanoff. (Funk & Wagnalls Co., $2.50.) This famous book on flight training should need no introduction. "Your Wings" is unique in its method of teaching for not only is the copy written in understandable language for the layman as well as aviation student, but it is profusely, and we *mean* profusely, illustrated by hundreds of accurate and often humorous diagrams and illustrations. Artist Carlson's work helps to make this collection of data easy to read and remember. The author, an ace of the First World War, has drawn upon his wide experience and that of many famous authorities for the accuracy of the many chapters, which range from simple aërodynamical theory, through actual flight procedure and technique, and to the many phases of aircraft structure and engine operation. "Your Wings" is a "must" addition to the library of any who would be actively airminded.

Wings for Carol. By Patricia O'Malley. (Greystone Press, $2.) At first we didn't recognize the author under the little-used name Patricia, but when we discovered it was "Pat" O'Malley, known throughout the industry for her many years' association with flying, the American Air Lines and at present the Civil Aëronautics Authority, we knew this story of air hostesses would be authentic. The plot follows the careers of Carol Rogers and Foster Allen, two young graduate nurses, through various interesting experiences as they train for *(Turn to page 59)*



MOTORLESS A.T.C.

BY ALEXIS DAWYDOFF

Take off that "X," we know you. The famous Schweizer two-place, holder of America's only Approved Type Certificate for a two-place all-metal job.

Want to build a glider? Better know Federal engineering requirements, explained here.

FROM the accident report published by the Civil Aëronautics Board, Washington, D. C.: "On . . . a home-built glider crashed at . . . resulting in fatal injury to its pilot and destruction of aircraft. The glider had been launched from an end of an 1,800-foot rope attached to the rear wheel of an automobile in a winch attachment. The pilot had released the tow line at an altitude of approximately 400 feet and immediately thereafter both wings collapsed, dropping the aircraft to the ground on its nose.

"The probable cause: structural failure of wings following take-off. Contributing factor: faulty structural design."

The last item of the report, "contributing factor: faulty structural design," is the reason why the C. A. A. requires all gliders to have an airworthiness or a type certificate, before an aircraft certificate, commonly known as a license, is issued to it. This is done in order to safeguard the operator of the glider as well as people who may be below and get injured by the falling ship, and property which may be damaged as a result of such a fall. A glider is an aircraft first, last and always, and as such is subject to a number of stresses and excess loads which may be imposed on it due to various flight conditions, and if its structural members are not strong enough to withstand those strains they are apt to break, causing a bad crash. The aërodynamic design of the ship may be all wrong also, and on the first flight test the ship may refuse to come out of a spin or a spiral dive, or it may stall too easily, the controls may not respond at or below stalling speed, they may be oversensitive or too sluggish; the release hook may be located too near the center of gravity and prevent the pilot from knowing when excessive loads are imposed on the ship during towing. Or the ship may exceed maximum allowable speed in normal air maneuvers or recovery from spins, stalls and spiral dives, as happens with gliders having abnormally long fuselages.

All this can happen very easily if the builder of the glider is not an engineer or knows little about the problems of aircraft construction. In 1930 a whole lot of gliders were built by rank amateurs in back yards, cellars and even so-called factories, the idea being that as long as it had wings, tail surfaces and some means to control the flight path, this aëronautical misfit would fly. The only ones who gained from this glider-building chaos were undertakers and doctors. True, a couple of ships were built by experienced engineers and one of them *(Turn to page 58)*

Ready for release in more ways than one. The rugged and well performing Briegleb BG-6 glider has been granted its A. T. C., is now in production.

A lot of engineering goes into the designing and building of such a ship as this, the Bowlus Super Albatross owned by Soarer Woody Brown.

A club for all those interested in aviation.

GREETINGS, Air Adventurers!

The laggards are coming back into the fold again and we are hearing from members who have not been active in months. The sudden interest in aviation and national defense has heated the old zip and zing and I am grateful to note the far greater response our appeals are getting for new members, new interest and new activity.

We have a nice letter from Richard Kauffman of Shippensburg, Pa., who writes in to tell us that they expect one of the new air mail pick-up stations to be erected there. "I do not live near a large airport," says Kauffman, "but I am experimenting with photography on some of my models. I have just finished up a DC-3 and a North American O-47A."

Well, there's a lot of fun in photographing models if you take your time and get a cheap portrait lens for your camera. As a matter of fact, some of the best camera fans in the country are now going in for a lot of that sort of thing. They call it table-top photography. We believe we have only scratched the surface of this hobby and would like to see some real effort put in by our members.

A Topography award goes out to Leonard Mumbower of Evanston, Ill., who sends in a rare map of the Curtiss-Reynolds Airport. This field, according to Mumbower, may be taken over by the navy for flying laboratory work. He also sends in a few photographs he took out there.

Gene Sommerich of 6551 Hoffman Avenue, St. Louis, Mo., wants to swap aircraft photos with other Air Adventurers.

A new member is Audrey Joan Dynner of Newark, N. J., who has also passed her Flight Lieutenant's examination. James Cleveland Williams of Easley, S. C., has passed his Engine Mechanic's test and shows unusual interest in the in-line motor which is placed behind the pilot as in the Bell Airacobra.

We have a complete report on the first air mail pick-up attempted at Pitcairn, Pa., by Peggy Wallace of Pitcairn, in which she gives full details on the event. Hugh Harper of Birmingham, Ala., has passed his Flight Lieutenant's examination. (We hope that many of you will get the question, "What is a dead stick?" straightened out. Many of you miss it completely.) Glenn W. Clark, Jr., of Philadelphia has passed his F. L. test, too. *(Turn to page 51)*

Where the orders come from. P. Conway, Jr., of Shamokin, Pa., snapped this nice shot of Harrisburg Airport control tower.

One for your scrapbooks! This Velie Monoprep was still going strong when snapped by Wallie Konantz, Columbia, Mo.

Sure, Air Adventurers build gas models. Fred Beales of Hamilton, Ontario, and his gas-powered Cub with Canadian markings.

Bombers and belles. These two Douglas B-18 bombers were snapped by member Walter Bolling of Hammond, La., while at New Orleans field.

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 inclose ten cents to cover postage and handling. (Please **print** name and address.)

Name .... Age ....

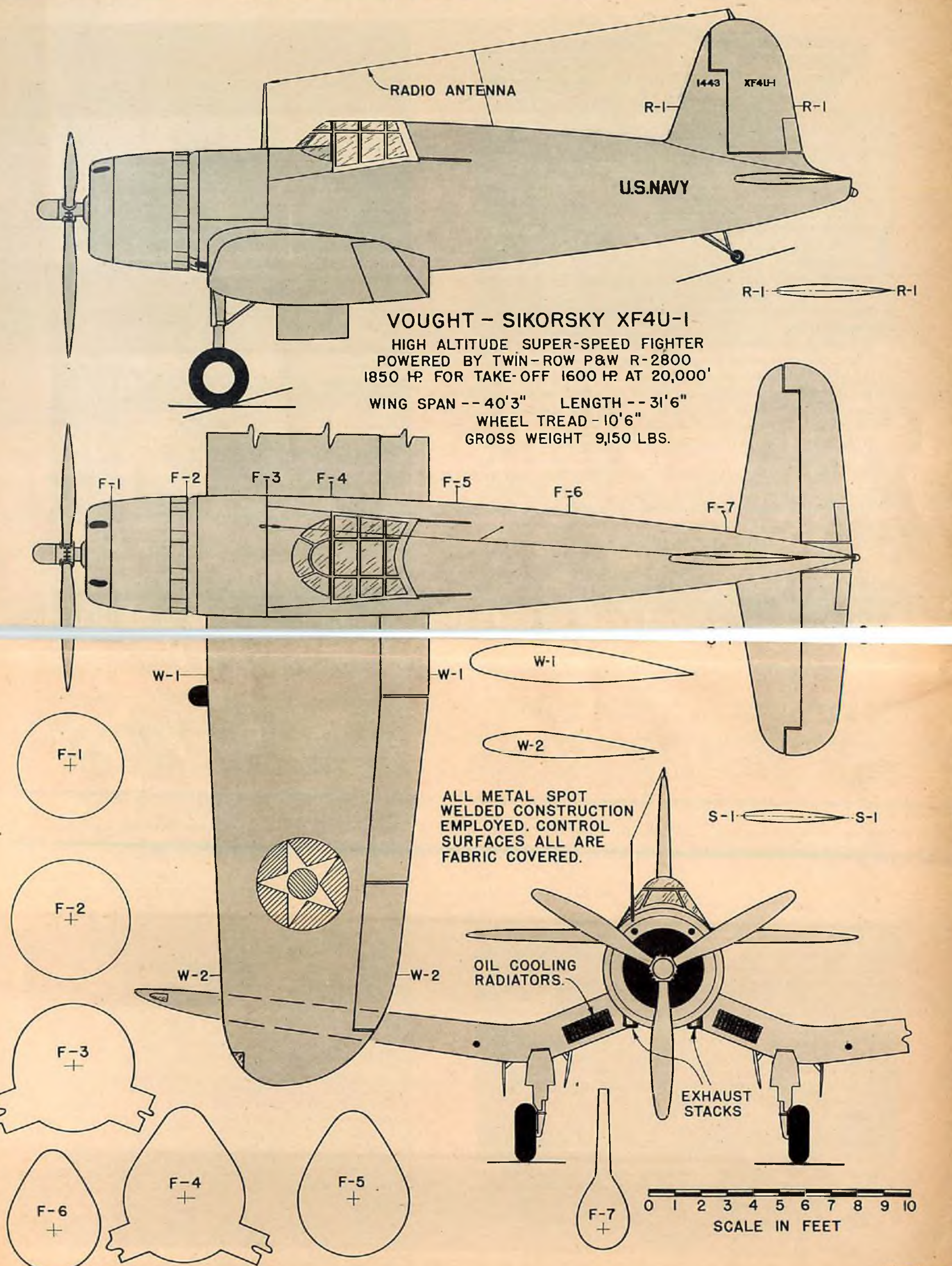
Address ....

....

☐ Check here if interested in model building.

MEET THE XF4U-1 in three-view

BY GEORGE ROSS



The war came to Brooklyn when Scotty Murray joined the Royal Canadian Air Force. Scotty is shown with well-known Topper.

Semiscale attracts Frank McElvee, who included cockpits in his Ohlsson "23" job.

Cousin Hugo from Bungo Bungo is up in a tree when it comes to gas modeling.

Model matters

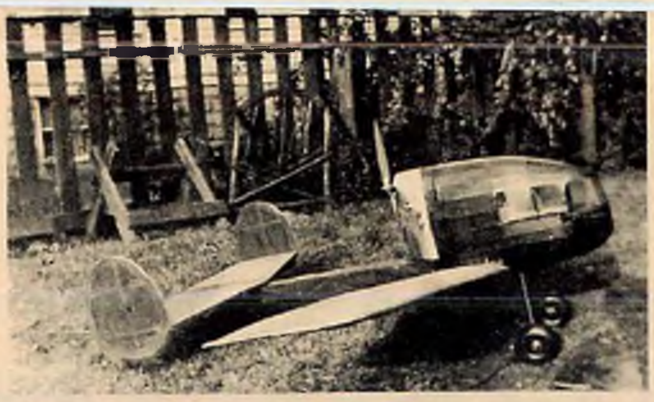
Gordon Light's Dope Can. Flash on 1941 Nationals.

Hot stuff is Frank Wright's Bombshell (October, 1940, Air Trails). Did 22 minutes with Bunch. Easily built. Swell flier.

THE DOPE CAN. (By Gordon Light.) It's not unusual for a member of the Little Rock (Arkansas) club to be rudely awakened late at night by the ringing telephone. Kingfish Sadler is on the line with a story that goes something like this: "Say, bud, I just had a swell idea that has great possibilities and I want you to build a model for us to experiment with. It will have . . . blah . . . blah—" (One of the club members took him seriously.) The result is a new gas job with a half dozen trick gadgets —all resulting from discussions with Sadler. If the ship doesn't fly it will be impossible to find out which "great idea" was sour. When some new device fails to come up to snuff, Sadler's comeback is, "I had a high fever that night, boys." So now the boys have decided to take his temperature before being taken in on some new development.

For the benefit of a visiting modeler the Little Rock boys put on an impressive show. One of the local hot shots did five minutes and then proceeded to tell the visitor that it's all really very simple after you get the hang of it. Well, the visitor calmly digested this sales talk, twisted the chopper on his Tiger-Zipper and sent it upstairs for a twenty-seven-minute O. O. S. flight in cold January weather. We wonder whose ears were long and fuzzy after that.

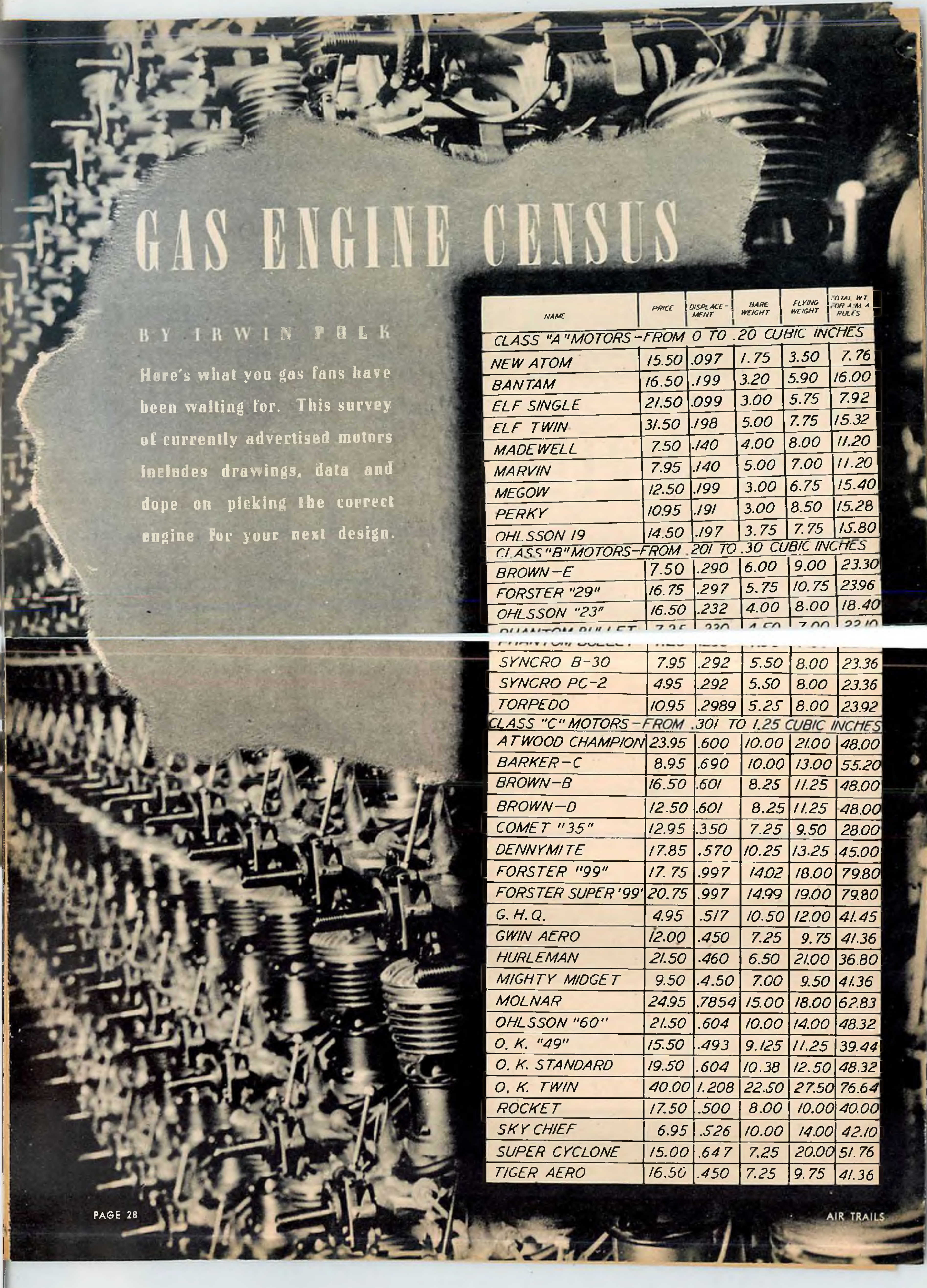
The low-speed wind tunnel developed by Boston modelers is being used to test outdoor wing sections. Considerable energy and research were put into the design of the tunnel and the balancing apparatus. Results should be an accurate guide to a more efficient selection of outdoor airfoils. A new "Experimenters Club"—a branch of the parent organization, Junior Aviation League—consists of nine experienced builders. They are putting the finishing touches to an eleven-foot radio-controlled gas model. New England continues to be the stronghold of indoor flying. Maybe it's the weather that drives the boys indoors, but it pays off at the national contest. The J. A. L. boys did especially well indoors at the 1940 contest with Gordon Cain winning the Bloomingdale Trophy for indoor cabin fuselage models.



Successful pusher. Ralph Prue uses Brown D for this 3 1/4-pound ship. Glides nicely, climbs well, and can take punishment, too.

Ernest E. Shott reports modeling in Lebanon (Pa.) to be enjoying a healthy growth with the gas-job total up to thirty-five. Lebanon boys never did turn out much in the way of quantity, but the caliber of the models has always been top-flight. (Note to readers familiar with my home address: Above statement does not apply to me.) Lebanon's old-timer, Harry E. Moyer, has always stuck by the theory that a true test is consistency. An even more important Moyer theory is that the first requirement of any model is to look and fly like an airplane. All his rubber and gas designs—and there have been plenty of them during the last twenty-one years—have had good looks without any sacrifice in flying ability. There's only one official contest a year to stir *(Turn to page 46)*

Comet Sailplane and Tom Thumb motor turned in a 33-minute flight for D. May. Fixed wheels substituted for retracting gear.

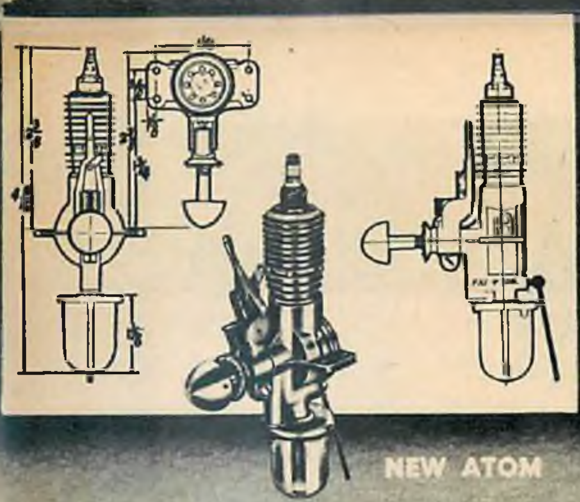


GAS ENGINE CENSUS

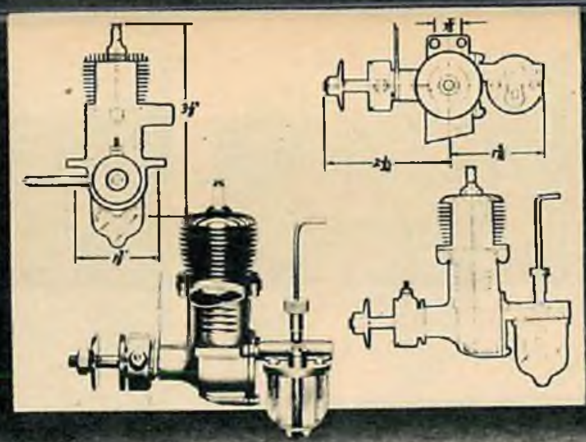
BY IRWIN POLK

Here's what you gas fans have been waiting for. This survey of currently advertised motors includes drawings, data and dope on picking the correct engine for your next design.

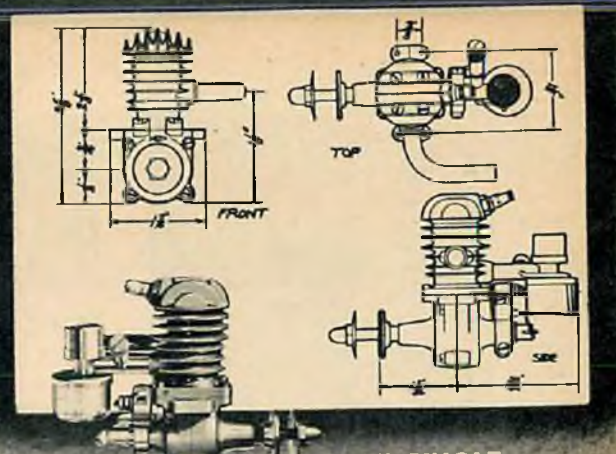
NAME	PRICE	DISPLACE-MENT	BARE WEIGHT	FLYING WEIGHT	TOTAL WT. FOR A.M.A. RULES
CLASS "A" MOTORS—FROM 0 TO .20 CUBIC INCHES					
NEW ATOM	15.50	.097	1.75	3.50	7.76
BANTAM	16.50	.199	3.20	5.90	16.00
ELF SINGLE	21.50	.099	3.00	5.75	7.92
ELF TWIN	31.50	.198	5.00	7.75	15.32
MADEWELL	7.50	.140	4.00	8.00	11.20
MARVIN	7.95	.140	5.00	7.00	11.20
MEGOW	12.50	.199	3.00	6.75	15.40
PERKY	10.95	.191	3.00	8.50	15.28
OHLSSON 19	14.50	.197	3.75	7.75	15.80
CLASS "B" MOTORS—FROM .201 TO .30 CUBIC INCHES					
BROWN-E	7.50	.290	6.00	9.00	23.30
FORSTER "29"	16.75	.297	5.75	10.75	23.96
OHLSSON "23"	16.50	.232	4.00	8.00	18.40
PHANTOM BULLET	7.25	.230	4.50	7.00	22.10
SYNCRO B-30	7.95	.292	5.50	8.00	23.36
SYNCRO PC-2	4.95	.292	5.50	8.00	23.36
TORPEDO	10.95	.2989	5.25	8.00	23.92
CLASS "C" MOTORS—FROM .301 TO 1.25 CUBIC INCHES					
ATWOOD CHAMPION	23.95	.600	10.00	21.00	48.00
BARKER-C	8.95	.690	10.00	13.00	55.20
BROWN-B	16.50	.601	8.25	11.25	48.00
BROWN-D	12.50	.601	8.25	11.25	48.00
COMET "35"	12.95	.350	7.25	9.50	28.00
DENNYMITE	17.85	.570	10.25	13.25	45.00
FORSTER "99"	17.75	.997	14.02	18.00	79.80
FORSTER SUPER '99'	20.75	.997	14.99	19.00	79.80
G. H. Q.	4.95	.517	10.50	12.00	41.45
GWIN AERO	12.00	.450	7.25	9.75	41.36
HURLEMAN	21.50	.460	6.50	21.00	36.80
MIGHTY MIDGET	9.50	.4.50	7.00	9.50	41.36
MOLNAR	24.95	.7854	15.00	18.00	62.83
OHLSSON "60"	21.50	.604	10.00	14.00	48.32
O. K. "49"	15.50	.493	9.125	11.25	39.44
O. K. STANDARD	19.50	.604	10.38	12.50	48.32
O. K. TWIN	40.00	1.208	22.50	27.50	76.64
ROCKET	17.50	.500	8.00	10.00	40.00
SKY CHIEF	6.95	.526	10.00	14.00	42.10
SUPER CYCLONE	15.00	.647	7.25	20.00	51.76
TIGER AERO	16.50	.450	7.25	9.75	41.36



NEW ATOM

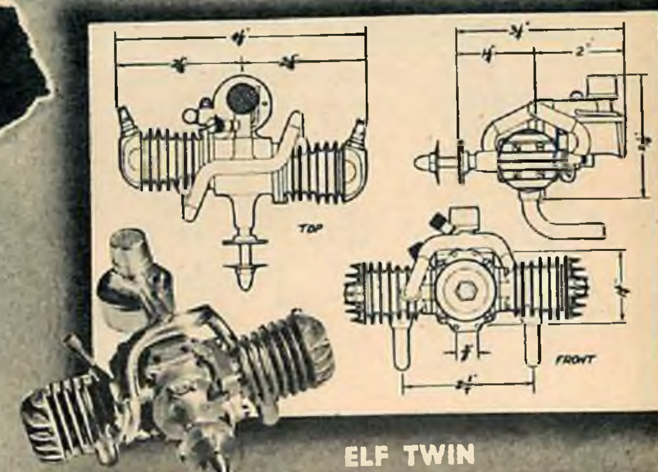


BANTAM



ELF SINGLE

CLASS A



ELF TWIN

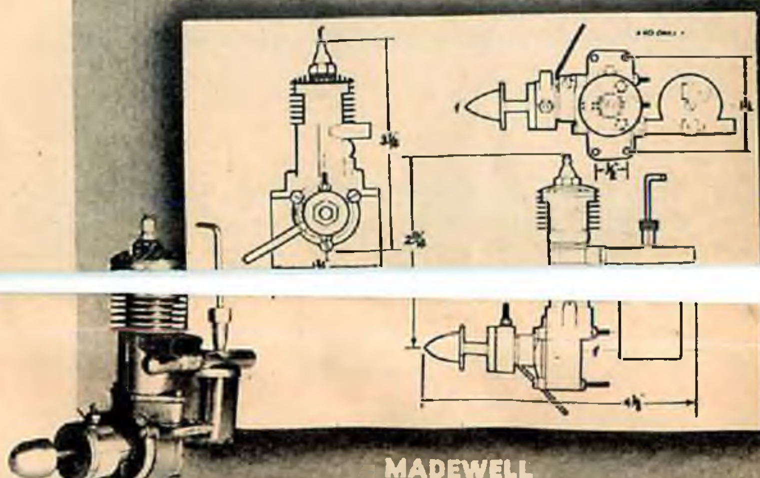
AS revealing as is the Federal Census is our survey of the current model gas-engine market. As the demand and the production of midget power plants increase, model builders today get more and more engine value per dollar than ever before. Originally a basement or back-yard shop product, the gas engine of today is manufactured and produced in impressive, large factories of which any more mature industry would be proud. New ideas, new materials and new methods of manufacturing help in producing a midget power plant that is reliable, durable and inexpensive.

