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AIR TRAILS



Your Money's Worth in the Air by LIEUT. W. M. WOOD

15¢

APRIL 1938



FULL PAGE PHOTOS OF MODERN PLANES

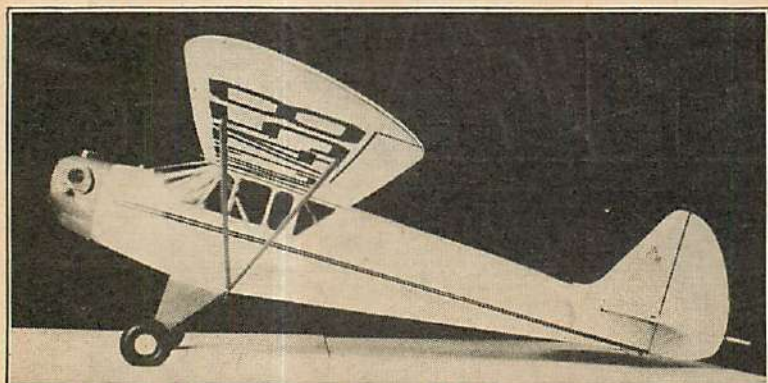
The Plane on the Cover ★ Gliding and Soaring

30 Features ★ Trophy-Winning Models ★ Light Planes

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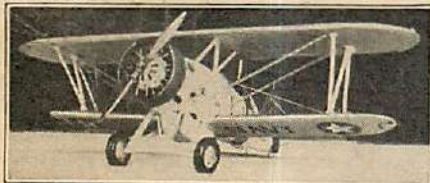
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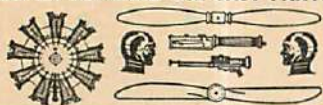


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STREET & SMITH
PUBLICATION
Volume X No. 1
April, 1938

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Single Copy, 15 Cents
Yearly Subscription, \$1.50



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Monthly publication issued by Street & Smith Publications, Inc., 79-89 Seventh Avenue, New York, N. Y. Artemas Holmes, President; Ormond V. Gould, Vice President and Treasurer; Henry W. Ralston, Vice President; Gerald H. Smith, Secretary; A. Lawrence Holmes, Assistant Secretary. Copyright, 1938, by Street & Smith Publications, Inc., New York. Copyright, 1938, by Street & Smith Publications, Inc., Great Britain. Entered as Second-class Matter, January 11, 1937, at the Post Office at New York, N. Y., under Act of Congress of March 3, 1879. Subscriptions to Cuba, Dom. Republic, Haiti, Spain, Central and South American Countries except The Guianas and British Honduras, \$1.75 per year. To all other foreign countries, including The Guianas and British Honduras, \$2.25 per year.

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PUBLICATIONS, INC.**
79 Seventh Avenue
New York, N. Y.

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Aviation Is Growing Fast

Get into Aviation now—when you can still get in on the ground floor of a new industry—when you have a chance to forge ahead without having to displace lots of older men. Aviation is a young industry, where young men earn real money. Most famous pilots are in their early thirties, or even younger. It is a young man's industry, which means that there are plenty of opportunities to forge ahead. But just because it is run by young men, don't get the idea that Aviation is a small business. Millions are being spent yearly to develop and improve

Here are just a few of the many well-paid jobs in the fast growing Aviation Industry