The present Academy of Model Aëronautics competition regulations give the modeler great latitude in choice of ships and engines. With the probability of the engine run being cut from twenty to fifteen seconds, model meets will become less and less contests of engines and greater stress will be placed on the performance of the ship after the engine has stopped running. Before purchasing your engine you should decide as to the size model you would like to build. To help you in your choice let us analyze the Academy of Model Aëronautics regulations for powered models which are as follows:

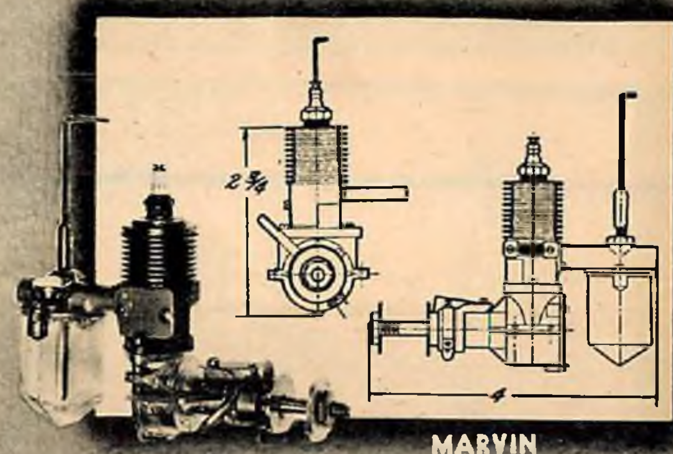
Models powered by internal combustion engine(s) displacement are as follows: Class A, where the displacement of the engine(s) does not exceed .20 cubic inches; Class B, where the displacement of the engine(s) exceeds .20 but is not more than .30 cubic inches; and Class C, where the displacement of the engine(s) exceeds .30 but is not more than 1.25 cubic inches. Models powered by internal combustion engine(s) must contain a device, mechanical or otherwise, to limit the length of the engine run to twenty seconds.

All model aircraft powered by internal combustion engine(s) are limited to a total flying weight of not more than seven pounds, shall weigh not less than eighty ounces for every cubic inch of engine(s) displacement, and shall weigh not less than eight ounces for each square foot of projected supporting surface(s).

Class A ships, some as small as twenty-four-inch wing span, are the quickest to construct and in most cases cost hardly more than a rubber-powered model. They are especially suited for the busy hobbyist who prefers to spend more time flying them than constructing models. Most Class A jobs can be built in a few evenings and combine advantages of

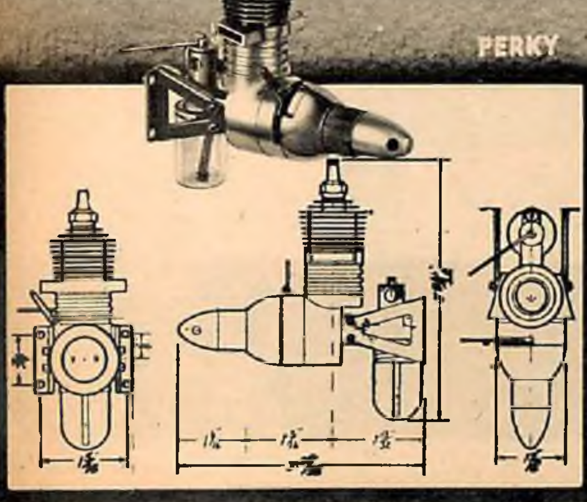


MADEWELL

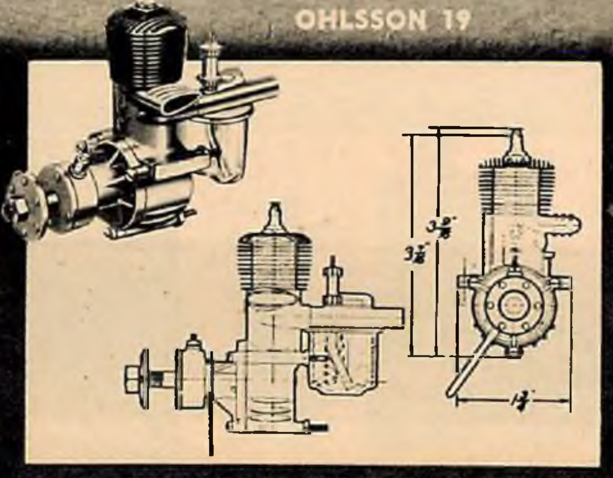


MARVIN

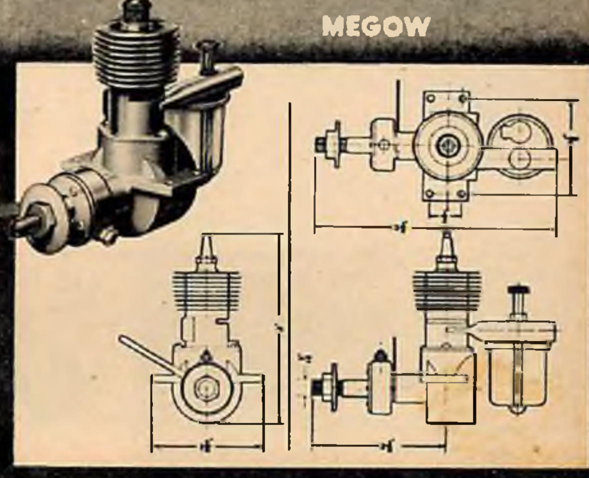
PERKY

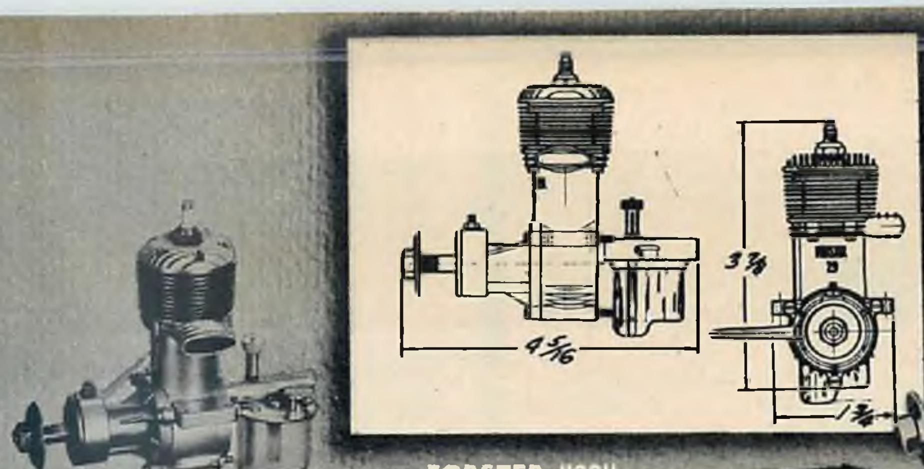


OHLSSON 19

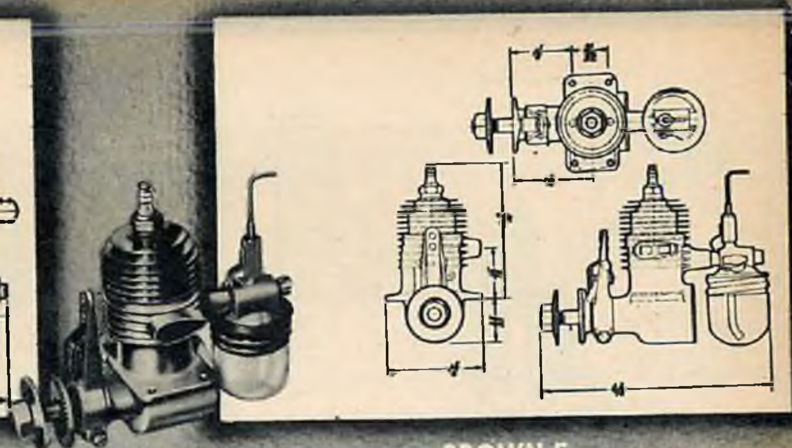


MEGOW



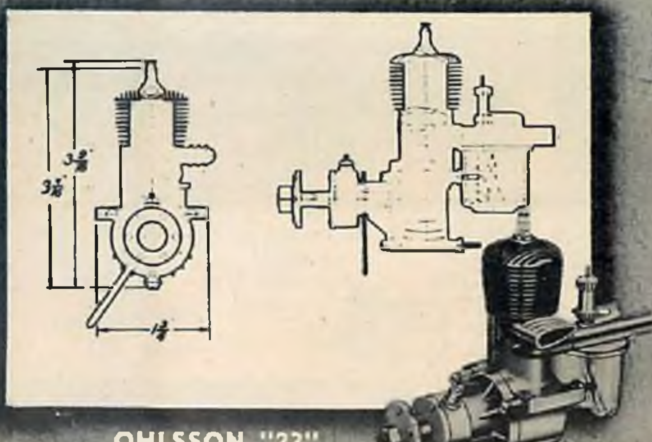


FORSTER "29"

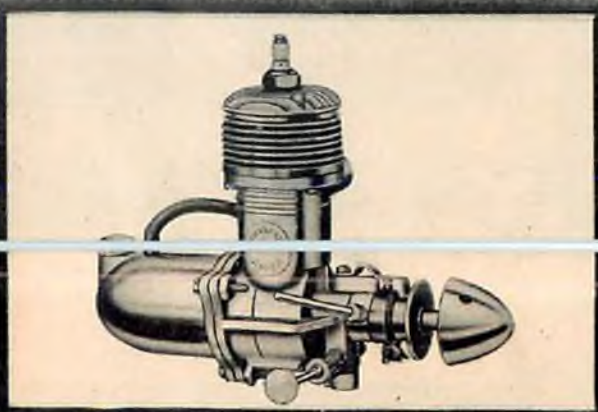


BROWN-E

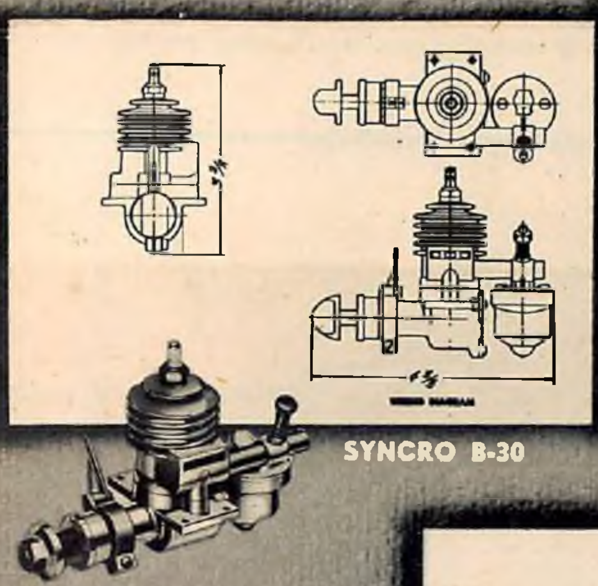
CLASS B



OHLSSON "23"



PHANTOM BULLET



SYNCRO B-30

low cost, ease of construction and repair. Such models can be tucked under the arm and transported in a bus, trolley car or subway with the greatest of ease to the nearest flying field.

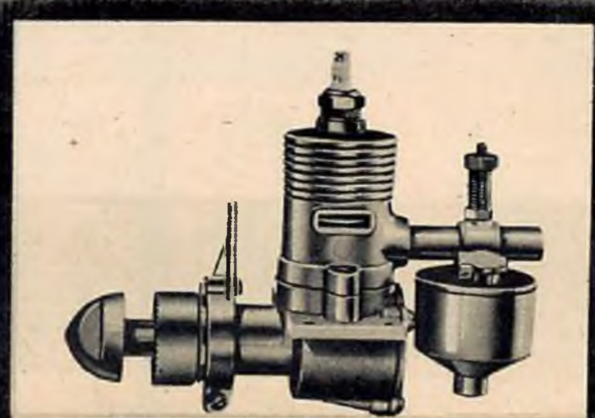
CLASS A ENGINES

Atom. The new Atom is one of the lightest and smallest miniature gasoline engines made today. Having a cubic-inch displacement of only .097, the Atom has a number of unusual features. It uses a different principle of bypassing the combustion gases from the crankcase to the cylinder. Fuel is fed by suction from a gas tank attached directly beneath the crankcase through an atomizer of .008 diameter. Fuel is controlled by means of a throttle arm rather than the conventional needle valve. This engine has a chrome-molybdenum cylinder and piston lapped to match. The connecting rod and rotary valve crankshaft are also made of the same hard and durable material. It uses an all-steel main bearing. The piston rotates freely within the cylinder, thus getting an even distribution of wear and increasing the life of the engine. The new model has an increased exhaust port area all around the cylinder providing rapid scavenging of burned gases. A shorter piston, improved sub piston, lighter connecting rod and advanced rotary valve have increased the power output of the new Atom.

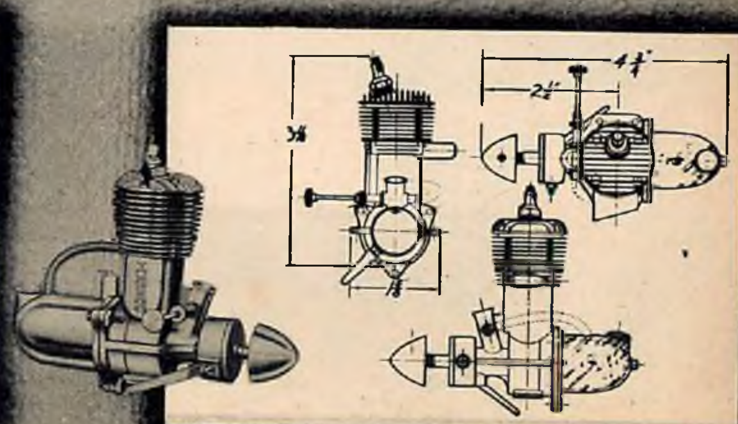
The revolutionary timer, seemingly complicated, places no load on the engine and is easy on the battery.

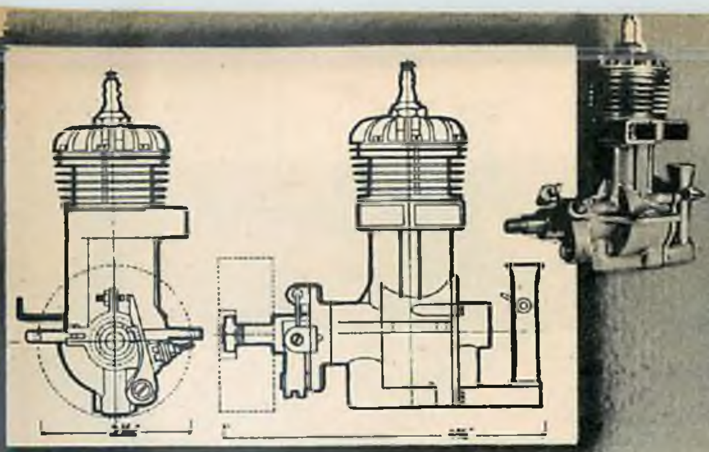
Bantam. The Bantam is designed and manufactured by the Miniature Motors Corp. Every operation of its manufacture is supervised by the designer. The Bantam is practically custom built. Its die-cast magnesium alloy crankcase contains an integral bypass and full-length phosphor bronze main bearing. A hardened chrome-molybdenum piston is ground, lapped and matched to a cylinder of high manganese moly steel, the cylinder being bolted to the crankcase. A disk-type rotary intake valve of tool steel is surface ground and lapped and is driven by the crankpin. The connecting rod is die cast of magnesium alloy with an aluminum alloy wrist pin bearing and a nickel iron bottom rod bearing. The crankshaft is drop forged of chrome nickel moly steel and is hardened and ground and chrome plated for wear resistance.

SYNCRO PC-2

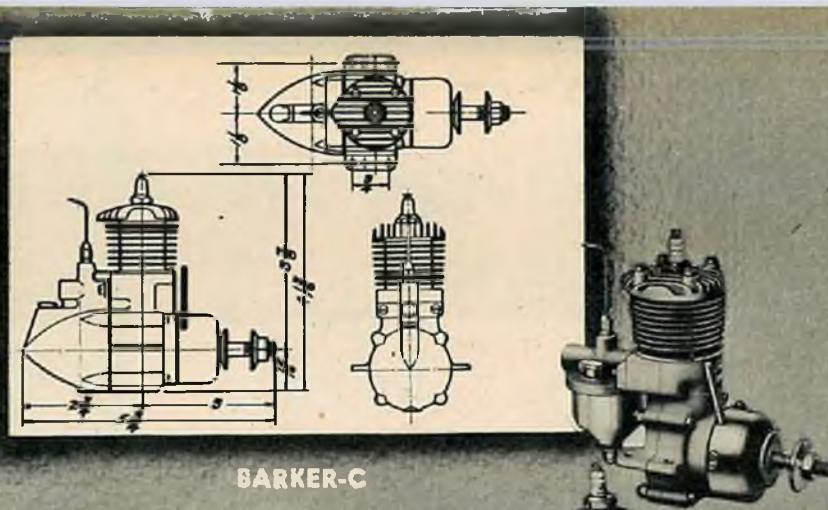


TORPEDO





ATWOOD CHAMPION



BARKER-C

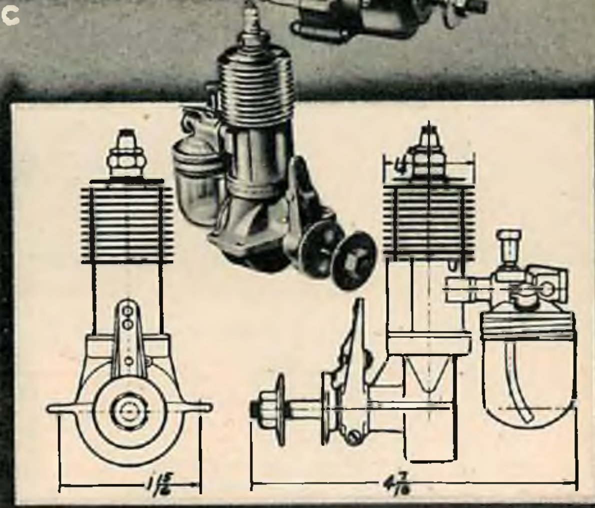
CLASS C

Elf Single. The makers of the Elf single cylinder were probably the first on the market with a really small workable gasoline engine. Retaining the reliability and the lasting qualities of the old model, the '41 version is greatly improved in appearance. The crankcase and cylinder are sand cast of aluminum. The cylinder has a carbon steel sleeve with a precision selective-fitted, aluminum, forged, machined piston. The connecting rod is machined from solid dural. Tool-steel wrist pin and carbon steel crankshaft. This motor has a double bearing crankshaft with a timer on the rear end. It also has a float-type carburetor.

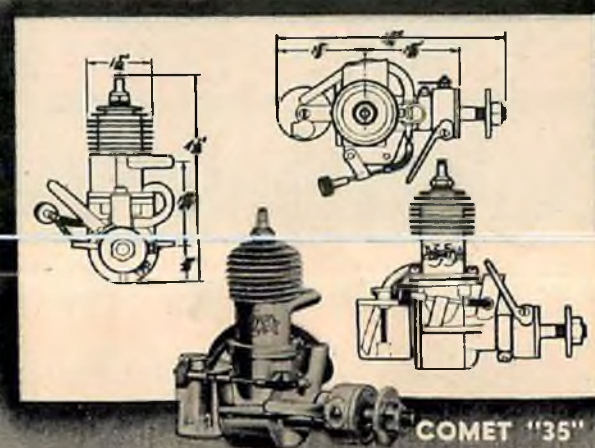
Elf Twin. This is the first simultaneous-firing twin Class A engine and it opens new horizons for experienced builders. Both Elf models have two main bearings and spark plugs mounted at right angles to the cylinder. The automobile-type timer, placed back of the crankcase, requires no cleaning or adjusting. Both engines use light oil for lubrication and employ air filters which prevent life-shortening grit and dust from reaching into the engine. The parts of the Twin are interchangeable with the Single except the crankcase, crankshaft and the gas tank. The Twin has twelve ball thrust bearings. Vibration is better absorbed because of the width of the engine.

Marvin. The Marvin engine (born Pee Wee) is now produced by the Marvin Manufacturing Co. of Royal Oak, Michigan. The transparent gas tank and die-cast crankcase with Oilite bearings are the major changes in the present model. The piston and cylinder are made of cast-iron lapped to fit. The cylinder has ten machined fins. The Marvin's heat-treated tool-steel crankshaft is counterbalanced. The $^3/_{16}$-inch crank pin is unusually large for an engine of this size and should increase the life of the connecting rod bearing considerably. The points are exposed, but the timer is adjustable.

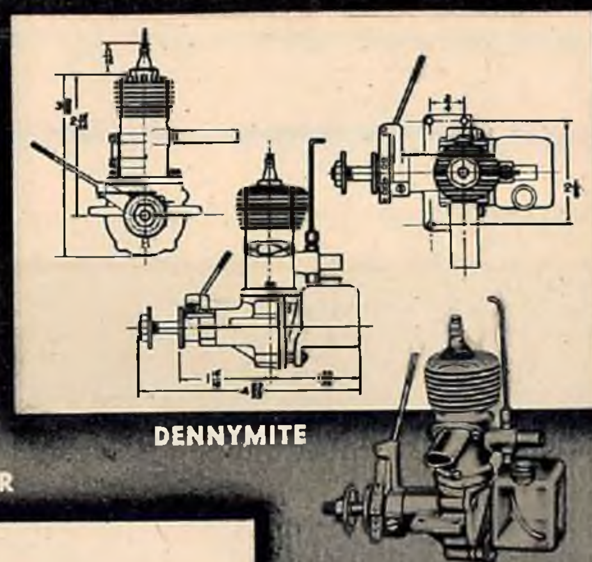
Madewell Mite. This is now manufactured by Jack Keener, designer and manufacturer of the Brat engine which was at the time the first production small engine on the market. The crankcase and connecting rod are cast of aluminum in a permanent mold. The bypass intake and exhaust manifold are brazed onto the steel cylinder before the final cut on the



BROWN-B

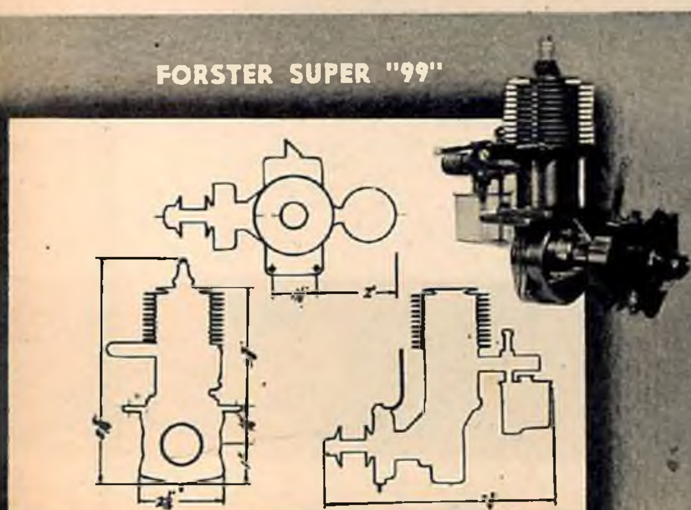


COMET "35"

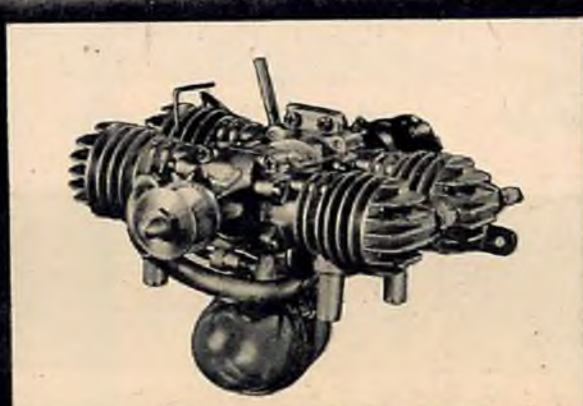


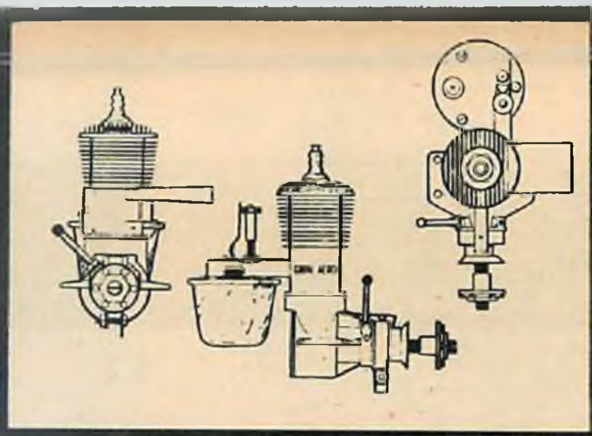
DENNYMITE

FORSTER SUPER "99"

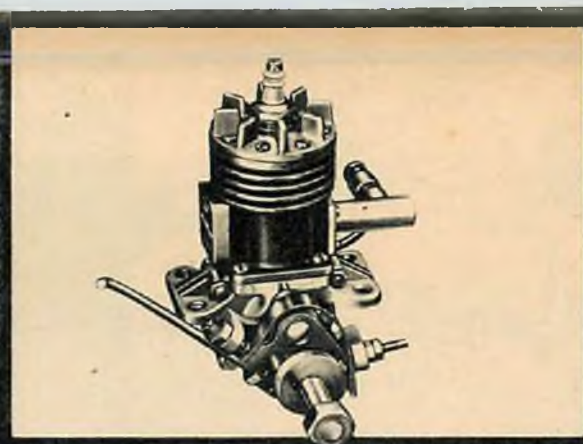


ELF FOUR



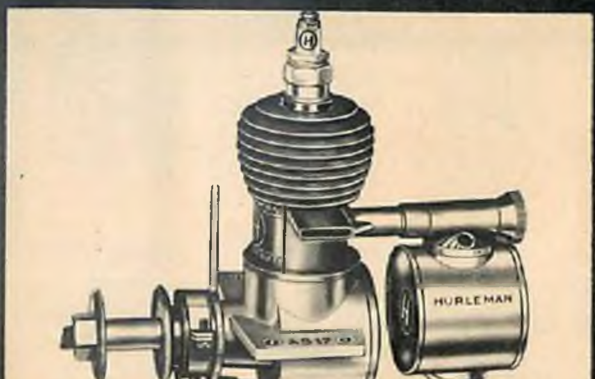


GWIN AERO



G. H. Q.

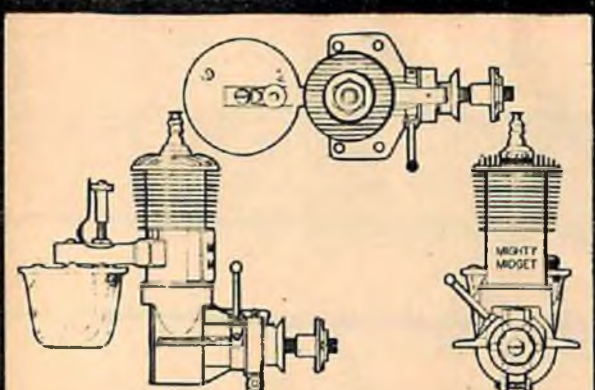
CLASS C



HURLEMAN

bore is made, thus assuring a perfectly round bore free from distortion sometimes caused by the brazing process. The cylinder is fitted with an aluminum head and a lapped cast-iron piston is employed. The cylinder is fastened to the case with two screws. The engine may be mounted radially or on lugs. The inclosed timer is adjustable and the fuel tank is transparent.

Megow .199. The Megow .199 has a permanently sealed crankcase. In place of a threaded cast or machined cover plate, there has been substituted an aluminum stamping which is pressed into place after the shaft and rod are assembled in the crankcase. This new idea will undoubtedly discourage a lot of unnecessary tampering with the motor. Of conventional four-port design otherwise, the .199 has an aluminum alloy crankcase and connecting rod cast in a permanent mold. The steel shaft turns in an extra-long main bearing made of high-speed bronze. The one-piece chrome vanadium cylinder which screws into the crankcase is fitted with a lapped cast-iron piston and has the intake and bypass manifolds brazed on. A fully inclosed timer and a transparent tank are incorporated in this motor.

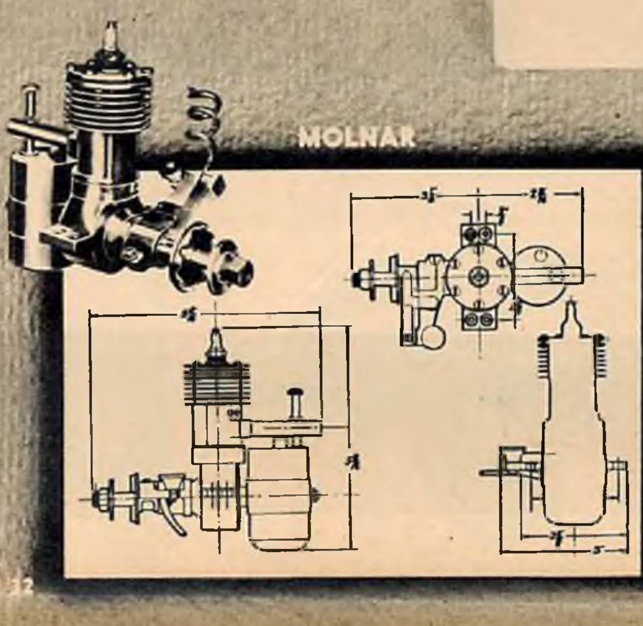


MIGHTY MIDGET

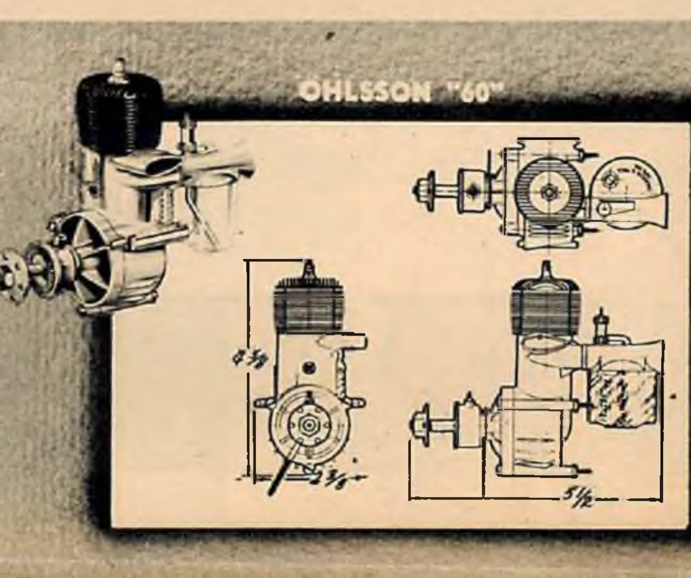
Ohlsson 19. The Ohlsson 19 is a smaller edition of the famous 23 Class B engine, the difference being in the use of a shorter stroke in order to cut the displacement down below the limit for Class A. The substitution of a different crankshaft to accomplish this also made it necessary to lower the cylinder head slightly to maintain a good compression ratio. The crankcase, timer, piston and all other parts are identical to those used on the larger engine, so for further details of the 19 please see the description of the Ohlsson 23 under Class B motors.

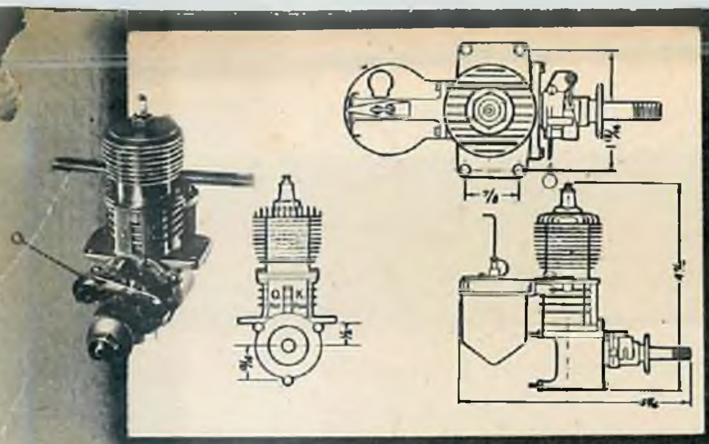
Perky. Manufactured by the Baycraft Miniatures, the Perky is a recent addition in the medium-price Class A motors that offer many interesting features. This motor has a bore of $^{30}/_{64}$ and a stroke of $^{21}/_{32}$, giving it a displacement of .191 and putting it on top of Class A. The motor has a Champion V2 spark plug and an aëro 3 volt coil. The timer is adjustable with inclosed points. The whole cylinder including fins is made

MOLNAR

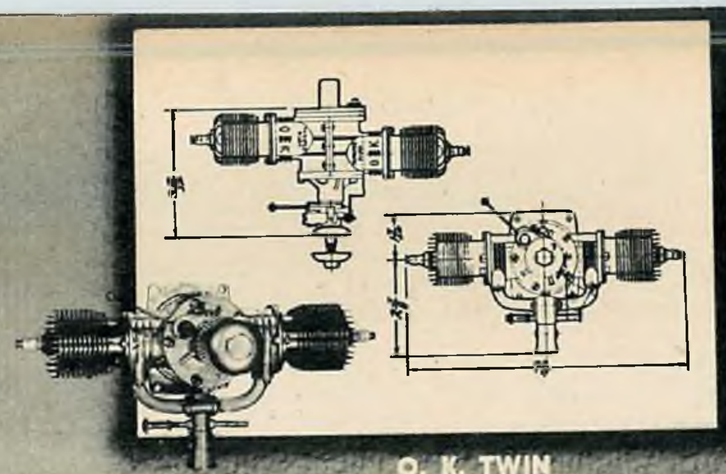


OHLSSON "60"





O. K. "49"



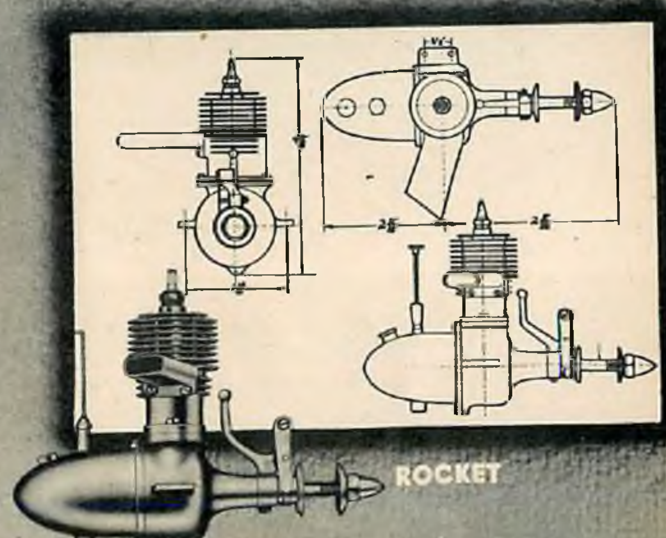
O. K. TWIN

of tool steel with a tool-steel hardened and ground lapped piston. The connecting rod is made of hardened steel without bearing either on top or bottom. The wrist pin as well as the crankshaft is made of hardened and ground tool steel with a high-speed bronze main bearing. The crankcase is of aluminum die cast. The Perky offers either beam or radial mounting. The bypass is unique in that the fuel vapor passes all around the cylinder, which is slotted around its circumference at the point it is screwed into the crankcase. The Perky has a new-type throttle control carburetor with patented fixed jets, which gives a steady gas control without critical adjustment.

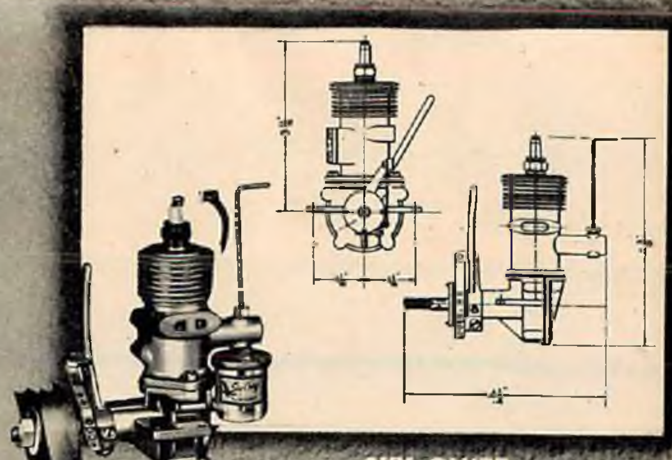
CLASS B ENGINES

With the addition of four new engines to this category in the past year, Class B models are headed for even greater popularity than before. Three of the lowest-priced gas engines on the market are in this category. Model-kit manufacturers provide builders with a great variety of design. Class B models, being considerably larger and stronger than those used in the A division, are ideally suited for beginners. They are not so small as to require special skill for construction and not large enough to be a factor in so far as engineering and cost are concerned. Class B engines weigh only a trifle less than Class C power plants and the models which they power usually have a greater flying speed.

Brownie. Made by the Junior Motors Corp., the Brown E is a departure from the now world-famous design standardized by this firm in their Class C engines. This Class B motor is of three-port design, the bypass being integral with the crankcase. Unlike other motors of this type, the steel cylinder is screwed into the crankcase instead of being bolted. A short, low-pitch thread just below the bottom fin does the trick. Case and rod are pressure cast of aluminum alloy and two cast-iron rings are fitted on the piston. The tank is transparent and the micrometer needle valve has a spring lock to prevent a change in adjustment due to vibration. Initial production difficulties being overcome, the Brownies are now coming through in larger numbers and are much more efficient. Further improvements are expected on this model. *(Turn to page 62)*

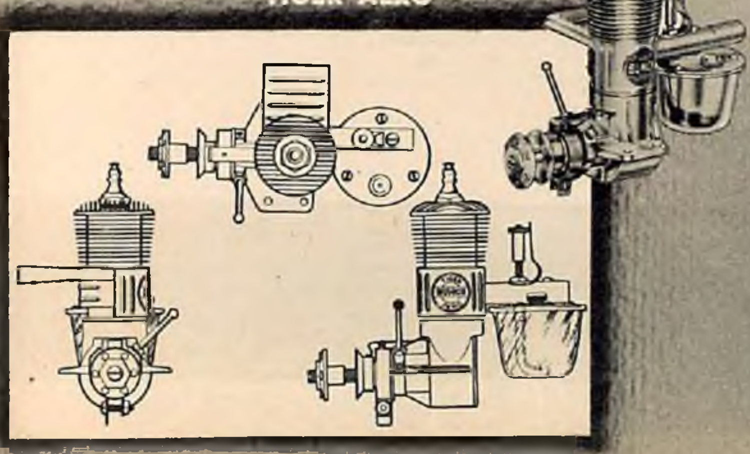


ROCKET

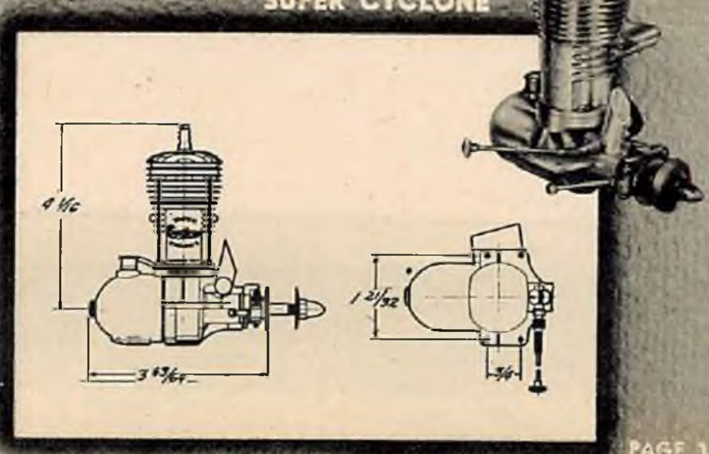


SKY CHIEF

TIGER AERO



SUPER CYCLONE



MEET THE XF4U-1

Our only gull wing plane
proven over 400 m. p. h. D

also our fastest. Powered with the 2,000 h. p. Double Wasp engine, its speed has

igned as a long-range fighter for the navy, it is one of our most sensational performers.

ALBATROSS

Well named is this outstanding soarer. It's a Class C job.

BY GEORGE REICH

SOARING ability interests me. And does the Albatross soar? Just build it and you'll agree it more than lives up to its name. It seems to have an instinct for thermals as it wheels in its flat, soaring glide.

These are the factors that entered into its design:

Spiral Stability. It will be noted on the side view of the body plan (Plate II) that the center of lateral area is in a low position in respect to the center of gravity. This makes the model extremely stable and, therefore, very consistent.

Efficient Climb. This largely depends on how the model is adjusted, but clean lines and a little streamlining help a great deal. The drag on the body is kept to a minimum by not having any more cross section than is necessary by having a V-shaped body and by cowling in the motor.

Flat, Soaring Glide. High-lift wing section, combined with the proper location of the c. g. produces this to the *n*th degree. The center of gravity is slightly behind the center of lift of the wing because of the lifting tail. A lifting tail of proper thickness will completely eliminate the use of downthrust. No negative thrust is needed in this design if a Dennymite is used. However, if an Ohlsson "60" is used, it would be wise to increase thickness of stabilizer to about $^{13}/_{16}$".

Flight Record. The model has a full 4-minute contest average. Longest official flight, 16:29. Longest official average, 6:37. Longest unofficial flight (motor run 23 seconds), one hour. Two first places, two seconds, one third out of seven contests.

CONSTRUCTION

Before starting any construction, study the plans thoroughly and then make full-size drawings.

Start construction of body by making sides. Out of $^{3}/_{16}$ x ⅞" medium hard stock, the front part of the side is formed. After this has been laid down and cemented, proceed by completing the outline of the body with $^{3}/_{16}$"-square hard balsa. The uprights out of the same size are of medium stock and are cemented in place. Then put in the diagonals of ⅛ x $^{3}/_{16}$". This will have completed one side. Now build another on top of it without any waxed paper between. Be sure to use the same grade of wood for all the longerons, and the same grade for all the uprights.

After both sides have dried take up off plan (both sides will be stuck together) and sand the outline so both sides will be alike. The sides can then be easily separated with a razor blade.

To assemble the body, each side is pinned upside down along the straight portion from Station A to F. Then insert all the cross pieces from A to F and glue. After thoroughly dry take up and finish assembly by gluing in all remaining cross braces, working from Station F to the end of the body. It will be noted that beginning at Station L the body has the form of a V and there are no cross pieces on the bottom. The lower longeron of each side from Station L to the end should be beveled on the inside as shown on the cross section detail of Station L on Plate II. After all the cross braces have been cemented in, put in diagonals on top and bottom.

The motor mount is cut out of a good grade of birch plywood, size ¼" flat. Before installing, give three coats of clear dope to make it oilproof. The ⅛" flat firewall is next glued in place and also doped. Then fill in the nose and cut holes for cooling.

The isometric drawing on Plate I shows clearly how to install wing supports and wing attachment dowels.

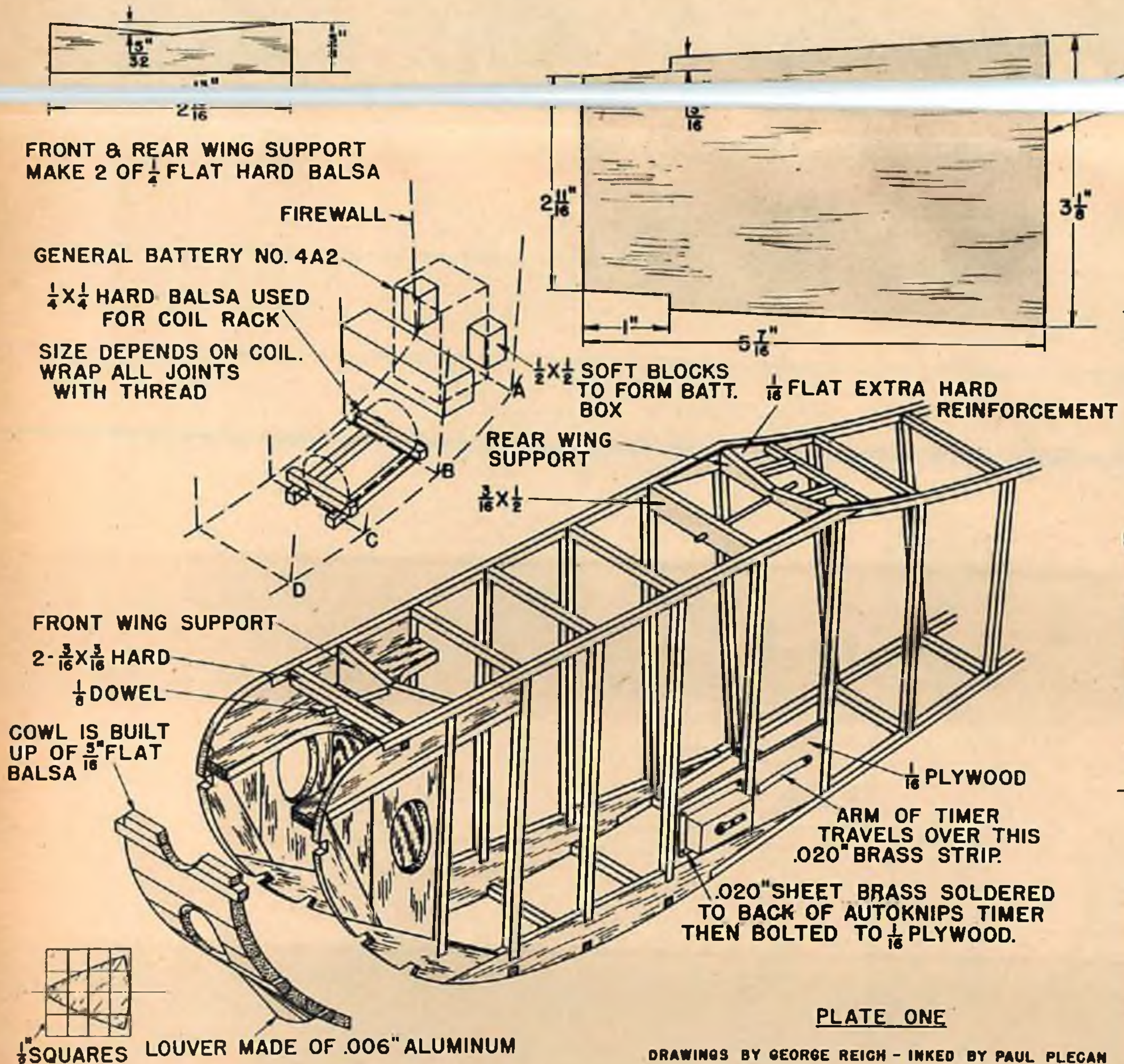
The stabilizer is supported by a length of bamboo 4½" long which is now cemented in place. Also the ⅛ x ¾" dowel at the extreme rear of the body is glued in and anchored with a triangle of ⅛" sheet balsa as shown.