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Shop Foreman	Radio Operator
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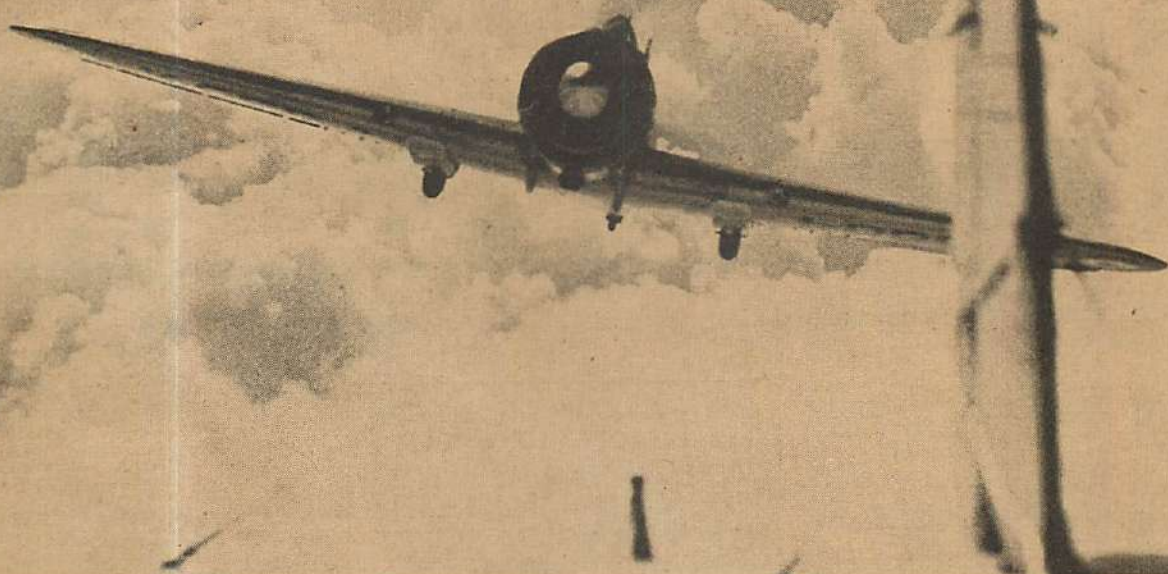
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AIR Progress



A Summary of Aviation News

TRANSPORT

THREE airplanes belonging to the British International Air Freight, Co., Ltd., have been licensed to carry motor cars. They are also fitted to carry horses.

An effort to work out a new reciprocal arrangement for the navigation of airplanes over the commercial routes between the United States and Canada was started in Washington recently. The most important problems involved fields that were adequately lighted and suited for night landings of passengers and mail, the installation of radio beacons synchronized between Canadian and American stations and the size of airports and hangar space for airplanes that might use Canadian fields.

The LZ-130 Zeppelin will begin her regular transatlantic flights between Germany and the United States in June, according to an announcement made recently by the American Zeppelin Transport Corp., general agents in the United States for the German dirigible's owners and operators. The schedule calls for fifteen round trips with passengers, mail and express. The ship will use helium which will limit the accommodations to forty passengers.

One hundred R. A. F. pilots are to be attached to the Imperial Airways and British Airways for special train-

ing. They will start by making an outward and a homeward journey in the cockpit of an airliner. Portuguese naval and military air force officers are scheduled to accompany the crews of the Pan American, Imperial Airways and Deutsche Luft Hansa flying boats on experimental flights between Lisbon and the Azores. A number of pilots are now undergoing an intensive course of modern air-line training in preparation for the new trans-Canada air mail which will start operations soon.

Air-France Transatlantique is still hopefully preparing a ground staff for transatlantic flying schedules. The company is negotiating with Portugal for the use of the Azores and with Great Britain for landing rights in Newfoundland. So far, nothing has come of these negotiations.

Luft Hansa has opened a regular twice-a-week schedule between Berlin and Bagdad. Junkers Ju.52s are being used on the run. Passengers aboard these planes may talk to telephonic ground stations up to a range of 40 miles through the plane's normal transmitting and receiving equipment.

The *Russian Clipper*, manufactured for Russia by Glenn Martin, is a far greater ship than the famed *China Clipper*. It has a gross weight of 63,000 pounds, a wing span of 154 feet and cruises between 145 (Turn to page 81)

How one of Britain's interceptors would look to an invading pilot. The new, fast Gloster rockets up from the clouds. The Gloster, now in experimental stages, is comparable with the Hurricane and Spitfire.

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ANOTHER DEPRESSION
CATCH YOU WITHOUT
A trade!**



The last depression boldly emphasizes two facts of great importance to young men now planning their futures:

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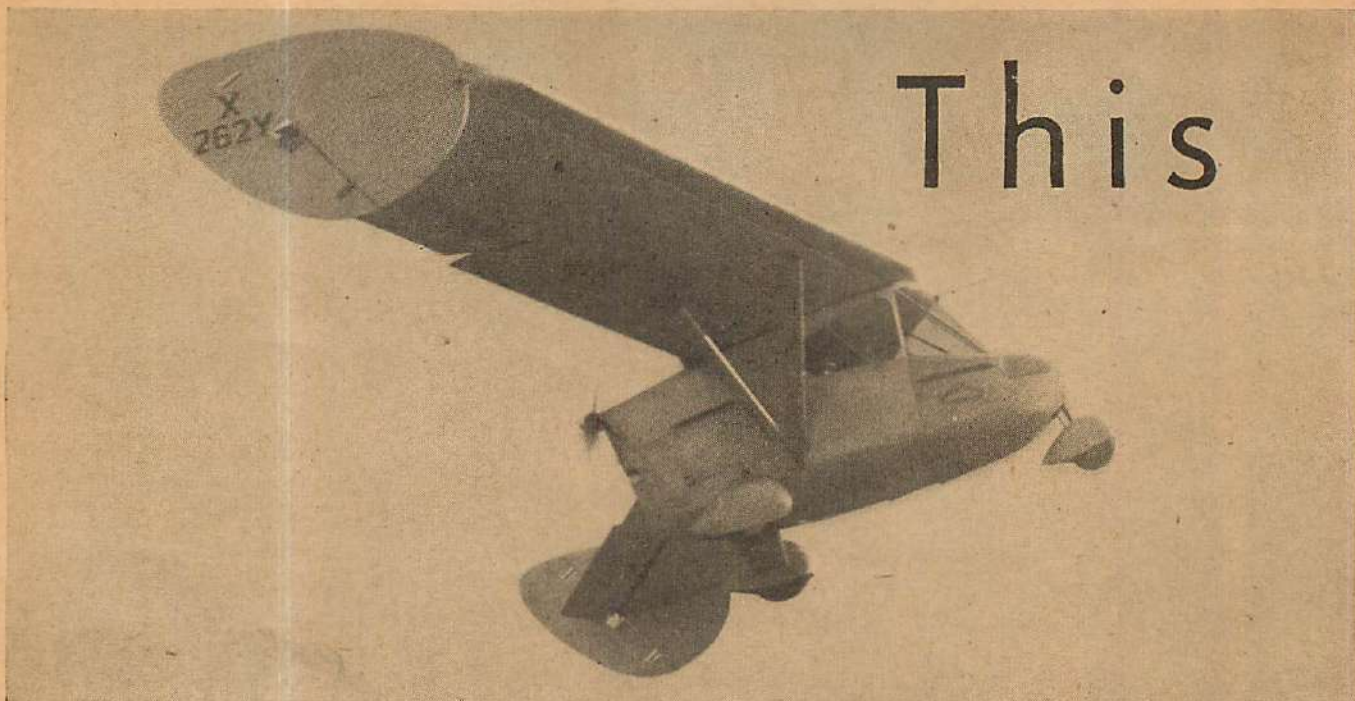
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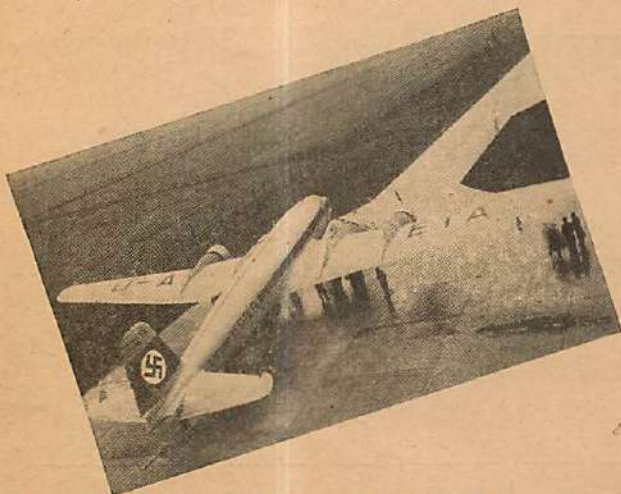
PTERODACTYL of the air is the Waterman Arrowbile, proven winged auto, with a 100 h.p. Studebaker auto engine. Without wings, the craft is driven on the ground like an auto by a clutch arrangement. Top speed in the air is 120 m.p.h.