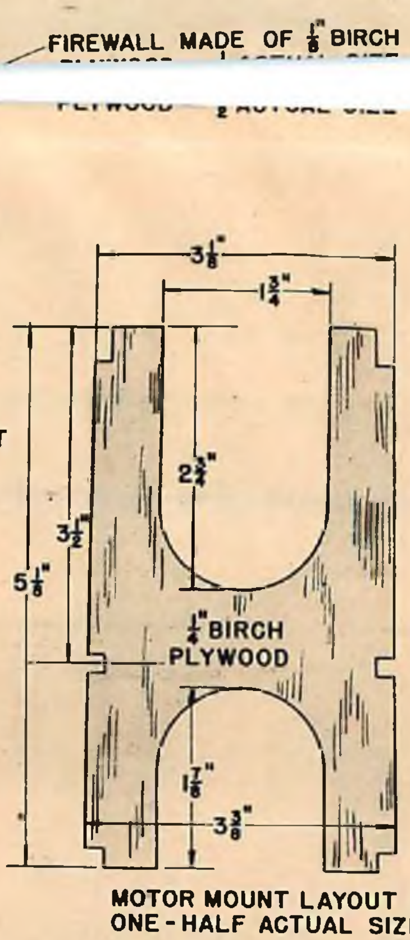
The landing gear may be made next as per drawing. After this is completed and the four fittings made, drill holes in the firewall and bolt landing gear to the same. *(Turn to page 43)*

Careful design and a high-lift wing section in harmony with the proper location of the center of gravity accounts for the Albatross' fine glide. Model has a 4-minute average for all contests entered. Takes Ohlsson 60, too.

The nose is simple to make, rugged, streamlined. Note hole for filling tank

And this shows how inverted Denny is installed. Note antispread chassis.

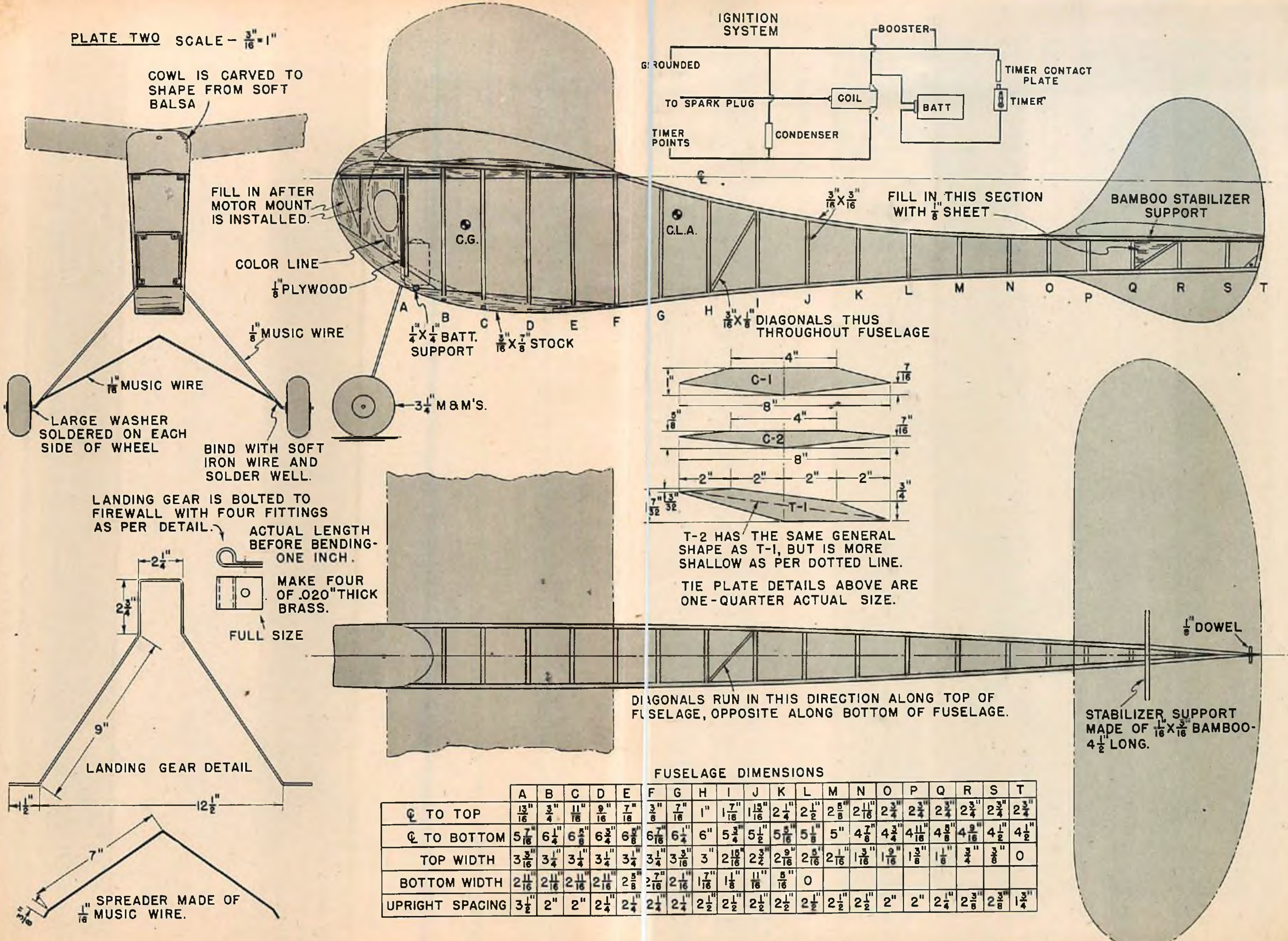




DRAWINGS BY GEORGE REICH - INKED BY PAUL PLECAN

— SPECIFICATIONS —

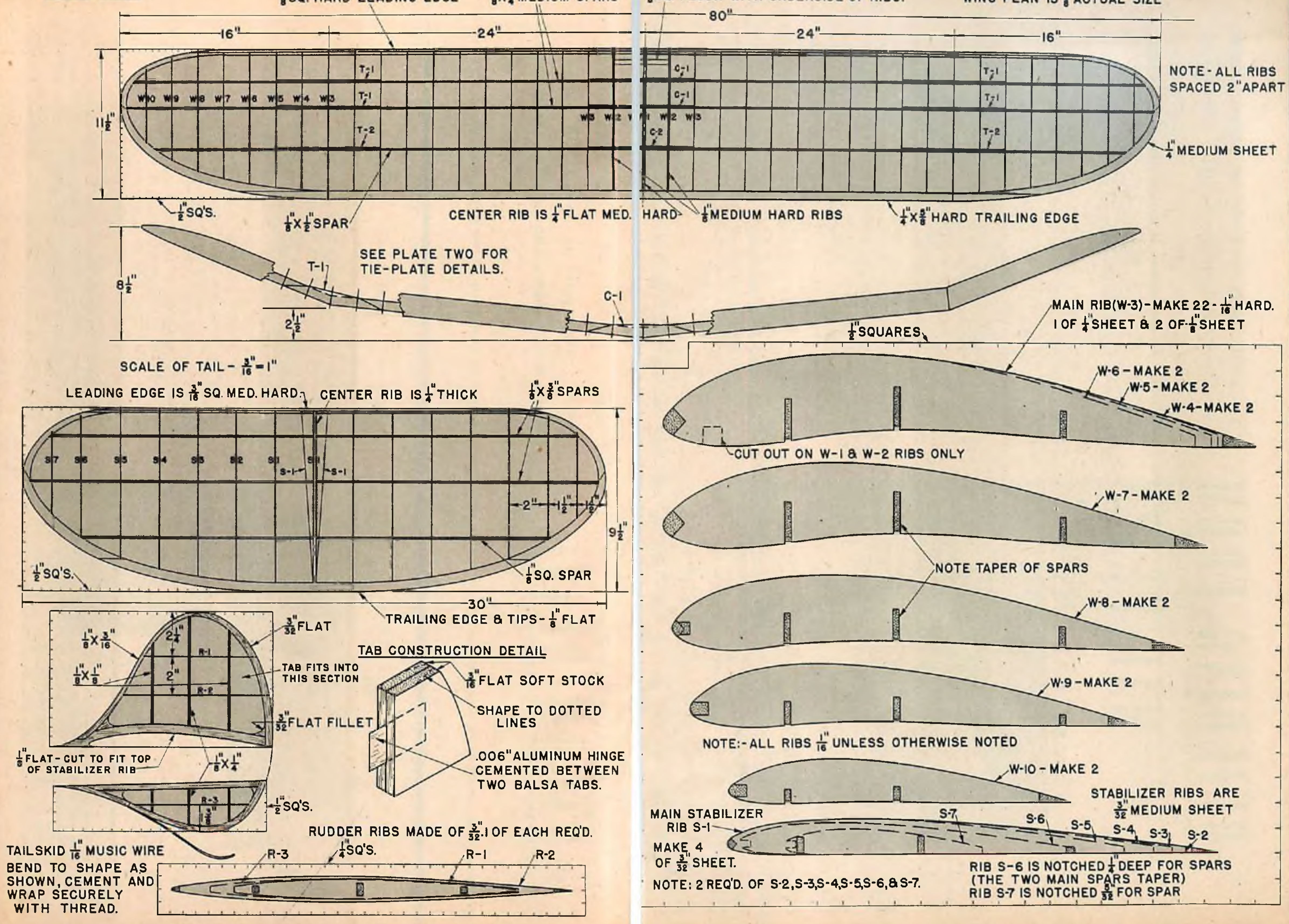
WING - 80 IN. SPAN X 11.5 IN. CHORD
WING AREA - 828 SQ. IN. OR 5.75 SQ. FT
BODY LENGTH - 47 INCHES
WEIGHT - 48 OZ. OR 3 POUNDS
WING LOADING - 8.35 OZ./SQ. FT.
POWER - DENNYMITE



FUSELAGE DIMENSIONS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
℄ TO TOP	13/16"	3/4"	11/16"	9/16"	7/16"	3/8"	7/16"	1"	1 7/16"	1 15/16"	2 1/4"	2 1/2"	2 5/8"	2 11/16"	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"	2 3/4"
℄ TO BOTTOM	5 7/16"	6 1/4"	6 5/8"	6 3/4"	6 5/8"	6 7/16"	6 1/4"	6"	5 3/4"	5 1/2"	5 5/16"	5 1/8"	5"	4 7/8"	4 3/4"	4 11/16"	4 5/8"	4 9/16"	4 1/2"	4 1/2"
TOP WIDTH	3 3/16"	3 1/4"	3 1/4"	3 1/4"	3 1/4"	3 1/4"	3 3/16"	3"	2 15/16"	2 3/4"	2 9/16"	2 5/16"	2 1/16"	1 3/16"	1 9/16"	1 3/8"	1 1/8"	3/4"	3/8"	0
BOTTOM WIDTH	2 11/16"	2 11/16"	2 11/16"	2 11/16"	2 5/8"	2 7/16"	2 1/16"	1 7/16"	1 1/8"	11/16"	5/16"	0								
UPRIGHT SPACING	3 1/2"	2"	2"	2 1/4"	2 1/4"	2 1/4"	2 1/4"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2 1/2"	2"	2"	2 1/4"	2 3/8"	2 3/8"	1 3/4"

PLATE THREE



3/8" SQ. HARD LEADING EDGE
1/8" X 3/4" MEDIUM SPARS
3/8" SQ. FLUSH WITH UNDERSIDE OF RIBS.
WING PLAN IS 1/8 ACTUAL SIZE
80"
16"
24"
24"
16"
NOTE - ALL RIBS SPACED 2" APART
11 1/2"
W10 W9 W8 W7 W6 W5 W4 W3
W3 W2 W1 W2 W3
T-1
T-2
C-1
C-2
1/4" MEDIUM SHEET
1/2" SQ'S.
1/8" X 1/2" SPAR
CENTER RIB IS 1/4" FLAT MED. HARD
1/8" MEDIUM HARD RIBS
1/4" X 5/8" HARD TRAILING EDGE
SEE PLATE TWO FOR TIE-PLATE DETAILS.
8 1/2"
2 1/2"
MAIN RIB (W-3) - MAKE 22 - 1/16" HARD. 1 OF 1/4" SHEET & 2 OF 1/8" SHEET
1/2" SQUARES
SCALE OF TAIL - 3/16" = 1"
LEADING EDGE IS 3/16" SQ. MED. HARD.
CENTER RIB IS 1/4" THICK
1/8" X 3/8" SPARS
S7 S6 S5 S4 S3 S2 S1 S1
S-1
2"
1 1/2"
9 1/2"
1/2" SQ'S.
1/8" SQ. SPAR
30"
TRAILING EDGE & TIPS - 1/8" FLAT
W-6 - MAKE 2
W-5 - MAKE 2
W-4 - MAKE 2
CUT OUT ON W-1 & W-2 RIBS ONLY
W-7 - MAKE 2
NOTE TAPER OF SPARS
W-8 - MAKE 2
W-9 - MAKE 2
NOTE:- ALL RIBS 1/16" UNLESS OTHERWISE NOTED
W-10 - MAKE 2
STABILIZER RIBS ARE 3/32" MEDIUM SHEET
MAIN STABILIZER RIB S-1
MAKE 4 OF 3/32" SHEET.
S-7 S-6 S-5 S-4 S-3 S-2
RIB S-6 IS NOTCHED 1/4" DEEP FOR SPARS (THE TWO MAIN SPARS TAPER)
RIB S-7 IS NOTCHED 3/32" FOR SPAR
NOTE: 2 REQ'D. OF S-2, S-3, S-4, S-5, S-6, & S-7.
3/32" FLAT
1/8" X 3/16"
2 1/4"
2"
R-1
R-2
R-3
1/8" X 1/8"
TAB FITS INTO THIS SECTION
3/32" FLAT FILLET
1/8" FLAT - CUT TO FIT TOP OF STABILIZER RIB
1/8" X 1/4"
1/2" SQ'S.
TAB CONSTRUCTION DETAIL
3/16" FLAT SOFT STOCK
SHAPE TO DOTTED LINES
.006" ALUMINUM HINGE CEMENTED BETWEEN TWO BALSA TABS.
RUDDER RIBS MADE OF 3/32". 1 OF EACH REQ'D.
1/4" SQ'S.
TAILSKID 1/16" MUSIC WIRE BEND TO SHAPE AS SHOWN, CEMENT AND WRAP SECURELY WITH THREAD.

BUILDING FROM MAG PLANS

It's really easy to scale up plans. Here are a few simple tricks to help. Try them.

BY CARROLL MOON

Gladiators are just one example of what many readers have done

THERE are any number of good reasons why competent builders forsake the drawing board and their own designs to build a ship from plans in Air Trails or other magazines.

First, the builder may simply like the ship presented. Second, he may be impressed with the record that the mag ship has made. Third, he may have an unused motor, plenty of material and no particular ideas other than to get a ship ready by the week end. Of course, he may be too darned lazy to "dream up" a ship of his own. It is even possible that he has no excuse whatsoever for building the ship from mag plans.

Magazines go to much pains to get a time-tested and thoroughly proven ship to grace the "build-it" pages. If possible they try to obtain a ship that has established a fine record in competition. They hire expert model draftsmen to do the finished plans (or simplify and "iron out" those submitted by the designer) and take pains to have the clearest, best and most descriptive photos accompany the article. If the finished product is a workmanlike job, the magazine will profit by its publication, and builders with much pride will refer to the ship as one published in such-and-such magazine.

Of course, there are builders who scorn magazine planes, preferring to be able to say, "It's my own design," to an enthusiastic group of admirers. Others may like the plane, but look askance at the task of scaling up the plans to full size from the scale drawings. This latter job has scared more builders from building a mag plane than all others.

To begin with, a majority of planes in magazines may be constructed *without* scaling the plans to full size, *(Turn to page 52)*

★ ★

STORM DEVIL

Dutch record-holding Wakefield compromises streamlining and ease of construction.

BY CUR MAC-LEAN

The author and the Storm Devil. The model outglides American designs, but has lower power.

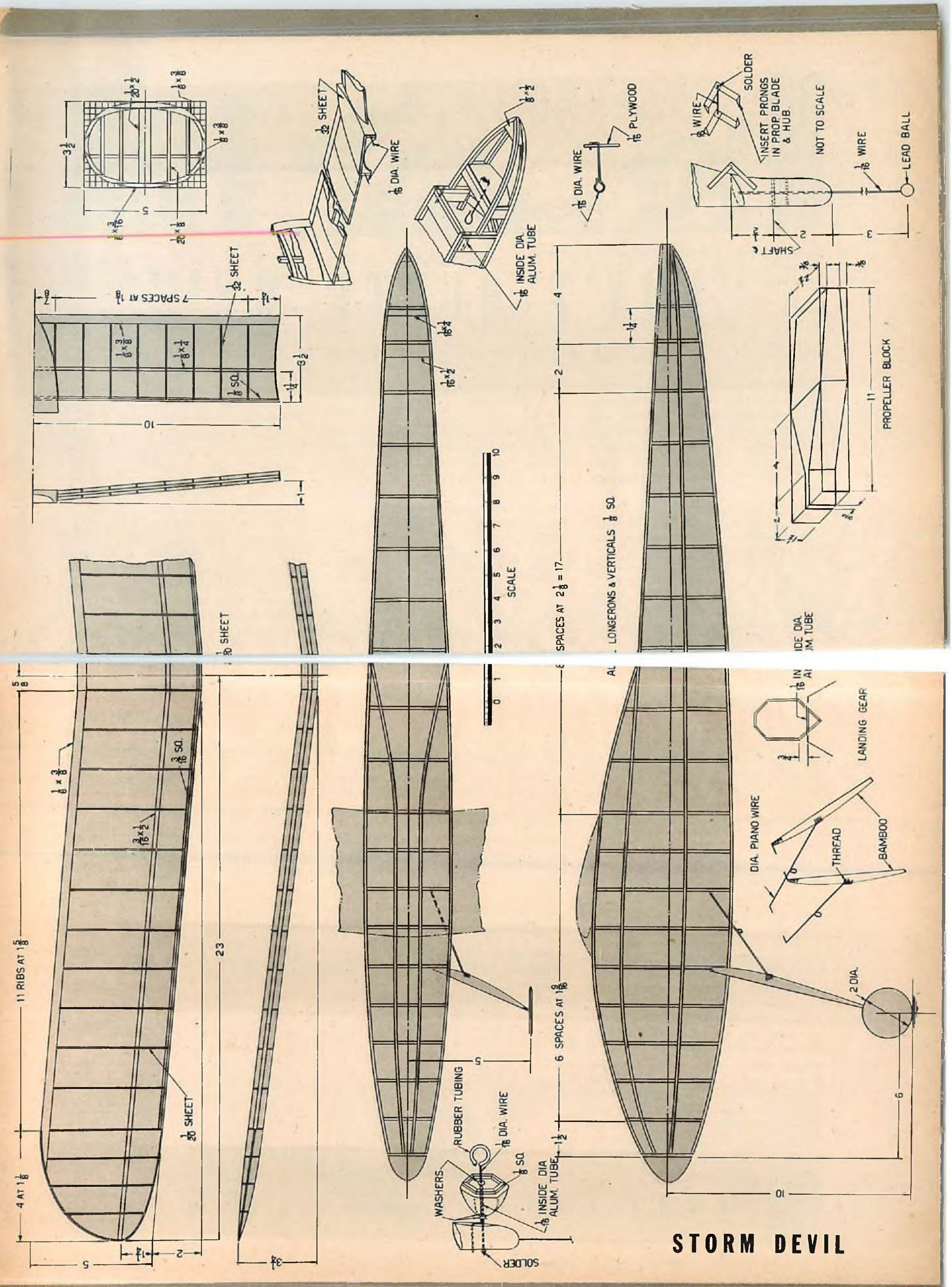
Author, shown in Dutch air force uniform, submitted Storm Devil before the invasion of Holland.

THE STORM DEVIL was designed as a contest model and Wakefield contender. It was built in the winter of 1938 and showed great promise when, on its first real flight, it flew 3½ minutes. During all that winter the Storm Devil averaged better than 2 minutes. It remained for the summer, however, to give the ship its real chance. On May 22, 1939, it flew to a new Dutch record of 10 minutes, 38 seconds.

As designer of the Storm Devil, and long engaged in Dutch modeling, let me introduce myself. I was afflicted with "modelitis" in 1933, and have had a pretty bad case of it. It started with the awful symptoms of a scale model which I entered in a contest and won. After that I began sliding downhill fast by winning in flying model contests. In 1936 I set the Dutch record with a flight of 1 minute, 27 seconds. I lost the record soon after, but regained it with a flight of 5 minutes, 31 seconds. It wasn't very long before someone took it again. However, in 1939 the Storm Devil recaptured it for me once more.

The model design is a compromise between streamlining and ease of building. A difficult and tedious oval fuselage is simplified to a six-sided box. The "Eiffel" 400 wing is mounted on a platform about one-third the overall distance aft of the nose. A device is used to keep the wing on an even keel on the narrow platform. Wire clips with hooks are cemented to the spars. These hooks fit into "eyes" on each side of the fuselage (see the sketch).

Numerous experiments showed that the single-bladed folding propeller was the most efficient for this airplane. The prop is turned by sixteen strands of ¼" flat rubber. *(Turn to page 49)*


STORM DEVIL
11 RIBS AT 1 5/8
4 AT 1 1/8
1/20 SHEET
3/16 SQ.
3/16 x 1/2
1/8 x 3/8
23
1/32 SHEET
7 SPACES AT 1 3/8
1/8 SQ.
1/16 DIA. WIRE
INSIDE DIA. ALUM. TUBE
PLYWOOD
SOLDER
INSERT PRONGS IN PROP. BLADE & HUB.
NOT TO SCALE
LEAD BALL
PROPELLER BLOCK
SCALE
SPACES AT 2 1/8 = 17
LONGERONS & VERTICALS 1/8 SQ.
LANDING GEAR
DIA. PIANO WIRE
THREAD
BAMBOO
2 DIA.
6 SPACES AT 9/16
RUBBER TUBING
WASHERS
1/16 DIA. WIRE
1/8 SQ.
1/8 INSIDE DIA ALUM. TUBE
SOLDER

"DON'T QUOTE ME!"

Unofficial news and talk of the trade as overheard in factory, field and store.

DUE to governmental regulation, miniature gas engines are prohibited entry into Canada. Energetic Frank Lucas of Ontario Model Aircraft is therefore busy at work on a new Canadian motor to be known as the Model Craft Premier. It will fall into the Class B category and will be ready sometime in May.

Ontario is also producing kits for airplanes of World War II ranging in size from 16 inches to 50 inches and in price from 15 cents to $1.50.

We hear that Comet Canadian is expanding its distribution facilities. Certainly looks like our cousins of the North (all eleven million of them) are going model aëronautical in a great big way!

T. (Ray) Arden, Atom designer, has been out of circulation for a long while. When he emerges from under cover you may be certain that something new will be brewing.

William L. Brown, formerly of Junior Motors Corp., will hit the market with a new gas engine shortly. Probably in B Class to start with.

Walter Hurleman is so busy with other work that his model gas engine and acaccessory line may be temporarily shelved.

Ideal Model & Supply Co. will introduce some twenty new models this spring. Among them two gas-model kits by Stephen Kawalick (now with Glenn Martin.)

Syncro Devices, who know the secret of mass production and have been one of the few firms to make deliveries when promised, will soon bring forth a Class C gas engine. It will sell under $15.

Paul Lindberg, who once before had a very small gas engine designed and advertised, has a pippin Class C engine to sell around $12. The original model has plenty of soup. Lindberg says that this time he will really get into production (beyond one sample).

Feeney Engines, whose tools and dies were destroyed in a fire, will resume production of the 10CC four-cycle engine radically redesigned and probably under new sponsorship.

H. & F. is supplying the trade with 2-inch and 2½-inch-diameter streamlined sponge wheels with wooden hubs to list at 40 cents. By the way, their kit of the Air Trails Rocketeer is proving as popular as the design was with our readers. A new Atom A kit has been scheduled.

The Model Industry Association is sponsoring two model shows—one during National Model Week, early in July, the other in February or March at an undetermined city. Showmen Pat Sweeney and Nat Polk head the committee. The M. I. A. has voted a fat appropriation toward the production of a movie film to be available to clubs and organizations at no cost with a view toward interesting more people in model building.

Jim Walker, of American Junior Aircraft, has positively perfected radio control to the extent he can chase birds with his model. When the manufacturer of the best ready-to-fly models achieves perfection in a new field it is only a matter of time before everyone will fly radio-control jobs. Republic's picture, "Petticoat Politics," features American Juniors U-Control.

At least one hundred model builders will make up the Texas Caravan in the trek to Chicago for the Nationals under leadership of Ed Bergdorff of Houston. What are the other forty-seven States going to do?

Bill Bibichkow, Comet technical chief, planed to the West coast recently.

Carl Goldberg is in the West on a lecture tour that proved so tremendously popular in the East last spring.

Junior Motors Corp., oldest and one of the biggest manufacturers in the gas-engine field, is going into the engine-accessory business on a large scale and will release a great many new items soon.

Richard Mair and Richard Watters (former sales manager of Cleveland Model Co.) are the Model Associates Corp. Selling direct to the trade only, they are featuring the Rocket (formerly Silver Bullet) improved gas engine and accessories.

Ritz Manufacture has put out a new line of ten propeller clocks.

The new Comet 35 will probably sell for $10 to $15 when it finally hits the market!

Berkeley Models are rushing their printers in order to be the first in '41 with a new gas-model catalog.

Herkimer Tool & Model Works announce the following new prices. The 49 is $15.50; Special, $15.50; De Luxe, $19.50 (Standard engine discontinued). The Twin is $40. What's this we hear about a new four-cylinder O. K. engine?

Bay Ridge Model Co., of Brooklyn, has two new Class B gas models in production and a new Class A Atom job on the board.

Capitol Model Aircraft Co. is now test-flying a Class A scale Taylor Cub gas model which will probably sell under $2.

Saw a swell book the other day. It was "Model Gasoline Engines—Their Operation and Use," by Raymond F. Yates, published by D. Appleton-Century Co., N. Y. C. ($2.50). We'll go on record as saying this is the best book on the subject we've seen. It treats model airplanes, radio control, race cars, boats. It is comprehensively illustrated with excellent drawings and photos. Don't miss it!

BY THE TRAVELING SALESMAN

Albatross

(Continued from page 36)

Countersink the nuts slightly on the back of firewall and cement. Then remove landing gear as the firewall and inside of nose are to be color-doped later on.

Make coil rack and battery box as shown on Plate I. The coil rack is cemented to bottom cross braces at Stations B and C and wrapped with thread. The coil is held onto the rack with rubber bands. The battery box is so constructed as to have the battery slide in rather snugly.

After the framework is complete, sand all over to take out any bumps and round all sharp corners. Apply another coat of cement to all joints at this time.

For the entire wiring system, use a well-insulated, oilproof, stranded wire such as used for high-tension leads. Do a good soldering job where wires are connected and wrap with tape.

See Plate I for a picture of the lower cowl. It is built up of $^5/_{16}$ x $^3/_4''$ soft balsa and of $^5/_{16}''$ square. The nose is used as a form when building this cowl. First notch the nose in three places as shown and then fit the $^5/_{16}''$ square strips in notches. Then in between these squares and the inside of the nose fit in the wider widths of $^5/_{16}''$ flat and cement. This cowl runs from the motor mount to the bottom of the firewall. After this portion has been filled in, then sand to the curve of the nose and remove cowl with the use of a razor blade. Finish cowl by making hole in the center for cooling. Make this hole big enough so all the fins of the motor will be exposed. To allow the warm air to escape, a louver of .006 aluminum is cemented to the lower end of cowl and a hole cut under the louver. Clear-dope the cowl, inside and out, and also the inside of the nose from the firewall forward.

Before covering the body, the sub-rudder should be cemented in its place. Its construction is the same as the rudder, which can also be built at this time. Start by making the outline out of $^1/_8''$ flat medium for leading edge and $^3/_{32}''$ flat for trailing edge. The base of rudder is cut out of $^1/_8''$ flat to shape shown. Next cut ribs of $^3/_{32}''$ flat and cut spars of medium grade to proper length. Then put ribs on spars and cement this unit between outline of rudder. While drying, the tab can be made according to the plan. After rudder framework has dried, shape leading and trailing edges and put in tab, the hinge of which is wrapped around and cemented to rear spar. After the sub-rudder has been sanded, glue in tail skid. Work can now be continued on the body.

The sub-rudder may be cemented in place and covering may begin. Covering material, of course, is left to the individual. However, if bamboo paper is used (this is recommended) use thick clear dope for applying it. If the color scheme of the original model is followed (dark-blue rudder and body with red wing, stabilizer and nose) use dark blue for body. After water-stretched and one coat of clear dope has been applied, sand lightly with fine sandpaper. Clear-dope once more and sand, then apply two coats of dark-blue pigmented dope. Don't use the dope too thick or you'll have trouble spreading it. Dope up to the color line as shown on Plate II. Forward of this line is doped red as is the motor mount and inside the nose. The entire bottom of the fuselage is colored red also.

The landing gear can now be bolted to the firewall and the motor installed. Put in about three degrees right thrust and no downthrust.

Now for the tail. Since the rudder framework is already made, we'll start on the stabilizer. Cut out the trailing edge and tips of $^1/_8''$ flat medium-hard. After this part of the outline is down on the plan, put in spars out of hard stock and cement in ribs over these spars. Now finish construction by cementing in the leading edge.

After framework has been sanded, cover with red bamboo tissue and water-stretch, apply two coats of clear dope, and two coats of red dope. Take care not to put on any more coats than just mentioned, as warpage is likely to occur.

Cover the rudder using same procedure as on the stabilizer, only use dark-blue tissue and dope. The rudder is cemented to stabilizer along the center stabilizer rib which is of $^1/_4''$ flat. Use plenty of cement and offset rudder a trifle for a right circle.

Start construction of the wing by cutting out all ribs as shown on Plate III. Next lay down the trailing edge and do the same with the tips. The spars are now cut to the proper length. The front spar will have to be blocked up $^3/_{16}''$, the center spar $^3/_8''$, and the rear spar $^3/_{16}''$ Now cement in the ribs and then the leading edge.

After thoroughly dry, cut at the center and put a $2^1/_2''$ block under each thirteenth rib, counting from the center. Then recement. In a similar manner the tip dihedral is put in. While this is being left to dry, make the reinforcement plates of $^1/_{16}''$ sheet basswood as detailed on Plate III. Use plenty of cement when cementing these in. Now the wing is sanded and covered with red bamboo tissue. Clear-dope and color-dope with two coats of each.

Put the wing in place on the body and proceed to make the top cowl. This is carved out of a 6 x $3^1/_2$ x $2^1/_2''$ soft block. On the 6 x $2^1/_2''$ plane, cut out the side view, then shape top and front. Cut a small hole for needle valve and then sand all over to a smooth finish, clear-dope, and red-color-dope.

FLYING

You've probably seen it happen time and time again—a new, never-before-flown model crashes on its initial flight. Reason—nine times out of ten it's the flier. He was too hasty, couldn't wait until he opened her up, or he didn't have the motor running properly, or didn't give the model a going-over before he flew it, or any one of a number of other things. Now this isn't mentioned to discourage anyone, but rather to remind the builder that the ship is the result of two or three weeks' work and should be handled in a sensible manner.

Before starting out for the flying field, wait for good weather. It's usually ideal after sundown. Check all surfaces for possible warps. If there are any, remove them with a little steam. Assemble the model by attaching the wing with about five feet of $^3/_{16}$" flat rubber, slightly lubed, divided into two separate loops. The tail is held in place with two separate loops of $^3/_{16}$" flat each about a five-inch loop. After all is assembled, glide the model. When doing this, don't run with the model for a quarter of a mile and then heave it, as the model will gain altitude, lose speed, stall and crash. The proper way is to grip the model below the c. g., along the lower part of the body, take one step forward and release the model, a little nose down, with sufficient force so the ship will travel at about its normal gliding speed. If the model stalls or dives, correct this by increasing or decreasing the wing incidence. The stabilizer angle should be 0 degree.

Now we're ready for a little power flight. First see that your rudder is offset a trifle to counteract torque and also to give it a right circle in the glide. Set the timer for about seven seconds and then get the motor running at about half throttle. Don't launch the model as soon as you get the motor running, but wait a half minute or so until it runs smooth and steady. Then with the same procedure as gliding, launch model (always against the direction of the wind). Notice two things: how it circles under power and how it circles in the glide. The ideal way to have the model fly is to have it climb spirally, to the left (with torque) at about a 60 to 65-degree angle, and glide opposite in a 150 to 200-foot circle. When adjusted this way the model will lose practically no altitude after the power quits. Of course, at half throttle the model won't climb in this manner. However, this can be attained by revving the motor a little more on succeeding flights and by changing the thrust setting. After the proper circle in the glide has been achieved by the use of the rudder tab, leave the setting alone and adjust the power part of the flight with right or left thrust only. If the model circles tighter and tighter with torque as flights proceed, then a little more right thrust is needed.

Take your time in adjusting the model. And it's advisable not to enter it in competition until you've flown it enough to really know it and know exactly what it will do. And after that you'll get a lot of satisfaction out of having a well-adjusted, good-flying gas job.

Sheet Metal Student

(Continued from page 21)

description of the drawing course will need some clarification. Actually, according to the definition of the word, this is not a pattern but merely a source of reference in laying out the project upon the metal—real metal.

I hope now you are ready for the main course, because here it comes. I've termed this the main course because Luscombe places more emphasis upon this important phase than upon any other. "Precision layout" is just what the name implies. However, before attempting this work, I must possess a knowledge of a comparatively simple yet highly important subject known as "bend allowance." By way of explanation: any metal in bending over a definite, predetermined radius and depending upon the thickness and type of metal used, will require an allowance of the material to form the bend. So, taking these various factors into consideration and by the use of a mathematical formula, I am able to compute the allowance for all the necessary bend in my piece. Another important factor in precision layout, which must be taken into consideration before proceeding, is the "grain flow" of the material I am using. This grain flow in metal is easily perceptible to the practiced eye. In bending metal, as in bending wood, the direction of the grain plays a very important part in the strength and life of the finished article. Wrong direction of bend may easily be the cause for failure of an important fitting while in use.

Well, it all looks very nice to me on paper, so now I'll try it on metal. I've coated the surface of the metal with a thin film of layout blue, and now with the few required tools which include a six-inch rule, pair of dividers, scriber, magnifying glass (I said precision), hammer and center punch, I'm ready to start. Any right angle or perpendiculars must be constructed, inasmuch as no such things as triangles are permitted. All dimensions are measured with the dividers from one reference line usually, and in the case of symmetrical layout, the center lines. This assures much greater accuracy and at the same time reduces the possibilities of my making a mistake. Having completed the flat layout, I give all dimensions a final check and center-punch the necessary holes before cutting out my piece. After drilling the holes and cutting out the piece, I am ready to make the bends required to form the finished fitting. So, by securing a bending block with an edge having the correct radius, I perform the final operation. Now comes the rub. My fitting must be checked upon a surface plate and all measurements must come within one-sixty-fourth of an inch of original blueprint dimensions.

During this time, to get back again to the theoretical flavor, I have been sampling a bit of knowledge on the types and uses of the many aluminum alloys and steels found in modern aircraft. This also includes the various processes, such as heat treatment, annealing, anodizing, cold-working, et cetera, related to these respective metals. Can you distinguish the difference between an A17ST and a 17S rivet? Or perhaps you thought all aircraft rivets were the same. Frankly, I must admit I did before coming to Luscombe.

Now that I've mentioned the word rivet I may as well dish up the last course of my shop work. That's right, it's riveting. Before I can do any riveting I must drill the holes in which to place the rivets. To drill the holes, I must learn the proper use of both electric and pneumatic drills. Therefore, I secure two suitable pieces of either Dural or Alclad and proceed to mark off, with a lead pencil, half-inch squares upon the surface of one piece. Placing the two sheets together and fastening them upon a board of soft-grained wood, I'm ready to start drilling. No center punching is done as this represents a considerable waste of time and I must learn accurately to hit the intersection of the lines by a hand spinning of the drill chuck preparatory to boring through. Thus the "punching" and drilling are done in one operation.

Naturally, I must form as straight a line as possible so that when the rivets are placed in the holes they will bear semblance to a line of well-trained soldiers at attention. Having completed drilling, I remove all chips and burrs from the surface to assure a good fit and a solid seat for the rivets to follow. Usually two fellows work together on the riveting, one "hitting" and the other "bucking." So is made my first completed project, the riveting dolly. The bucker, being the boss of the team, gives all orders such as "set" and "hit." In riveting it is very essential that an equalized pressure be exerted by both hitter and bucker. Unequalized pressure results in a definite and perceptible bulge of the "skin."

Throughout the entire course I had lectures dealing with the proper sharpening of drills, use of reamers and counterbores, taps and dies, welding, brazing, cable splicing and reading of army-navy specifications.

To mention another project I was required to complete, I might add the making of a universal link joint. The main intention here being to learn the proper use of machine reamers and to work within tolerances of several thousandths of an inch.

Not to forget my previously made drill gauge, I had to sharpen drills correctly, check them, and receive a mark for my ability. Try sharpening a drill sometime and see how long it takes you to do it right!

Any attempt to describe in detail all the subjects covered would be a Herculean (that's not my name) task, and like all good things they should be seen to be appreciated. I hope that from the more important subjects mentioned and stressed you can gather some idea as to what makes up a typical spread at Luscombe. This is one table at which overeating has no sad results, and as a closing tribute to the head "chef," Dick Rude, I wish you could sample his cooking.

Right now I'm famished, so let's call this thing off for dinner.

Model Matters

(Continued from page 27)

up interest, yet the boys log as many hours as the most rabid contest fliers. Last summer and fall they spent practically every evening on the airport at Indiantown Gap military reservation. Without any publicity they attracted crowds of spectators who gathered spontaneously just as soon as the boys reached the field. As many as several hundred, complete with soft-drink venders, would gather during an evening. Flying didn't necessarily end with daylight, as many of the models were wired for lights.

Alliance (Ohio) Flying Screwballs went to the Nationals last year in two Model T Fords with coffinlike boxes on top. These boxes were intended for the models, but after their punk showing at the meet the Screwballs felt like crawling into the coffins themselves and hiding. But since that time the club has grown in membership (thirty-two) and flying ability. In 1941 they hope to justify the slogan on their club stationery—"Watch for Alliance Among the Winners." Secretary Lyle would like to contact other clubs. His address is 611 South Union Avenue, Alliance, Ohio.

Another Ohio club is the Marion Gas Model Plane Club sponsored by the Elks Lodge, which supplies a clubroom and financial support. A local newspaper and radio station have given publicity and several adjoining towns have formed member clubs. The forty-six club members are 100 percent A. M. A. Headquarters is in the Elks Temple, South State Street, Marion.

Wisconsin State Model Airplane Conference held late in December in Milwaukee went on record favoring a later date for the national contest. One month later would give them better flying weather for the preliminary elimination contests held prior to the national meet. Forty-one delegates from all parts of the State covered a half dozen troublesome points in model work. Morning session carried right through lunch—even food failed to take their minds off the topics. But they stopped talking long enough during midafternoon to take a swim in the Y. M. C. A. pool. Discussions were resumed enthusiastically after this workout. Let's keep this in mind when the A. M. A. meets again. Those meetings go on for hours and slap-happy modelers begin talking in their sleep.

Wisconsin is still mindful of its stand last year on the industry's place in the Academy. They feel that industry members have a definite place in the A. M. A. operation, but rules should not be established, maintained, or changed by their direct vote. If such is the case the A. M. A. can be assured of Wisconsin's loyal support in all its activities.

Sam Hall (ex-Cleveland Balsa Butcher) is working in the service engineering department of the Glenn L. Martin Co. in Baltimore, Md. . . . Leslie Adams, who did some big-time model flying a few contests ago, is in Orlando, Fla., with the Monocoupe Airplane & Engine Co. Monocoupe will send you a full-size plan for a fifty-inch flying model. There's no charge; just send request to Monocoupe, 444 Madison Avenue, New York City. . . . Paul Plecan is drafting for Simmonds Aerocessories Co. in New York City. Many of Paul's well-done model drawings have appeared in this department. . . . Indoor expert Lawrence Smithline recently rounded out two and one half years at the Martin company when he took a new job in New York City doing stress work on a plastic composition trainer.

John T. Dilly of Galt, Ontario, is working for the British government installing and putting into operation a tracer-bullet factory in Toronto. This sort of work is old stuff to John, who was doing it long before the outbreak of the war. . . . Ted Booth, old-time Canadian model flier, editor, and organizer is in the Royal Canadian Air Force. . . . Don't forget that through the A. M. A. you can save fifty cents on a subscription to this, your favorite aviation magazine. . . . Fred J. Hoffer, 7146 Apple Street—6, Pittsburgh, Pa., has been relieved of his Ohlsson "23," No. 7685. He'd like to have it returned. Have you seen it? . . . Don't feel bad, Jimmy Cahill; Frank Zaic is getting chubbier and chubbier these days, too. But he's planning to write a new model yearbook. He'll need the extra pounds before he's finished with it.

Louis J. Mass, Jr., secretary of the Tri-City Gas Model Club (Davenport, Ia., Rock Island and Moline, Ill.) clears up a hazy idea we Easterners had about Midwest flying. Tri-City builders are as good as any in the country. Four of the seven entered in the Nationals won high places. Contests in this area are tough as they come, yet T. C. G. M. C. members have the reputation of always taking the major awards. Flying fields in this area are hard to find. (January Air Trails, page 63, erred in making a contrary statement.) Corn fields are numerous and deadly. If chasing a model leads you to a corn field, you can't go into it because the tall corn soon blots out everything. The best way is to spot the model's approximate landing spot from an open field and get twenty or more fellows for a systematic cross-hatching of the entire field—but then you might easily be looking in the wrong field. Or you still might pass within a few feet of it and never see it. The unhappy boys who get thermal flights sometimes keep them in sight by fast driving. Usually the models get away. The boys are hoping to do '41 flying on the site of the 1940 National Cornhusking Contest. It's the flattest spot in the area and roads radiate from it in all directions.

But Iowa weather isn't all thermal weather by a long shot. During the club's invitation meet in Davenport last August the weather was rainy and windy. The motor run on the fast climbers was enough to carry them out of sight into the clouds hanging low over the field.

Detroit news comes via Jim Bohash, whose model interest has been revived after a temporary lull during which he devoted most of his energy to his job with General Motors. But he's back in the saddle again and getting ready for the '41 Nationals. Jim reports that Steve Corbett (department of recreation model airplane director) continues to carry out an interesting model program that attracts over 400 builders throughout the city. Detroit's winning the 1940 national championship club trophy proves his methods are getting results. Frank Kiewicz is working for Holley Carburetor Co. in Detroit. . . . Ed Naudzius is majoring in aëro engineering at the University of Detroit. . . . George Sass, 1940 national champion, is studying at thé Cass Technical School. . . . Photographer Walter Farynk (co-editor of "National Model Meet in Pictures") has settled down in Detroit with his new wife, Amelia Bohash (Jim's sister).

A cartoon in the January, 1941, (English) *Aero-Modeler* carried a chuckle. It showed a model builder working on his contest job. An enemy air raid is blasting the house away, but the builder is in the midst of the flying debris gluing sticks to gether.

Following the West Virginia State Indoor Championship Meet held in Morgantown, W. Va., Jan. 12th, the officials of this State conferred with the western Pennsylvania officials on a policy and contest dates for the 1941 season. Both State A. M. A. Directors Hopkins of West Virginia and Vogler of Pennsylvania agreed that the hobby would greatly benefit from a centrally located school designed to train club and contest advisers.

Organization of model work in Virginia received a nice boost with the establishment of a permanent office for the Virginia State contest director, Rutledge Fuller, in the Central Y. M. C. A., Norfolk, Va. This office is intended as a clearing house for State activity, and model clubs throughout the State are urged to contact this office. Beginning in January this office publishes a monthly bulletin of State news.

A radio-control job is nearing completion in Lynchburg. Charles Sumpter and Casey Casbiere are the builders. This is practically ready for tests at the city's new airport. There's been much high-flying talk about various r. c. models, but it looks as though this will be the first successful effort in radio control in the State.

NATIONAL MEET. The Fourteenth National Model Airplane Championship Meet will be held in Chicago July 1st through 5th under the sponsorship of the Chicago Park District and the Chicago *Times* and sanctioned by the Academy of Model Aeronautics. Contest schedule will be as follows:

July 1st, Tuesday—Registration, probably at the Hotel Sherman, contest headquarters.

July 2nd, Wednesday—Indoor events and record trials at International Amphitheater.

July 3rd, Thursday—Outdoor rubber events, including flying scale models and Moffett eliminations.

Photo Credit List

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

Page 12—Harwood photos.

Page 13—TopL., International; TopR., Official photo U. S. army air corps; Bot.R., Vultee photo; Bot.L., International.

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Page 22—Photos by the author.

Page 23—Fletcher—Pic photo.

Page 24—Top, Hans Groenhoff; Bot.L., West & Associates; Bot.R., Todd Brown.

Page 27—Three top by Kulick.

Page 28—Wide World.

Page 34-35—Rudy Arnold.

Page 38—Al Daraghy.

Page 39—Al Daraghy.

Page 40—Top, Kulick.

July 4th, Friday—Gas models, Classes A and B.

July 5th, Saturday—Gas models, Class C and Moffett finals.

The radio-control model committee of the A. M. A. will be in charge of that event again and it is expected such craft will be flown on any and all days of the meet. There will be an event for "best-finished" model which will be conducted at the headquarters hotel, since it will not be required that these models must fly. All types of entries are eligible for this award—solid and flying scale craft, rubber and gas-powered ships.

Models entered in the flying scale event will be "processed" and judged the evening of July 2nd, so such painstaking examinations as the judges give the craft will be undertaken unhurriedly and in the cool of the evening. It is expected new flying scale model regulations brought forth by the A. M. A. flying scale model committee will emphasize scale more than previously and put not quite so much importance on flight durations.

The meet champion will be selected regardless of age, and in the awarding of points for that honor, flight times in each event will be put together regardless of age classification. It is further planned to distribute no merchandise awards at the meet, since it is felt such awards do not give fair representation to the donor or recipient. An auxiliary processing station for outdoor models will be established at the headquarters hotel, so fuselage cross sections and wing areas can be measured the evening before to facilitate rapid processing on the day of the event. In conjunction with the meet, the Model Industry Association will sponsor a trade show for model materials and related hobby products in the exposition building of the Sherman.

The Academy of Model Aeronautics will hold its annual meeting on Sunday morning, July 6th, making it unnecessary for A. M. A. members to stay an extra night in Chicago.

During the national meet the Academy's contest and resolutions committees will convene to listen to proposals for changes in regulations or other suggestions. Improved camping facilities are to be arranged for by the Chicago Park District and the usual low hotel rates will apply for contestants and helpers.

The management personnel of the Fourteenth A. M. A.-N. A. A. sanctioned national competition is as follows: Meet chairman, Albert L. Lewis, A. M. A.; meet manager, S. J. Meuris, Chicago Parks; contest director, J. J. Rappold, Chicago Parks; field judge, Bruno Marchi, A. M. A.; publicity chairman, Maurice Roddy, Chicago *Times;* committee on arrangements, D. K. Penny, Chicago Parks; Russ Stewart, Chicago *Times;* Maurice Roddy, Chicago *Times;* S. J. Meuris, Chicago Parks.

All entrants in the competition are scheduled to receive a program of events at no charge, also an official sporting aviation arm band which they will wear during the meet and which will become their personal property. Plans are under way for an informal reception to be tendered all

Academy leader members; it is expected that the Model Industry Association will provide special welcoming festivities for members of the model trade. An elaborate entertainment schedule is being worked out by the committee on arrangements so contestants at the Fourteenth National Meet shall have a bigger and better time than ever before.

All the traditional trophies of the Academy will be up for competition as well as scores of new awards and prizes. Suggestions have been advanced for the meet sponsors to award handsome certificates of merit to prize winners who receive traditional trophies which they may retain for only a year.

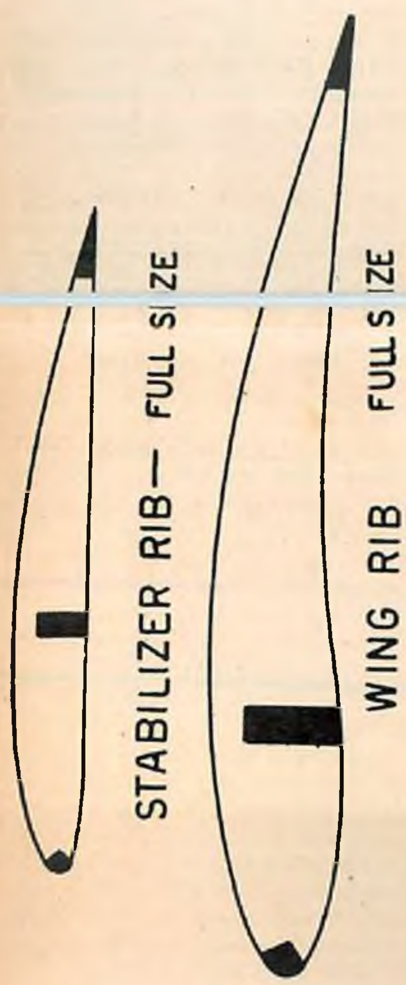
All in all, the meet promises to be a most exciting and interesting one and total registration will probably exceed 1,200. Application blanks and rules may be obtained from the Academy of Model Aeronautics, Willard Hotel, Washington, D. C. Send ten cents in stamps with your request for information and entry blanks for the 1941 National Model Airplane Championship Meet.

Storm Devil

(Continued from page 40)

The tail surfaces are easily removed from the fuselage. The dihedral tail and twin fins give the model much additional stability. The landing gear is also removable. In fact, the model breaks down into six pieces and makes only a very small box necessary for packing.

The author built an outstanding American design in order to compare his model with American ones. This American job showed a faster climb (as is usually the case), but the glide of the Storm Devil was far superior and consequently turned in longer average flights.



CONSTRUCTION

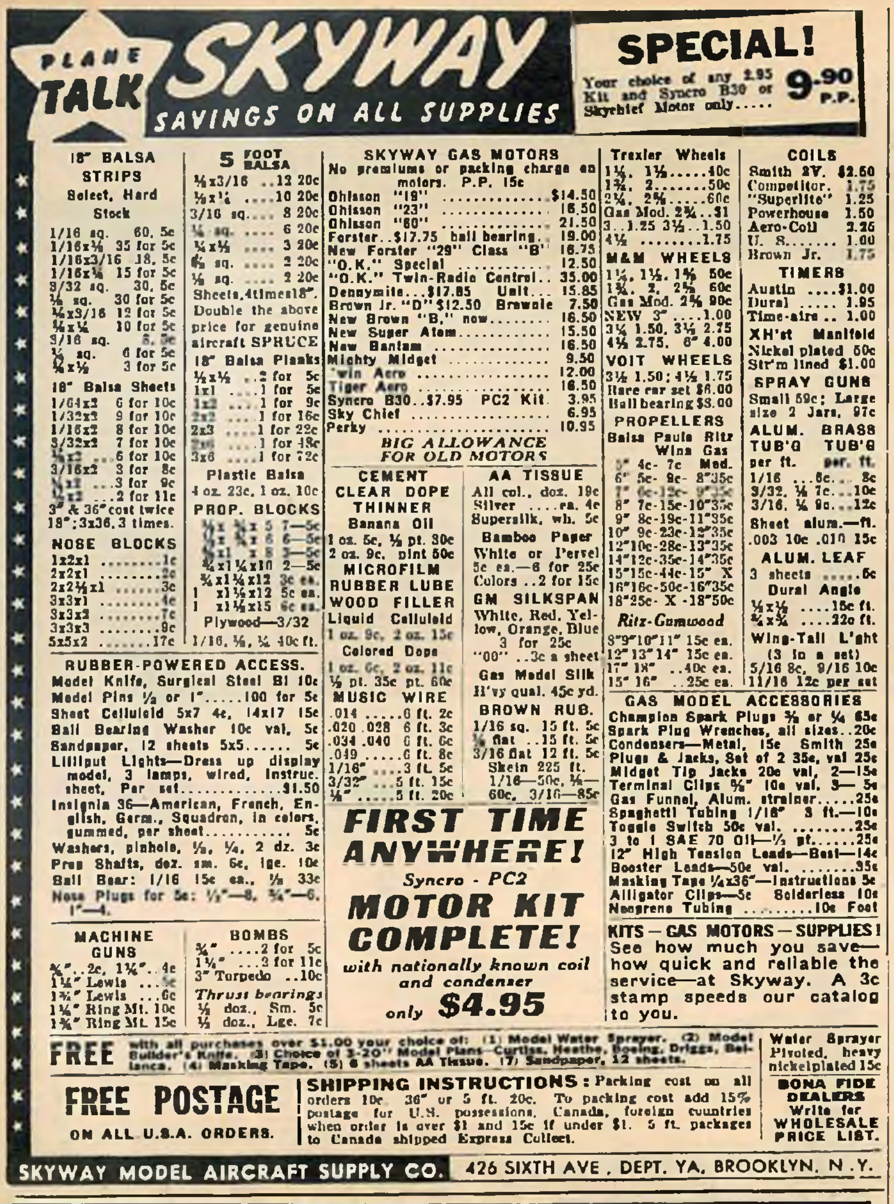
The fuselage is made by first building up an ordinary square fuselage to the dimensions shown on the plans. The upper and lower longerons and "platform" for the wing are then built up on the square skeleton. After the fuselage is completely built up, the horizontal cross braces are removed. Make the nose plug before covering the fuselage in order to fit it properly. The plug is held in place in flight by having a snug fit.

The wing is built in the ordinary manner. The full-size wing section is provided in the plans. After the wing is covered, cement to the spar the wire "wing stabilizers" made according to the sketch. Note that these clips only serve to keep the wing on an even keel. Rubber, wound around the wing and fuselage in the ordinary manner, keeps it on. The tail surfaces are also built in the usual manner. The purpose of the two wire prongs in the forward portion of the tail is to keep the surface from sliding about. Rubber is also wound around the surfaces as on the wing.

FLYING

The model is powered by sixteen strands of ¼" flat rubber. It should be adjusted to fly in right-hand circles of about twenty yards in diameter. The glide should be about 20 to 1 and also to the right. Ordinary flying requires about 950 turns, but for contest results make your motor forty-eight inches long and use 1100 turns.

WING ATTACHMENT TO FUSELAGE



Wilderness Castaways

(Continued from page 22)

makes for a four to six-week halt in air services both in spring and late autumn when the water is either not open enough for pontoons or the ice not thick enough for skis.

There was a plane forced down north of Sioux Lookout, in northwestern Ontario. It was in between seasons, but this is a heavily traveled air region with many gold mines some hundreds of miles north of the railway. Engine failure forced the pilot down. His pontoons hit the thinly formed ice, cracked through. But the wings held the plane above the ice, and the ice was strong enough for the men to clamber out on and reach shore. They knew that it would be only hours till their absence was noted, that rescue would be soon. So they made signal fires, gathered many branches near shore, and when the first planes were heard were ready to make signs with the branches out on the ice telling they were safe and that the ice was thin. The plane brought them blankets and food, dropped by parachute. They were comfortable for a night. They made their way overland to another small lake, found the ice harder here, and their rescue plane finally came down on skis to pick them up.

In a somewhat similar predicament another couple of airmen, forced down near an Indian camp, with the help of Indians in canoes broke a channel through the newly formed ice, and were able to take off with their pontoon-equipped ship.

There are not many airliners flying in Canada's northland. Most planes can carry five or six people. But there are a few which can take more. One of these flying north of Lake Superior south from one of the mining camps, had seven passengers and a crew of three on board, when it was forced down as early darkness made flying unsafe. The pilot brought the ship as close to shore as possible. The men were able to wade to shore, make camp. They had little food on board, not expecting such a forced landing. There was one girl in the party. She slept in the plane, the men in two sleeping bags on shore, while three kept fires going. The next day the weather was bad, and the pilot decided to wait out the storm. It would be difficult enough to take off from this small lake. Again the sleeping arrangement was the same, and there was less food. All that was on board was some hard tack and fruit. On the third day the plane took off, made its base, and the passengers had their first good meal in three days.

The Canadian bush flier has to heat his engine in winter with a portable blow torch or kerosene stove. They build special nose hangars for their planes and keep the portable stove running all night to keep the engine warmed up in temperatures that often go down to sixty below zero and are normal at thirty below zero. They often have to make repairs to their planes in that weather. They do not dress in uniforms, but, winter and summer, in heavy checked shirts and riding breeches. In winter they wear Eskimo fur parkas, Eskimo sealskin hip-high boots called mukluks and fur hoods. Their trips are heaviest in winter when planes are the only method of travel in that vast territory north of the railway.

Part of a Canadian plane's load is the list of essentials which every plane is supposed to carry. Many do not do so on short flights. But planes which take off from the end of steel for the sub-Arctic and Arctic Circle territory are always equipped with eiderdown sleeping bags, a tent, axes, rifles, cooking utensils, a first-aid kit, food in the form of canned soups, chocolate bars, flour, bacon, tea, rolled oats, sugar, powdered milk, tinned butter, hard tack and matches. Always there are spare parts carried, and sometimes even whole sectional canoes.

One of the strangest accidents to maroon an airman and his two passengers in the north Ontario woods happened not long ago to Pilot Vic Sauve. He was flying out to a camp when his propeller flew off. He was up about 5,000 feet at the time. In the distance below was a small lake. Sauve shut off his motor, began plunging down. The fabric of one wing ripped, where the propeller had hit the wing as it broke off. The wing began to wabble. Sauve found the ship harder to handle every second. After all, this was no glider, but a Northern freighter. With all the skill of his many years of bush flying he kept the ship from plunging head-on down. The trees were approaching at lightning speed. In a minute they would hit them. The wing still held. The lake was not far away. How they glanced over the trees to plunge into the lake, Sauve never knew. But he made it. He and his passengers spent a few nights in the bush, found some game, and burned signal fires. They were found, but their safe landing was a miracle.

In the wilds of northern Quebec near the Labrador boundary, a practically unexplored area, a pilot and two prospectors were forced down. Rescue planes went out within two weeks of their take-off when they should have been back. Week on week the hunt was continued. Winter came and it had to be given up. The men had not yet been found. Last summer, airmen going into the region accidentally spotted what looked like a plane on a small unmapped lake below. The airmen came down, investigated. It was the missing plane, in good condition. In the plane was a note. The bodies of the three men were found not far away. The official report on the fatality issued at Ottawa remarked on how carefully the pilot had stowed his plane away so that it was only accidental that it was discovered at all, instead of placing it out in the open so all planes could see it, and wondered why the radio transmitter on board had not been inspected before the pilot had left on his flight. With it he might have saved his own life and that of his passengers.

Air Adventurers

(Continued from page 25)

We want to thank George Micari of Sag Harbor, L. I., for his Christmas card. A new member is Ronald H. Enoch of 338 West Middle St., Gettysburg, Pa., who is interested in aircraft photographs and would like to contact other members on the subject.

In the December, 1940, issue we had an article on the training course at Chanute Field. Since then we have had dozens of letters from our Air Adventurers asking for "more information" on the subject. In that article we gave all we believed was necessary, and presumed that if our members wanted more information they would make an inquiry to the Commanding Officer, Chanute Field. You can all save much time by going direct to headquarters in all matters of this kind. Either that or make your request for more information to your local recruiting sergeant. Chanute Field is at Rantoul, Ill.

J. L. Campbell of Memphis, Tenn., has passed his Engine Mechanic's examination. David Katsonis of Upper Darby, Pa., has also passed his engine test. Joseph McCaustlin of 44 Murray St., St. John, New Brunswick, Canada, would like to get in touch with Air Adventurers to talk over aviation matters and swap ideas.

A very fine group of pictures came in from Walter Bolling of Hammond, La., which were taken at the New Orleans airport. Harold Murray of Bridgeport, Conn., has passed his Flight Lieutenant's examination. Ted Fredstrom of Cincinnati, Ohio, has sent in a successful paper on his Engine Mechanic's examination.

Jim Phillips of Errington, Vancouver, B. C., has sent in two particularly interesting drawings of airports he would like to see built. For them he gets a Topographer's award. His drawing includes details of the runways, the arrangements of the buildings and hangars and a suggested improvement for radio beam signals, searchlights, floodlights and many special safety devices. This is the sort of thing we like to get now and then, because it shows real interest in the business, and Jim's drawings were carefully done and carefully lettered. We'd like to see more ideas of this kind. Who knows, we may yet discover the ideal airport!

Probably the best drawing ever to come in from an Air Adventurer is that sent in by Bernard Kloehn of Milwaukee, Wis., who has really done a job on the Milwaukee County Airport. He reports: "The national guard is going to establish a base at the western end of the field. The Milwaukee County Airport has received W. P. A. funds and the runways are going to be extended to 4,000 feet. The City of Milwaukee has announced its willingness to donate land for a government research laboratory which will cost about $8,000,000."

Among other Air Adventurers who have passed tests are Fred Schkoda of Brooklyn who has successfully negotiated his Photographer, Engine Mechanic and Airplane Mechanic tests. Bobby Weeks of Birmingham, Ala., passed his Flight Lieutenant's examination with flying colors. Frank Campo of New York City is a new Flight Lieutenant. Leon Landman of Roxbury, Mass., has completed his Engine Mechanic's test. Albert Harding of Clarkston, Wash., is a new Engine Mechanic.

We have a lot of new Photographers as usual and some very fine prints have been offered. Jean Myers of Pitcairn, Pa., was down at the new Washington, D. C., airport and managed to get a nice shot of an Eastern Airlines DC-3 all ready for the take-off. Jean uses Kodak Verichrome in a Baby Brownie. Robert Walser of Syracuse, N. Y., sends in a Curtiss P-40 taken recently at the Syracuse Municipal Airport with a Kodak Bantam. Arthur Blechman of Mount Vernon, N. Y., has sent in a shot of his scale model Grumman F2F which has been cleverly photographed against a background of snow which creates the illusion of clouds. Robert Kroejeck of Detroit sends in a film of a shot he made at his local airport of a Pennsylvania Central Airlines DC-3. He used an Agfa 8A Cadet camera.

George Petrlik of Chicago sends in a shot of his Zipper Jr., rubber-powered model taking off. He tells us, too, that he is planning to build a gas model. Charles Peters sends in a picture of a four-engined Douglas Stratoliner probably taken at Kansas City. Ray Purdue of Rocky Mount, Va., sends in two shots of a Waco taken down his way, but unfortunately they are not clear enough for publication. James C. Williams of Easley, S. C., has photographed his Bellanca Skyrocket in flight and has won his Photographer's award for the effort.

Building From Mag Plans

(Continued from page 40)

believe it or not. Our first experience with this type of building came when we started construction on the Buzzard Bombshell, Joe Konefes' swell ship which took first in Class C at the Nationals.

If you will refer to the plans of the ship, in the October issue of Air Trails, we can easily outline the steps necessary in this type of construction. The side of the fuselage, shown at the left on Page 38, gives the dimensions very clearly. Simply cut out the side panels from 1/8" balsa sheet. Then mark on these sides at proper intervals (the measurements are given) the positions of the various formers. The instructions then tell the builder to cement upright pieces to these sides. To obtain absolutely accurate results, the panels may be laid flat on a table top with the straight sides touching. In this way one may check to make sure they are similar. After the pieces are in, it is a simple matter to insert the formers, cement them in place, then lo! the fuselage is almost done. The rest is simple construction, and notice—no plans have been used. Building the wing is a simple matter of measurement. The cut-out tips should be compared to be sure they are similar before cementing in place. The same applies to the tail section, but see how easy it is? Lookee—no plans and it flies.

Following the same system of construction—measurement and careful study of the drawings—we have just finished construction of the Arrow, which was published in the December issue of Air Trails. After cutting the formers, the rest was easy and the finished product was true and an excellent replica of the original—even in flight.

For ease of work in scaling plans, a builder should obtain a chart of decimal equivalents. For example, we recently constructed a miniature Buzzard Bombshell which was 70 percent the size of the original ship, and was powered by an Ohlsson 23—later by a Bantam. Several problems calling for the use of a decimal chart confronted us in this work. Take the lateral dimension from the front of the fuselage to Station 2, given in the plans as 4 1/16". Unless one is a mathematician, it is almost impossible to multiply the fraction by 70, but the decimal equivalent, 4.0625, is easily figured giving 2.843, which, in fractional terms, is shown on the chart as 2 and 27/32, or if one prefers to eliminate the 32nds, is 2 7/8". The chart of equivalents may be readily obtained in most stationery stores, and is often distributed free of charge by hardware concerns.

If the builder cuts formers, as given in magazine ships, valuable aids in the cutting are a sheet of carbon paper and plenty of thin cardboard. Such cardboard as found in office file folders, which is about the thickness of a playing card, is best. However, many builders "beg" old posters from motion-picture houses and find this cardboard ideal. The process is simple. The formers are traced with carbon paper on the cardboard, and the pattern is cut from the cardboard. The pattern is then placed over the wood, a pencil traces the outline on the balsa, and a razor blade does the rest. Of course in cutting formers all like parts, such as wing ribs, wing tips, et cetera, should be similar, and if they're not after the first cut, should be sanded to the same outline.

Remember one thing in building from magazine plans. When making little changes (often called modifications by builders) be sure you do not weaken the construction. It is considered a bit better to have a tough ship that is slightly heavy than a very light ship which will "spatter" at the first hard landing.

Over a period of years magazine ships have made such outstanding performances that they have proved the wisdom of the editors who purchased them from their original designers. Generally speaking, magazine plans are better (the draftsmen do more of them) and the articles are clearer due to competent editing. If you have never yet built a mag plane, try one. We're sure you'll be satisfied.

Dodoes Are My Job

(Continued from page 15)

actual flying is begun. Like most laymen, the student has many false preconceived ideas about piloting a plane, such as: that a plane will fall into a spin or dive the moment the controls are released; that it takes brute force to move the controls; that learning to fly is a highly complicated and mysterious ritual; or that a person must be endowed with extra senses or unnatural powers to enable him to learn to fly, and that without these powers he might as well throw in the towel. All these ideas must be dispelled.

Very few students have had previous instruction, but nearly all have been up a time or two as a passenger. Many candidates believe that flying time previous to the beginning of their cadet training is an asset, but unless their training has been closely supervised by a competent instructor, it can be detrimental, inasmuch as they must "unlearn" former bad habits. Consequently an untrained student has a better than even chance of getting through.

Actual flying is begun the second day of the training course. The first flight is generally an indoctrination ride to allow the student to see the surrounding country, observe any restricted areas and become familiar with the roar of the motor, the smell of the exhaust and the unlimited view from two or three thousand feet.

He is shown gentle turns and banks and the proper position of the nose and wings in straight and level flight. In the mirror in the front cockpit the instructor watches the student's facial expressions for signs of apprehension, fear, interest or enjoyment. From the feel of the dual controls he knows whether the student is relaxed and at ease, or tense and jerky.

In flight training, the first fifteen hours are the most strenuous both for the student and instructor. This is the initial critical period, and eliminations come more quickly during this phase than at any other time. Following his first ride, the student learns the four basic maneuvers of flight: straight and level flight, turns, climbs and glides. It is from the combination of these four simple steps that all flying is evolved, and unless a fledgling learns them well, he never becomes a smooth pilot.

To accomplish the very elementary training, a "monkey see, monkey do" system is applied. For instance, a medium banked turn is demonstrated. The student attempts to duplicate the maneuver, and his errors, greatly exaggerated, are shown to him followed by a correct turn. He tries again. And so it goes until he can passably execute a turn. Thus he learns not only how, but why.

As soon as the student can handle the plane fairly well at higher altitudes, training is begun closer to the ground with such maneuvers as "S" turns along a road or elementary figure eights. Flying at four or five hundred feet gives him a clearer conception of speed of the plane than at higher altitudes where there is no basis for comparison.

The scene that John Q. Public sees when he stops by the fence at our auxiliary training field about the fifth or sixth hour in a student's training is apt to be a most appalling one. Ten or twelve airplanes are following each other around a roughly rectangular pattern at about four hundred feet altitude. In turn they make a diving approach for the runway, bang into the ground, careen along for a few yards and then bounce wildly into the air to race around the course and repeat the silly operation. Or so it seems.

However, looking at it from an instructor's viewpoint, here is what is happening. The procedure sounds simple enough. Take off, fly a rectangular course around the field, and then land. Yet there are a hundred and one things that can alter this orderly program. First, take-offs are seldom straight because of the effect of motor torque on the path of the plane. Overcontrolling on the rudder generally makes the take-off look like a one-man snake dance. There is always the possibility of a too-steep initial climb and potential stall. Improperly executed turns close to the ground leave but little room for recovery. Turns at more or less than ninety degrees make the pattern odd shaped, causing confusion for the other planes. Poor judgment as to where to close the throttle for the approach glide causes the plane to undershoot or overshoot the entire field. If not leveled off at the proper moment the plane will either fly into the ground at eighty miles per hour, bounce, or drop from a few feet of altitude, in either case causing a considerable jolt to both the plane and pilots.

At this point an instructor must be extremely cautious in the methods he uses. The student is usually confused by the noise and multiplicity of "dos" and "don'ts" and is very tense on the controls. Yet he must be allowed to continue his mistakes up to the permissible limits of safety in order to appreciate his errors and avoid them the next time. And though letting a student hurtle across the ground with his wing clearing inches is tough on the nervous system, it is not dangerous. An experienced instructor can anticipate his student's actions, and so remain at least one jump ahead of him.

And so it goes. With each trip around the field, the student eliminates another error. His eyes become accustomed to the relative speed of the plane and the ground. He becomes able to establish the correct focal point to level off before landing.

Take-offs are gradually straightened out, and he learns to space himself in the heavy traffic. In short, he is about ready for his greatest of moments, his First Solo!

With slight variations, the usual solo time for most students is between eight and twelve hours of dual instruction. When the great day arrives, the instructor very likely gives his rabbit's foot an extra pat and summons all his psychological aids. If a student anticipates his solo it's two to one he will blow up, but if he is unaware of his readiness, little trouble is encountered.

The period starts the same as any previous day. Several circuits of the field with take-offs and landings are made. Corrections and criticisms are still forthcoming, but in a more subtle tone. Finally the instructor is convinced that his student actually realizes the attitudes of the plane and can make his own corrections for the usual errors. They taxi back up to the head of the runway. The instructor climbs from the cockpit, and with a few last-minute directions and a silent prayer, sends his dodo out solo.

With his mind and body trained like a well-oiled machine, the student makes the circuit, lands and taxies back almost before he realizes he did it alone. He has passed the first crucial point, and the bugaboo of the ever-impending "washout" is not quite so apparent.

Eliminations are the toughest part of the entire program. An intelligent student who can quickly grasp instruction, shows initiative and aggressiveness, and above all uses his head in the emergencies, is a godsend and a delight to an instructor's heart. His opposite, the chap who is unable to do much but grasp the controls in a deathlike grip and view the surrounding terrain from glassy eyes, is not such a problem as he appears. When a candidate is this far out of line it is apparent he has no business in an airplane and consequently is eliminated at the prescribed eight hours of dual instruction.

However, the students that make us prematurely gray and cause us to talk in our sleep are the borderline cases. These problem children will indicate normal progress in all but one or two phases of the work and sometimes all the instruction in the world can't pull them over the hump. It might be landings, or air work, or some hidden idiosyncracy that pops out at a crucial time and renders them a potential source of danger.

What to do is problematical. Possibly the weaknesses are curable, and we don't like to have future aces slipping through our hands without sufficient time to prove their worth. On the other hand, we are open to criticism for nursing a dud and wasting Joe Taxpayer's money. The army's system of periodical progress check rides by the supervisory personnel tends to keep a close tab, not only on the student's work, but on the instructors' methods as well.

It is the air corps supervisors who turn the final thumbs down on the student unable to meet the exacting standards. Or, if aided by their years of experience, they can detect possibilities formerly overlooked, a transfer of instructors is made and the "dodo" is given another chance. He is given every break possible before his final ride in the "gray ghost."

It is small consolation to him to know that thirty percent of all primary cadets are eliminated, and that a washout from such a rigid course is no reflection upon his general ability or character. We know that he left the old home town to become a red-hot army pilot and make good. We know, too, that he has based his entire future on getting through. However, we also know that he would not only be apt to injure himself and government equipment if allowed to continue, but be a continual source of danger to those around him. The possible damage to aircraft is, of course, a secondary consideration.

True, he may still have enough ability to be a "Sunday pilot," but he is not competent enough to fly a pursuit plane at 300 miles an hour. The lonely road out of the training program is strewn with broken hearts, but that is one reason why the road to national defense is not paved with broken bodies.

A psychological letdown frequently follows a student's solo. But only for a short time. As his time in the air begins to mount, greater precision and accuracy are demanded. Instead of merely getting into the field with his landings he must be able to set the plane down reasonably near a chalk line. Hundreds of landings are made, and with each one the student learns more about the capabilities of the airplane. Judgment and perspective are slowly developed until he can land close to the spot from several different approach angles.

During each dual session away from the field the throttle is closed at unexpected moments to simulate a forced landing. A field must be quickly chosen and an accurate approach made. Over and over the procedure is repeated. Errors are pointed out and criticism hammered home, preparing the student against the unlikely but none the less potential possibility of motor trouble. This, coupled with the accuracy landings, is one reason you seldom hear of student fatalities.

With more than half of the course behind him, the student is beginning to feel more at home in the cockpit of the plane. Elementary precision and co-ordination exercises are practiced continually until smoothness and relaxation become second nature. He is more at ease roaring through the sky than he is driving at fifty miles per hour down the highway. He is ready for the advanced maneuvers which will include such aërobatics as loops, snap rolls, slow rolls, Immelmanns and precision spins.

In an off-guarded moment the other day the mother of one of the cadets cornered me at the airport fence and demanded to know why her Willie had to go through the—to her—death-defying acrobatic maneuvers. She didn't mind her boy becoming an aviator, but to deliberately stick his neck out in dangerous maneuvers was going too far.

I don't blame her a bit for her attitude. Possibly she has seen or read about (haven't we all?) some inexperienced exhibitionist who has crashed to a sensational death attempting acrobatics close to the ground. What she doesn't know is that her son will never completely master the art of flying until he can put an airplane into every conceivable attitude and recover with accuracy.

And she needn't worry about Willie crashing if he sticks to the rules. All army aërobatic maneuvers are executed under rigidly maintained safe altitude requirements and careful supervision, leaving more than ample room for recovery, in the event of mistakes.

To the instructor a student's behavior in acrobatics will clearly indicate the progress or lack of progress made in the previous weeks of flying. First reactions are interesting. Because of the amount of time flown and the gradual transition, few cadets actually experience the sickness of which one sometimes hears in connection with aërobatics. Even those who are slightly green around the gills at first become accustomed to inverted attitudes and learn to enjoy it as much as any other phase.

To retain placid composure and full control of the plane flying upside down at 120 miles per hour takes a little getting used to, but being able to do so makes Charley Cadet a better pilot. We don't expect our students to become acrobatic aces, but we do expect them to be proficient enough to make a safe recovery from any attitude in which the airplane is placed, accidentally or intentionally. Hours spent in acrobatics make this possible.

As the cadet's training nears completion, he is given a few hours' instruction from the front cockpit of the plane. Previously he has received all dual and solo from the rear cockpit, for several reasons. From the rear he has more of the plane in view and is better able to judge the attitude of the wings and nose on the horizon. In the mirror, the instructor can watch his every move, and last but far from least, we are on the windward side in case of airsickness. Flying from the front cockpit alters perspective slightly and aids in shortening the transition time into basic training at other schools, where all of his flying will be from the front cockpit.

In this respect, we at the Ryan School of Aëronautics have, since midsummer last year, been training our flying cadets in a military version of the well-known Ryan S-T low-wing monoplane. Overshadowing the economic features of the Ryan trainer, its oomph and its photogenic nature is the fact that here for the first time in air corps history, primary training is shaking tradition.

Instead of biplane primary training, the student starts out in a low-wing monoplane—the little sister of every plane he will fly from now on. We are proud of our pioneering status and can't but feel that the air corps' order for many more "low-wingers" is complete vindication of our sincere conviction that low-wing primary training is safe, practicable and infinitely logical.

Accustomed as we have become to instructing cadets, their aptitude and flying technique at the completion of the sixty hours of training always appears to be a little miracle. Ten short weeks ago they sat rigid and goggle-eyed in the cockpit, putting on exhibitions that would shame any self-respecting bird. Today they can outperform the eagle they have pledged themselves to defend. True, they are still fledglings with another six months of basic and advanced work ahead, but their foundation is solid. The esprit de corps of the army air force has seeped in and given them a more confident bearing. Already traditions are being established by this new young brother of the army. And we, the instructors, are plenty proud as each man passes his final check ride!

Prone Pilots

(Continued from page 11)

a pull-out weighs eight times as much as in level flight.

Recently, a glider was built in Germany to verify the results of research made on the effects of acceleration upon the blacking out of dive-bomber men. In this glider, the pilot was laid out prone, with a chin rest to support his head. His chest was padded with his parachute pack. The pilot was also made to lie on his back. Curiously, in the former posture there was less labor involved in respiration, though greater weight was exerted on the thorax; this is ascribed to the fact that in the on-the-back position the diaphragm does not move as it does in the face-downward posture. It was also ascertained from these tests that the prone flying position is no more tiring than that of sitting upright, and that the field of vision is sufficient for all normal flying.

Naturally, the reduced frontal area of the prone-pilot ship will be a great advantage to pilots engaged in dive bombing and torpedo bombing. Not only will the smaller frontal area present a much smaller target to defenders below, but the prone position will enable the pilot to pull out at a much lower altitude, thereby increasing his chances for an accurate hit with bomb or torpedo.

It has been suggested that in the case of dive bombers or the rocket-zooming fighters the pilots' seats could be made adjustable. They would be equipped with an automatic flattening-out gadget, which would permit the pilot to adopt a reclining position in accordance with the particular angle of the dive or pull-out. Those who strongly advocate the prone posture say that the upright seating serves no useful purpose in the speedy lighter ships because in combat they are pointed at the enemy, anyway. Their argument is that a man can take it lying down just as well, if not better, than sitting up.

Today we are hearing more and more of armored fighter planes. With the present cost of training pilots around $25,000, it is no wonder that the various air forces are trying to protect the pilots, at least in a small way. It is unfortunate for the pilots that a modern pursuit ship does not lend itself to good armoring. There are too many control cables, structural members and other gadgets which must be compensated for when designing the armor. This difficulty cannot be overcome except by such a radical departure as placing the pilot in a steel tube made of armor plate. It is a well-known principle of armor engineering that the armor is more effective if curved to deflect the bullets. Also, the more curved the more effective is the armor. A pilot would certainly feel safer if he were lying in a steel tube than if he had a few squares of steel placed around him. No position for the pilot is as adaptable to armoring as the prone. Not only is the armor more effective, but the pilot presents a smaller target to guns on his tail or head-on.

Then there's the matter of bailing out. Even after the pilot has left the ordinary ship he still has to anticipate a battle with the tail surfaces. With the present disposition of pilot and crew, it is impossible to make their departure from the plane any less hazardous. Now suppose a ship could be designed which would permit the crew to drop out much as bombs are dropped from a bomber. Such a pilot-dropping plane would of necessity be one featuring the prone pilot. You can easily imagine how easy would be the parting of the ways for the pilot and his ship if it were merely necessary for the pilot to pull a lever and immediately drop through a trapdoor opening at the bottom of the fuselage. The method would make bailing out as easy and as safe as falling off a log.

The ease, safety and speed with which a pilot could leave a prone-pilot pursuit ship suggests that our present parachute troopships are designed too much along conventional lines. It does not take a great deal of imagination to see how much more effective a parachute troop attack would be if the troops could be released simultaneously and at such a low altitude that they would not long be a target for ground crews.

Let's go a little higher—into the substratosphere. Boeing Stratoliners have the cabin made airtight and air pumped into the cabin to make the pressure more nearly that of air at sea level. In a high-flying bomber the crew generally suck oxygen. Although the oxygen-tube technique is highly unsatisfactory from the standpoint of the interference to movement it causes the crew, it has nevertheless persisted in military aviation because pressurized cabins are difficult to design in such a way as to permit the bomber to perform its many operations. This problem can never be solved satisfactorily unless the crew can be pressurized individually. We have seen that pressurizing is impossible on a bomber; do we say then that the crew must continue to suck oxygen? No! The crew can be individually pressurized much as an undersea diver is pressurized. If those same tubes which are used for armoring the pilot can be made airtight and fitted with windows and with proper controls, the pressurizing problem is solved.

Keep your eye on the prone pilot!

Don't Ground Private Flying

(Continued from page 19)

by military training. We need this pool, it is held, because the military establishment cannot support in peace time the tremendous number of pilots needed *quickly* in war time. Speed in obtaining military pilots is immeasurably set back by the long process of selection and preliminary training during which the majority of applicants do not qualify. Estimates have run as high as one finished military pilot from thirty or forty applicants. With the civilian pool, set up on military fitness standards, the army or navy, it is argued, can "put its finger on" all the pilot material needed without any delay at all.

The opponents of this scheme, and they include military experts as well as lay critics, claim that the C. P. T. pilot is undisciplined, poorly trained, and must be untaught his C. P. T. bad habits before the services can use him, and that even then he won't compare to a pilot selected and taught the service way. They particularly criticize the college-boy C. P. T. product, claiming that his "attitude" ruins him for service flying, whereas the very small percentage of noncollege C. P. T. students are far above the college boy in every respect. If we must have a Civilian Pilot Training Program, they argue, (and add "God forbid" under their breath), let's face the fact that it has only a military justification, and turn it over to the army and navy to run.

There is much more to the argument, much more on both sides. Pilots who fly at their own expense want "in," noncollege aspirants want the college part of the program thrown out, service and air-line pilots want "those so-and-so cubs" out of the air (and their hair). Officers brought up in the air corps and naval aviation tradition cannot unlearn the sacred precepts of holiness traditional to the services, are scornful of the civilians. Old-timers (and they run virtually everything in aviation) still hope that they will wake up soon to learn that military primary training in civilian schools, and those oversize model airplanes that fill the sky and cover the airports, will turn out to have been just a nightmare after all. Political opponents of the present Civilian Pilot Training Program want any excuse to secure control of it—or else destroy it. And so the argument rages on and will continue until doomsday. Meanwhile certain facts emerge which, to some extent, speak for themselves:

1. Fitness and training standards have constantly been lowered by both sides in the war, and there is every reason to suppose that they would be here,

once the supply of "perfect pilots" began to be used up. At such times a civilian pilot pool should prove extremely useful.

2. In England and in Germany much was made of training civilian pilots at government expense, and apparently all pilots, of all ages, and both sexes, are being used in one way or another—for ferry service of new military ships, as instructors, for liaison flying, errand running, et cetera.
3. It is beginning to be whispered about that the services are not receiving anything like the enlistment applications needed to fill their pilot training quotas, but thousands of C. P. T. graduates have gone on into the air corps and naval aviation, thus taking up some of the slack. This trend appears to be accelerating, not declining.
4. Hard pressed for instructor pilots, the services have turned to the C. A. A. instructor list for hundreds of C. P. T. trained men. Creation of instructors is an invaluable byproduct of C. P. T., vital for the future.

In light of these and other facts it is hard to believe that the C. P. T. program will be junked. Its cost is trifling, its benefits, both in immediate and potential results, are relatively very great. And it is significant that the thirty-seven-horsepower "*put-put*" in use a few years ago is today a comfortable, practical, fast little ship of nearly double that horsepower, *selling at the same approximate price*. We cannot afford at any price to overlook the meaning of this trend in terms of after-the-war peacetime industry, when any economic demand will mean less economic slump. We must not win a war only to starve to death afterward.

So, all in all, it would seem logical that the Civilian Pilot Training Program continue with war department support, in which event the Defense Commission and Priorities Board must see to it that airplanes are available to it. Dislocation in light plane manufacturing is more apt to come through unavailability of materials (already being felt), increasing costs, and attraction of labor to higher pay plants. But, we have no doubt, ships there will be, for pilot training.

More real probability is grounding of individual pilots who fly for pleasure or on their own business; in fact, grounding of any flying except that concerned with and under immediate control of the war department. Even the air lines are feeling a sense of insecurity. Although no one will consent to being quoted, it is common gossip that the army wants everyone else "out of the air." The army, at this point, is pretty influential. Various reasons, some obvious, are given for the need for this step. For example:

1. The risk of sabotage by private planes over arsenals, factories, utilities, et cetera.
2. The possibility of gas and oil rations with none to be available for non-military, essential activities.
3. Spying by aërial photography.
4. Uncontrollability of alien pilots under present regulations (a disgrace).
5. Infiltration of alien ownership into flight training schools.
6. Necessity of turning *all* airports and flying fields over to the services. (And even then they will not have enough. Why is Congress so asleep on the need for thousands more flying fields?)
7. In total war, civilians do most of the fighting, and the mechanics, gas pump operators, airport employees, everyone including the private pilots themselves will be under rigid control with every minute of their activity directed to the sole objective of winning the war.

Whatever specific reasons there may be, there seems to be real agreement among everyone concerned, including private fliers themselves, that as this country goes further and further out in aid to Britain, which is another way of saying further and further into the war, it becomes more and more important to know who is flying, where he is flying, and why he is flying, lest he do our war effort irreparable damage. The ease with which a few private pilots, skilled at tossing flour bags at circles, also could toss substantial bombs upon our too few motor factories, is something to cause nightmares. None of us quite likes the idea of aërial surveys going to potential enemies covering various vital objectives, but how easy to make such surveys today! No, there is no real quarrel over the desirability of *control*, but private flying cannot see the sense in obliteration for the sake of control, with resultant loss of thousands of pilots potentially of tremendous value for defense or offense. Flying skill, whether civil or military, is not created on an assembly line overnight, and experience comes even harder. It is that skill that spells air power, and it is air power that will decide this war, not because it is the whole of military force, but because it is the factor without superiority of which victory is not possible. In consequence we cannot afford as a country to lose one particle of our immediate or potential air power—not even one private pilot with seventy-five or one hundred hours, and a way must be found to preserve what we have.

There are a number of plans afoot in the country, many under promotional auspices, for solving this problem by creation of a "reserve" of civilian fliers. It seems the only practical solution, to this writer, provided that the "reserve" embodied the following characteristics:

1. Semimilitary type of organization, with command and control vested in a government board representing the C. A. A., army, navy and civilian fliers.
2. Official government status, nonmilitary, and though membership be voluntary, no one but members allowed to fly at all.
3. Administration through the Civilian Pilot Training service whose organization is available in the field to handle it.
4. A provision for privilege of personal flying under certain controls, in return for certain prescribed skill-building flying to be done at government expense.
5. A careful check of each member by the F. B. I. as to associations, activities and antecedents, with refusal of membership to the doubtful.
6. A classified card file at headquarters of all members by location, special skills and abilities, occupation in vital defense activities, and availability for emergency duty.

With such a set-up we could be sure of preserving those pilots already flying, including thousands trained at taxpayers' expenses. Not only preserve them, but organize them, keep them in training, improve their skills, and provide the machinery for instant mobilization in time of need. In addition we would preserve to some extent the private flying gains made in the past few years against the return of peace and the tremendous economic problems that will then confront us.

A plan such as that outlined in generalities above already exists in official circles—may be a fact by the time this reaches print. If a fact, it deserves study and support. If not yet in existence, agitation for its inception is help for the preservation of private flying, which may *yet* be lost under pressure of more popular problems. Such a loss would be a knife thrust in the back of our future industry.

Motorless A. T. C.

(Continued from page 24)

particularly, the Franklin, is still the backbone of most of our glider clubs. Licensing laws were lax; any ship built prior to January 1, 1931, was eligible for a license upon visual inspection by the department of commerce inspector.

The wholesale accidents, however, alarmed the department of commerce, bureau of air commerce. They decided that the builders really did not know as much as they claimed and that it was up to them to tighten up on the regulations and save the lives and limbs of the gliding fraternity. So, through the co-operation of the Soaring Society of America whose two members, Milton Stoughton, current design engineer of Vultee Aircraft, and Henry Wightman, together with Ted Hammon of the engineering section of the C. A. A., drew up a set of regulations on the airworthiness of gliders as well as a manual interpreting these regulations and giving definite construction hints. These two works are known as the C. A. R. (Civil Air Regulations) 05 and C. A. M. (Civil Air Manual) 05. They can be obtained from the Publications and Statistics Division, Civil Aëronautics Authority. However, if you are interested in a condensed version of the airworthiness rating for gliders we suggest that you obtain the Aircraft Airworthiness Section Report No. 17.

All licensing of newly built gliders is done by the Airworthiness Section of the Civil Aëronautics Authority. If you build only one ship, just for yourself, and do not intend to go into production, an airworthiness certificate is all that you need. But if you decide to go into business of selling gliders, you will have to obtain a type certificate besides. As a basis for an airworthiness rating, you must demonstrate to the aëronautical authority the suitability of the glider in respect to the following factors: structural strength of wing, tail, control surfaces, fuselage, fittings, control system and landing gear; pilot compartment, control arrangement; equipment, i. e., instruments, safety belts and wheel; design details; products, construction and workmanship; flying characteristics and safety features. In order to obtain an airworthiness certificate, you must present a three-view drawing of the ship to a designated scale, specifying on it external dimensions, manufacturers' designation, gross and empty weight, wing and control surface areas, seating arrangement, baggage and ballast capacities in pounds, and equipment supplied. After studying this drawing, the Airworthiness Section may ask you to supply such additional data as it may deem necessary. It will, undoubtedly, be basic load data, dealing with load tests on the strength of wings, tail surfaces and fuselage, location of center of gravity, empty and with full load. Not all the tests have to be in the form of a written report; some can be conducted in the presence of the inspector of the engineering section of the C. A. A., who will come out and witness them whenever you drop him a line. The same representative of the C. A. A. will conduct all necessary inspection in regard to structure, and method of construction prior to completion of the glider. If he is satisfied with what he sees he will give you the go-ahead on the ship. Otherwise you will have to alter whatever he thinks is not according to Hoyle.

Having satisfied the inspector, you may finish building the ship and get it ready for an official test flight to prove that it will handle in the air according to flight-operation requirements. Your glider must not stall abruptly, have good control at any time at or below stalling speeds, must recover easily from spins and spiral dives, must not float too much in landing, have good control on the ground, not be unduly sensitive or sluggish to control, have good visibility, good towing characteristics. If your ship lives up to all that, you will be granted an airworthiness certificate and can paint the letters NC in front of registration numerals on the wings and the rudder.

Perhaps you want to set yourself up as a glider manufacturer. Then you must first obtain a type certificate for your ship which will enable you to build ships in quantity. This certificate is a document issued to the manufacturer or designer certifying that the data filed with the C. A. A. on this ship has been found suitable for the manufacture of the glider in quantity. The data mentioned above consists of: complete drawings of the ship, a drawing list in duplicate, equipment list, i. e., instruments, safety belts, release hook—if it was not made by the manufacturer but purchased outside; preliminary weight and balance report; balance diagram showing the location of the centers of gravity of the component parts of the glider and its contents; location of the assumed center of pressure of the horizontal tail surfaces; weight table which includes a list of weights of all component parts of the ship; structural report; structural analysis, showing the minimum margins of safety computed for all structural members.

After all this mass of data is filed in Washington and bears up under the close scrutiny of the engineering section, a structural inspection is conducted similar to the one for the airworthiness certificate. After this has passed muster, the manufacturer can conduct his own test flights and later submit the ship for a ground inspection and test flight by the C. A. A. inspector. Prior to that, he will have to file what is known as a certificate of conformity, which is a document stating that the ship to be test-flown by the inspector conforms with the drawings and data filed in Washington. However, if minor changes and alterations have been made on the glider during the period of construction, they must be put down on the certificate along with the reasons why they were made. A flight-test report must also be filed. After the type certificate is issued to the manufacturer, he can apply for a production certificate, for which he must show that he has production facilities, including qualified personnel, for the manufacture in quantities of the glider for which he received the type certificate.

This may seem to you like a lot of work, and it is. It takes an engineer to make load tests, stress analysis, et cetera. You must know structural strengths of various materials, such as wood, metal and fabric, you must know aërodynamics to select the best wing-section, wing shape, sizes of tail surfaces, know all about moment arms, oscillations, vibrations, tail buffeting, control loads, vertical gust components, load factors and a thousand other things. All this knowledge, work and research, goes into the glider not to make life difficult for the home builders or pay the salary of engineers but to insure your bones when you fly the ship. For those who cannot afford to buy a ready-built glider, construction kits of a ship which has acquired its type certificate are available. If built according to manufacturer's specification, a license for this glider will be granted by the C. A. A. At the present writing, only two gliders manufactured in the U. S. have obtained their type certificates. One is the Schweizer two-place sailplane and the other is the Briegleb utility, the last being available in kit form. In the next few months, three other manufacturers will have their products approved: the Frankfort Sailplane Manufacturing Co., which builds the Frankfort single-place glider and a two-place ship, and the Midwest glider company in Michigan, and Bowlus Sailplanes, Inc., in California.

Nevertheless, if you see a glider or sailplane without the NC on it, it does not necessarily mean that the ship is dangerous. A number of fellows with plenty of engineering experience, have built excellently performing ships and just never got around to going through the necessary paper work to have them licensed. It takes hundreds of hours to write up reports on stress analysis, make drawings, et cetera. They built the ships entirely for their own purpose and are perfectly satisfied to fly them with the "X" license. Some day, they say, they will get around to apply for an airworthiness certificate, and they will undoubtedly get it. But to the ordinary chap who is interested in flying gliders, our suggestion is save your pennies and either join a club which is flying approved equipment, or form a club of your own. With several fellows pooling together, enough money may be dug up to buy a licensed new or good used ship.

NEWS AND EVENTS

The India Gliding Association of Bombay, India, has purchased a number of sailplanes from Bowlus Sailplanes, Inc. The Indian government intends to train a number of pilots for the British Empire and is going to use the gliders for preliminary training.

The Schweizer Aircraft Corp. has sold a second two-place sailplane to Joe Steinhauser of Chicago, Ill. With his first Schweizer, Steinhauser has carried over 350 passengers since October, 1940.

Edward Knight of Toledo, Ohio, also has purchased a two-place Schweizer. He is a member of the Toledo Glider Club.

At the annual meeting of the Detroit Glider Council, the following officers were elected for the coming year: Dallas Wise, Sr., president; John Nowak, vice president; Charlotte Palmer, secretary; Charles Kohl, treasurer; Arthur Schultz and William Putnam, directors. The Detroit Glider Council has obtained a new glider field at Ypsilanti, Michigan. This field, 3,500 feet square, was made available to the council by the Township of Ypsilanti. To Lyman Wiard of the XYZ Glider Club, goes most of the credit for the idea, not overlooking the many hours of work he put in to make the idea a reality.

Herman Stiglmeier of the El Segundo Division of the Douglas Aircraft Co., soared to an altitude of 10,500 feet in his sailplane *Stick* at Rosamond Dry Lake, California. The Briegleb Aircraft Co. of Van Nuys, California, whose model BG-6 has recently been awarded a type certificate, announce that they have sold a number of construction kits and plans. Among the aircraft manufacturer employees are many groups building Briegleb gliders, these including glider clubs at Vultee, Lockheed and Douglas.

Reviewing Stand

(Continued from page 23)

and finally become hostesses on an air line. As full-fledged hostesses they find enough excitement to satisfy all concerned, and the book ends in a most satisfactory manner after a thrilling rescue of—well, read it yourselves. An exciting book dealing with a rather neglected subject in the field of fiction, written by an author who has a complete and thorough knowledge of her background.

Flight Training for the Army and Navy. By Captain Burr Leyson. (E. P. Dutton & Co., Inc., $2.50.) Working in close co-operation with the Civil Aëronautics Authority, the army and navy air services and other government bodies, Captain Leyson has turned out an excellent job. The author presupposes the reader has no knowledge of flight or the various phases of aviation, and begins from the ground up. The early chapters are concerned with the medium through which we fly and give complete and graphic data on its composition. From this foundation the reader is initiated into the mysteries of *how* we fly, in a chapter on the theory of flight. From then on a complete and popularly written series of chapters takes you through the technical side of planes, engines, instruments, parachutes and meteorology. The last chapters are devoted to such timely subjects as requirements for the air corps, airport traffic procedure, navy pilot training, et cetera.

We Bomb By Night

(Continued from page 13)

killed. He knows that one hit from the nose cannon of a pursuit plane will send the Flying Fortress to its doom. And he realizes that if they see him, his top speed of only 268 miles per hour will be hardly enough to elude a 400-mile-per-hour fighter.

But they are still two hours from the objective, flying in a camouflaged black plane at a height of three miles. The secret black paint will make it all but impossible for searchlights and airplanes to spot the giant bomber, and the pilot knows that if he gets within ten minutes—thirty-three miles—of the target, the enemy will have a hard time stopping him.

One hour to go. The copilot peers downward, striving to make out a landmark. There is nothing to check on, and the landscape is of no assistance. If they do not find the objective on time they may wander around for an hour before finding it, or they might remain lost and never get home at all.

A hundred miles out, the captain orders all hands to battle stations. The bombardier, down in the nose, leans over his bomb sight. The side, top, and bottom blisters are manned, the gun checked by firing two or three short bursts into the night. The radio man reports that the broadcast station went off the air, and that a check on the home station bore the reciprocal of the present course. The bomber thunders on.

The last thirty minutes are crucial. The plane and its tense crew of nine flies toward the objective. Every man is alert for the attack that must come, be it by antiaircraft or airplane. Without a doubt, the enemy is aloft, searching the dark skies for a black bomber, knowing that they cannot pursue it over the city because of their own antiaircraft fire!

Suddenly the copilot points downward. The pilot nods: he has seen the slight cluster of buildings and the still darker clusters beyond. The clusters are towns on the outskirts of the objective; he is about thirty miles, or ten minutes, away. In five minutes they will be in line for a bombing run.

By dropping from fifteen thousand feet he does not have to approach closer than two miles to the target, because the bombs will travel forward as they fall. The bomb goes ahead with the speed of the bomber—two hundred miles per hour—landing two miles ahead of the dropping point. That means that after dropping his bombs the pilot can turn away from the city and fly clear of the nerve-racking, dangerous antiaircraft fire.

The pilot and copilot strain their eyes for the city proper. The bomber is slightly off course, and to the south. The pilot flies more to the north, trying to recognize the terrain in order to fly a straight course toward the objective. Without a straight, unmolested course, the bombardier cannot operate his bombsight.

In the nose, the bombardier makes preparations for the bombing run. The belly is opened, revealing the nine thousand pounds of high explosives. He kneels over the illuminated bomb sight, trying to pick up the railroad terminal in the heart of the city.

But the starless night and the complete black-out of the city make it impossible to see. The terminal merges with the rest of the landscape in one invisible mass. There is nothing left but to drop a flare, thereby doubling the hazard.

A pull of a lever sends a magnesium parachute flare fluttering down, to ignite and burst into a brilliant light of thousands of candlepower. It illuminates the city below: the railroad terminal stands out clearly. But as the flare ignites, the first antiaircraft fire strikes at the Flying Fortress—four starlike shells burst a few thousand feet below.

Wheeling the plane to the left, the pilot gets away from the next four shots, maneuvers into position for a second run. On this run the fire will be heavier, and enemy planes may locate the bomber. Bringing his B-17 back on course, the pilot again makes a run on the target. The bombardier picks up the terminal in his sight and sets the automatic lever that will drop the bombs.

White, vicious jabs from the antiaircraft bursts rock the plane. Now, if ever, the pilot must fly straight and level in the darkness. Any unnecessary turn will cause the bombs to drop hundreds of yards away from the target. From fifteen thousand feet it is easy to miss.

The men in the sixty-eight-foot fuselage are tense, alert. One of them warms up his gun with a short burst, and the familiar chug of the 50 is heard. No enemy planes have been sighted, but the shells are bursting closer every second. They do not bother the pilot, whose eyes are fastened on the pointer that tells him how the bombardier wants him to fly: "turn left"; "fly straight."

Suddenly a slight tremor of the plane tells the crew that four incendiaries have been dropped. Without waiting a second, the pilot puts his left wing down and banks swiftly away, far from the next shells that the enemy's automatic range finders will send up. The copilot looks to the right, and where the plane would have been are four white, glaring bits of fireworks—a beautiful miss! Pilot and copilot grin at one another.

"One last run," the pilot says.

"One last run," the copilot nods. He looks down at the target, counting the seconds. The bombs are screaming earthward at terminal velocity, taking nearly half a minute to traverse the distance. Four tiny lights spring up, die down, and commence to brighten; the terminal will soon be a fiery mass.

There are eight thousand pounds left to drop. This time the pilot will make his run from the west, against a furious onslaught of bursting shells. The plane rocks, the pilot struggles to fly straight, and the bombardier puts his selector on "Salvo." He finds the burning objective in the sight and sets the automatic release lever.

The antiaircraft brighten the sky in clusters and rock the B-17 roughly. The target creeps under the sight, and

(See page 54)

when the plane is still two miles away the bombs fall lazily away from the plane. Nearly eight thousand pounds of TNT dive for the terminal.

Scarcely a second later the pilot wheels the Flying Fortress to the north, away from the blazing antiaircraft to clearer skies. But the attack is not yet over; the copilot shakes the wheel and points to his right: A squadron of pursuit planes have popped from the overcast and are engaging the bomber.

A single cannon hit and the attack will be over. There are no odds between a bomber and a fighter, especially against nose cannon. The copilot squirms as a row of high-caliber machine-gun bullets tattoo a pattern in the wings—there are no puncture-resisting gas tanks in this airplane.

From the side blisters comes an answering hail; suddenly they cease. The top blister takes up the fight, and the *chug-chug* of the .50 sounds good. But they are no match for four, six, or eight guns fired from an interceptor, and suddenly the gun in the top blister becomes silent, too.

The pilot shoves his throttles full forward and pulls back on the yoke. The speed slacks off, but the giant fortress climbs upward. The copilot points to his right—a screaming, fiery, yellow torch goes spinning earthward—a lucky hit for an unlucky interceptor pilot. That leaves only eleven fighters to go.

Eleven to one—impossible odds. But the bomber is boring upward at fifteen hundred feet per minute. Two fighters roar past, but they do not find a vital spot. The bombardier in the nose catches one, the tunnel gun tries for the other—both miss. Someone has taken over the side blister, but its .30 caliber sounds like a peashooter, and is just as effective.

Suddenly, mist envelops the nose, spreading to the tail and entire ship. The pilot goes on instruments, flying into the safety of the overcast. He sets his course immediately for home.

They drop down after an hour and look for landmarks. If the wind has shifted, they might fly out to sea and, once lost, there would be no getting home—no radio stations would open up with a friendly beam. At the end of two hours and fifty minutes they see the coast line in the darkness.

Quickly the radio man gives the recognition signal. The reply comes: "Land at once." Taking a bearing on a familiar landmark, the pilot flies toward the airport. He knows that statistics have proved that for every pilot killed in action, another pilot is killed through nervous blunders. And landing a $400,000 four-engined, twenty-two-ton bomber at night without any but the most essential light is a job calling for cool nerves.

A light flashes. The copilot eases the throttles back and the B-17 glides in for a landing. A quick flash of the landing lights, a marker light at the end of the runway, the black ground coming up to meet them in the dark. There is a sharp squeal of rubber as they burn on for a landing. The copilot closes all four throttles.

They cut the switches and climb out wearily. A new group is waiting for the plane. The ground crew loads the bomber with ten thousand pounds of bombs. The new captain inquires about the wind.

"You can't miss," he is told. "Fly for the bonfire at B— And stay close to the overcast. Best of luck."

"Thanks, old man. See you in six hours. Cheerio!"

The four Cyclones turn over, the ship taxies down the runway and slowly disappears into the night. The roar of the four motors is heard for a moment, then dies away in the distance as the giant bomber pushes on in the darkness to its rendezvous six hundred miles away.

Gas Engine Census

(Continued from page 31)

Phantom Bullet. This year's version of the Bullet comes with a streamlined gas tank attached to the back of the crankcase. Both tank and crankcase are die cast of magnesium Dow metal. This engine has exposed points and adjustable timer. The rotary valve crankshaft operates in a bronze main bearing. The cylinder is cast iron; the head, die cast of magnesium, is held with several screws. The steel piston is lapped to the cylinder. The connecting rod is die cast of Dow metal and the wrist pin is machined of brass.

Phantom Torpedo. This engine is identical in construction with the Bullet, having the by-pass die cast integral with the crankcase. It is of a larger displacement and differs only in that the timer is inclosed and that the carburetor is of the down-draft type, being above the crankshaft instead of below, as in the Bullet. The Torpedo boasts a float-type gas gauge.

Forster 29. Entering the Class B field, Forster Brothers, with an enviable reputation and background of producing Class C engines for aircraft and marine use for many years, offer modeldom a really fine power plant. The Forster 29 features the new disk-type rotary intake valve of the type employed in the Bantam and Atwood Champion engines. The aluminum-alloy crankcase is die cast, diamond bored, and has an Oilite-bronze main bearing. The connecting rod is also aluminum die cast with an Oilite-bronze bottom bearing. The by-pass manifold and the exhaust pipe are cast integral with the crankcase. The steel cylinder and aluminum head are bolted to the case at four points on the lower cooling fin. The alloy-steel heat-treated high-dome piston is lapped to the cylinder. The wrist pin is tubular alloy steel, full floating with snap-lock retainers. Equipped for both radial and lug mounting, the 29 has a new clutch propeller lock to prevent the prop from flying off in the event that the motor should suddenly backfire. This long-past-due safety device is being adopted in one form or another by other engine builders, and will perhaps one day become standard equipment on all model engines. By the time you read this, production should be in full swing.

Ohlsson 23. The product of Irwin Ohlsson, expert West coast model builder, and Harry Rice, the 23 was the first small motor to gain widespread popularity and has done much to stimulate interest in the smaller models. Embodying several new methods of construction, the one-piece steel cylinders are spot welded to the aluminum-alloy crankcases. Uniting these two dissimilar metals is quite an accomplishment, and is achieved by the use of two small fusible plugs located at the front and rear of the crankcase near the bottom of the cylinder sleeve. The drawn-steel piston and the aluminum rod are inserted into the cylinder through the crankcase. This is made possible by an extra-large removable front cover plate. The main crankshaft bearing and shaft are tapered to compensate automatically for wear, and a ball thrust bearing on the shaft cuts down power losses due to friction. A transparent tank, inclosed timer and radial as well as lug mounting are to be found on this and other Ohlsson motors. All Ohlsson engines are test run and checked for power output. Only those engines developing power ratings set up by the manufacturer are released. Practically everything used in Ohlsson engines is made in their own plant.

Syncro B-30. Employing revolutionary methods of construction, the Syncro B-30 is likely to be the forerunner of really mass-production methods and design. The entire engine, even the tank, is permanent-mold cast of aluminum alloy. The aluminum piston on the new models has only two rings, thus reducing drag. The aluminum alloy of which the engine is cast being a bearing material, no other bearing metal is employed in the main bearing or connecting rod. The crankshaft is made of steel and the wrist pin of bronze. The adjustable timer is entirely different from any used on other model engines. It is of the commutator-brush type employing no points and requiring no adjustments. The B-30 is factory tested and run in with flywheels on a specially designed rotating table—an example of the mass-production methods employed in the manufacture of this engine which makes possible its low price. Quite a number of improvements have been incorporated since it was first placed on the market.

Syncro PC-2 Kit. This engine, constructed just like the B-30, is different only in that it does not employ piston rings. The piston is matched to the cylinder. The new model uses a cylinder different in appearance from the B-30. The kit comes with spark plug, but without coil and condenser, and can be readily assembled in a few minutes without special tools. Both Syncro engines can be inverted easily.

CLASS C ENGINES

Most numerous and considered by many the most practical, Class C models are as popular as ever with the model builders. The smaller engines have made no inroad on the popularity of the Class C's.

Barker. The three motors, Model A, B and C made by the Barker Engineering Co., are all of the same general design and specifications, the only difference being in the matter of gas tanks and their manner of mounting.

The Model C has a sand-cast Dow metal crankcase made in two sections and held together by four bolts. The front section, with an integral bypass, houses the bronze main bearing and supports the streamlined, fully inclosed timer. The rear section contains the exhaust ports and has bolted to it the intake tube with its spun dural gas tank. The chrome-nickel-iron cylinder has a cast-aluminum head. Four studs passing through the head and the cooling fins of the cylinder screw directly into the crankcase, thereby serving the dual purpose of holding both the cylinder and head in place. A drop-forged shaft, phosphor-bronze rod and a gray-iron piston complete the picture.

Models A and B have a streamlined Dow-metal tank mounted to and fairing into the rear of the crankcase. Two vent holes running between the crankcase proper and the tank prevent engine heat from boiling the gas. In so doing, they remove the hazards of vapor lock which often causes a motor to "act up" as soon as it gets warm. Model A has the filler cap and needle valve placed on the opposite side of the gas tank to permit inversions. The newer Barker engines have pressed dural tanks.

Brown Junior. Made by the Junior Motors Corp., Brown motors have established an enviable reputation for dependability dating back to the early days of gas-model flying. The first really powerful engine to be produced in quantity, the early Browns did much toward popularizing this hobby of ours. With but a few refinements in the design, today's Browns are made in two different models, the only differences being in the type of piston used, choke nut and skids. Model B comes mounted on a test block and is all wired ready to run. The B has a steel piston individually lapped to fit the cylinder. This is considered by many the best way to obtain the most power out of the engine without too much friction or compression leakage. The Brown D has an aluminum piston with two cast-iron rings, but does not have the choke nut on the intake tube which is standard equipment on the B's. Both engines have special pressure-cast aluminum-alloy crankcases with drop-forge aluminum-alloy connecting rod and drop-forged machined chrome-molybdenum crankshaft. The wrist pins are a machined Tobin bronze, and the main bronze bearing has a high lead content.

Dennymite. The Dennymite engine produced by the Righter Manufacturing Co. is available in the airstream model. The streamlined cylinder, though slightly heavier, allows the engine to cool better. The cylinder is sand cast of iron alloy, as is the piston, which is carboloy turned, bored and hand-fitted. The crankcases are now permanent mold cast of aluminum alloy and have a bronze main bearing. The crankshaft is drop forged and machined of chrome-moly steel. The connecting rod is of aluminum alloy, and the new models have a square lucite gas tank. This engine reached the peak of its popularity in 1940 and is used extensively in model race cars. The exposed timer points have proven very reliable, and do not float even at a tremendously high speed when the engine is used in race cars. The timer is adjustable.

Forster. Pioneers in the model-engine field, Forster Brothers continue to turn out well-built powerful engines of larger-than-average size. Rated at from $^1/_3$ to $^1/_2$ horsepower, the latest Forsters are offered in four different models, two being designed for use in airplanes and two for speedboats. The displacement of the airplane motors is .997 cubic inches, while the boat motors are slightly smaller (14.5 c.c.) to bring them down below the limits set for power-boat racing.

All four types are constructed along the same lines, having die-cast aluminum-alloy crankcases and cylinders. The aluminum piston with its two cast-iron rings travels in a steel liner sleeve in the cylinder. The main and all other bearings throughout the engines are of Oilite bronze; however, the aëro motors may be had with a ball bearing in place of the bronze for the crankshaft bearing. In this case, compression is sealed by the use of a short Oilite bushing at the point where the shaft runs out through the crankcase housing.

Models 99 and Super 99 plane motors are now coming through with transparent tanks and an offset timer arm, the only difference between them being the new speed-control carburetor with which the Super 99 is equipped. This gadget makes it possible to regulate fully the speed of the motor by merely moving the throttle instead of ambidextrously manipulating both spark and needle-valve controls. Ideal for radio-control work, their super power enables them to pull into the air large models heavily laden with equipment. The C marine motor is identical to the 99 except for the difference in displacement. The Super C features a double-bearing crankshaft and is also equipped with the new carburetor.

The double bearing made it possible to move the timer to the rear of the crankcase, permitting a horizontal installation to be made. Both marine engines can be ordered with jackets for water cooling.

G. H. Q. Developed from the famous old Loutrel gas engines, the G. H. Q. of today is the lowest-priced "big" motor on the market. Sold both as a kit and as a ready-to-run engine, the G. H. Q. is built around a cast-iron cylinder with a die-cast aluminum-alloy case and head. Its innards are composed of a drawn-steel piston connected to the chrome-steel shaft by means of a solid-bronze rod and pin. With all of the necessary machine work finished, the kit may be assembled in a short time with no tools other than a screwdriver and a pair of pliers. The factory-assembled engine is built up from the same parts as those included in the kits, and has been run in before shipment.

Hurleman Aristocrat. This engine is manufactured by Walter Hurleman, and is distributed by the Hurleman Distributing Co. of Philadelphia. Hurleman has had considerable experience in manufacturing model gasoline engines, being the first plant to turn out the Brown Jr. motors when they first appeared on the market. The cylinder is machined steel and the piston is made of an alloy-iron casting, being heat treated, machined and honed to a perfect fit. The wrist pin is a bronze alloy, and the steel connecting rod is hardened and lapped. The crankshaft is of steel. The crankcase is sand cast of aluminum with a bronze main bearing. The special Hurleman timer with exposed points is adjustable. The Hurleman boasts a new-style carburetor with a metal tank. The fuel is controlled by a sleeve valve which is vibration proof.

Ohlsson 60. In keeping with the reputation created by the Ohlsson 19 and 23, the 60 leaves nothing to be desired. In construction it is identical with the smaller engine. It has oversized wrist pin and crank pin, friction-free lower bearings and ball-bearing thrust bearings and an oversized large Venturi intake. The new models have a cast-iron piston, and like old-model Ohlssons, have a plastic molded gas tank with a jiffy tank cap.

O. K. Twin. Suited ideally for the experimenter and for radio-control models, the O. K. Twin is a reliable source of constant power. The steel one-piece cylinders have lapped steel pistons to match. The crankcase is die cast from aluminum with bronze and ball double bearing. The connecting rod is drop forged of steel and is of one piece, made possible by the unique patented crankshaft guide. The timer, of the automobile type, is adjustable with exposed contact points. The intake Venturi is designed to permit the installation of a butterfly control.

O. K. Special and Deluxe. The .49 is the newest addition to the O. K. line. It is especially designed for models at the bottom of the Class C category and is of the same general design as the other single-cylinder engines in this line. Utilizing the same die-cast aluminum cases, the three different single-cylinder models vary only slightly from each other. The 49 and the Special both mount the same type steel cylinders fitted with lapped pistons of the same material, but the 49 has a shorter stroke, uses a ¼" x 32 (V-2) in place of the ⅜" x 24 (V-1) plugs, which is standard on all other O. K. motors. An aluminum rod is also substituted in place of the regular drop-forged steel rods on the .49. Although the Standard had the same displacement as the Special, the cylinder was different, having a finned head. The Deluxe model is of slightly greater displacement (.616 instead of .604) with a larger bore, and is completely run in. These Deluxe gas engines are all equipped with exhaust stacks. A translucent bakelite tank is standard equipment on all of the aircraft motors. Race car and marine versions of the above four motors are being shipped with fireproof metal gas tanks, and in addition to the flywheels are also equipped with a metal slide on the intake manifold to act as a choke.

Bunch Engine. Each one of the seven different model engines produced by the Bunch Motor Co. may be classified as being a member of either the Mighty Midget, Gwin or Tiger series of motors. While all are of the same displacement and the parts are interchangeable, the power output varies according to the purpose for which the engine was designed. This is accomplished by using various porting arrangements.

The Mighty Midget, from which all the other engines were developed, is of standard four-port design and exhausts straight back, for it has no stack. The Gwin Aero is similar, but has an exhaust manifold on the left side. Adapted from the Gwin, the Mighty Marine speedboat engine has a beveled exhaust stack on the right side and an eight-ounce flywheel.

The race-car version, called the Speedway, has a straight stack on the right side and comes with six-and-a-half-ounce flywheel. A unique feature of the Speedway is an extra intake port in the cylinder which admits air only directly into the combustion chamber. This supercharging port enables the motor to obtain the greater supply of air needed for the high speeds of race-car operation.

The latest Bunch development is the Tiger. Of the same bore and stroke, the Tiger has fifty percent more port area. Six instead of the usual four square ports are used for the intake, by-pass and exhaust. This new arrangement practically extends the port openings all the way around the cylinder, thus accounting for greater efficiency at high speeds. All of the Tigers have a tapered exhaust stack on the right side. The Aero and Marine motors are essentially the same, the latter being equipped with an eight-ounce flywheel. The Speedway, for race cars, has an extra row of intake ports placed above the regular openings. Their purpose is to admit a greater charge of mixture by remaining open for a longer period. The standard six-and-a-half-ounce race-car flywheel is also included.

Identical to each other in construction, all of the motors have a die-cast aluminum-alloy crankcase with a bronze main bearing and a hardened shaft. The cylinders are machined from solid steel, the finned head, intake, by-pass and exhaust manifolds being brazed in place. Of more than ordinary interest is the steel piston, for it is not only lapped to fit, but also carries two cast-iron rings as a double precaution against compression leaks. All connecting rods are chrome moly steel.

The motors intended for use in planes are supplied with transparent tanks, while the race-car and marine models come with metal tanks. With the exception of the Tiger series, all the above motors may also be purchased in kit form and easily assembled, for there is no machine work of any kind to be done. However, the kit engines (called standard models) differ from the factory-built motors (sport models) in the following respects: They have less fins, a 4:1 compression ratio instead of the usual 7½:1, the pistons are not lapped, and quite naturally have not been run in at the factory. This most complete line of Class C motors also offers as standard equipment the newly developed safety-lock hub nut.

Sky Chief. This low-priced Class C motor is especially popular with beginners. It has a die-cast crankcase with bronze bearing and aluminum die-cast connecting rod, and a three-piece crankshaft. The cylinder is machined of molybdenum iron and has a piston of the same metal with one piston ring. The timer is adjustable with exposed contact points, and the gas tank is transparent.

Rocket (formerly Silver King). This engine, made by May Motors of Detroit, Mich., features a rotary valve, which has its bearing in the crankcase back-cover plate with carburetor tubes screwing into the plate directly behind the rotary valve. The whole assembly supports the gas tank. The case and the cylinder are die cast of aluminum. The steel machined sleeve integral with head is assembled to the cylinder in the process of die casting. The piston is steel and lapped to match. The connecting rod, wrist pin and crank shaft are all hardened steel. The carburetor is inside the gas tank, the timer is adjustable with exposed contact points. The Rocket has a transparent tank.

Molnar. This engine comes in two sizes—.78 and .99 cubic inches. This engine is especially suited for large ships and has flown models having a wing area of twenty-eight square feet and weighing nine pounds. The crankcase is aluminum alloy with Oilite bearings. The cylinder is machined from solid chrome moly as is the head, which is attached by means of fixed bolts. A ringless chrome moly piston is used and is lapped to the cylinder. The wrist pin is made of tool steel with two keys to prevent it from sliding. The steel rod has a bronze bearing at the lower end. The crankshaft and cam are also made of chrome moly. The shaft being tapered, maintains compression in the case. The contact points are exposed but are so situated as to prevent oil splashing. The timer is adjustable. The metal gas tank has a one-and-a-half-ounce capacity and its attached to the intake tube and crankcase.

Comet 35. Manufactured by the Comet Model Airplane Co., this motor is perfect for smaller Class C type models. The Comet 35 features a rotary valve and down-draft carburetor. It also features a flexible extension on the needle valve which permits adjustments away from the prop and exhaust, eliminating barked and burned fingers. The cylinder is made from solid bar stock of special alloy steel with fins integral. The piston, which is made of special cast iron machined from the solid bar, is lapped to the cylinder without oil grooves. The connecting rod is of aluminum alloy die cast connected to a bronze wrist pin with a crankshaft that is machined from solid bar stock hardened and ground. The motor is made for beam mounting. The by-pass is brazed to the cylinder and the motor may be used with suction feed or gravity feed. The manufacturers claim 1/5 horsepower and forty-five-ounce minimum thrust on this engine. Accelerated service tests are just being completed and not until they are absolutely complete and quantities of motors are in stock will the Comet 35 be ready for national distribution. National advertising will announce when ready.

New Atwood Champion. This is a new improved version of the Atwood twin rotary-valve engine made easy to adjust by means of a single down-draft carburetion system. Originally, this engine required a separate needle valve for each carburetor. It is designed and built for race-car operation, therefore it should develop more than enough power to satisfy the model-aircraft builder.

The crankcase is die cast, and the cylinder and piston are made of special alloy iron lapped to fit. A separate finned head and the cylinder are anchored through the crankcase by means of three bolts. The connecting rod is die-cast aluminum with special cast-in bearings. The exhaust ports utilize virtually the entire cylinder diameter. The by-pass manifold die-cast integral is extra large. The wrist pin is made of steel with aluminum end pads. Automobile-type timer is adjustable, with exposed points.

Super Cyclone. Both the crankcase and the cylinder are made of die-cast aluminum alloy. The cylinder has a cast-iron sleeve, and the piston is made of hardened steel aluminum lapped to fit. The connecting rod is die cast with top and bottom bearings. The wrist pin is tubular, and the crankshaft is machined out of one piece of special alloy. The timer is adjustable with exposed points. Fuel admission is through a rotary crank valve in the shaft, with the down-draft-type carburetor. The cam is made of hardened steel, and the engine has heavy-duty ball-bearing thrust bearings with hardened steel races. The fuel tank is attached to the back of the crankcase and is made of transparent plastic with a large snap-cover filler. The Cyclone comes in upright or inverted types, with single ignition or with dual ignition. While the value of two spark plugs on a single-cylinder engine is questioned by some, in actual tests it was found that the engine with dual ignition ran more consistently and delivered more power.

(See page 54)

Air Trails Advertisers April 1941

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