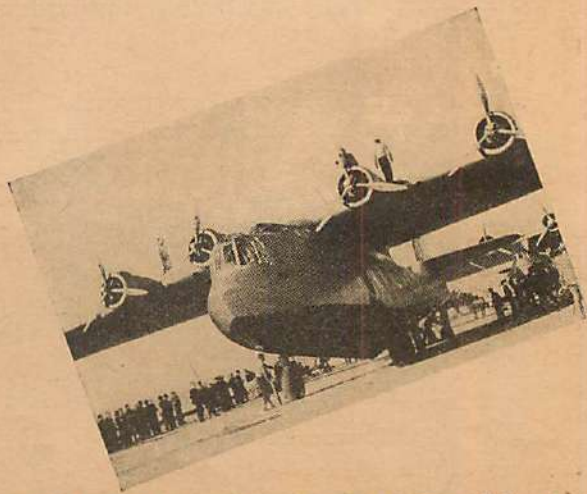
FLYING TRAILER is this Beechcraft, equipped with electric stove, running water, sleeping accommodations and other trailer equipment. Shown above are Lanny Ross, singer-pilot, Virginia Dale and Mary Russell, both actresses.



SKI PLANE of United Airlines inaugurated recently the new "Ski Special" Mainliner service. Eight of these Douglasses link Burbank, California, with Sun Valley Lodge, Idaho, and Broadmoor, Colorado. The ski planes are operated daily.

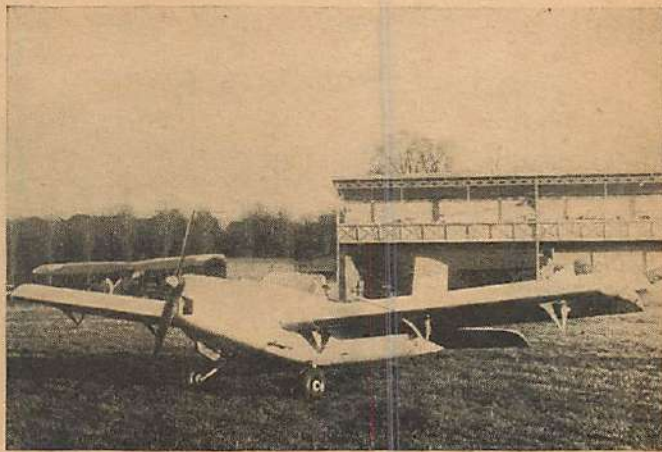


GERMAN SKYLINERS are a familiar sight on the Continent. The latest is this 26-passenger Focke-Wulf "Condor."

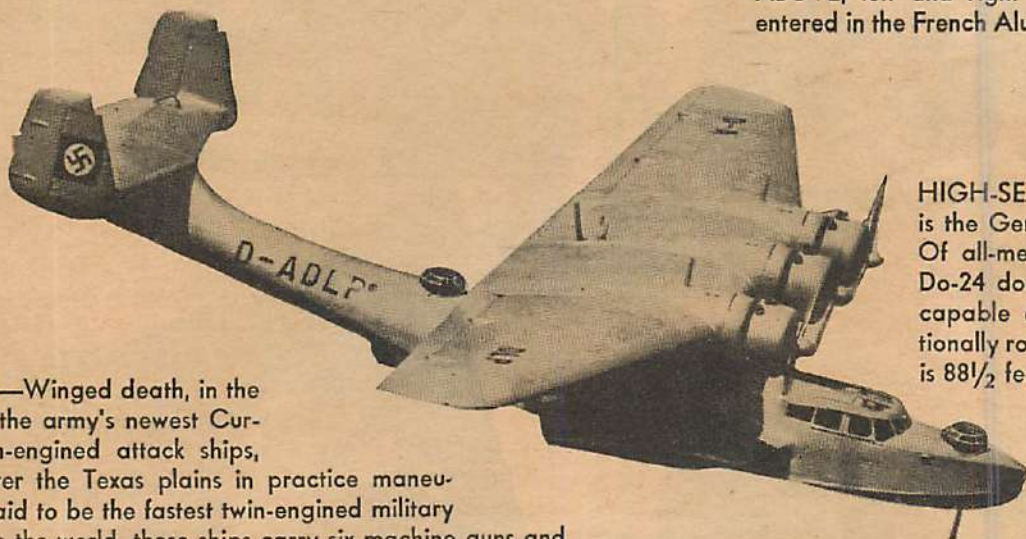


MAMMOTH FLYING BOAT of Consolidated is completed on the coast. Called the XPBY-1, she will compete for new navy contracts.

Winged World

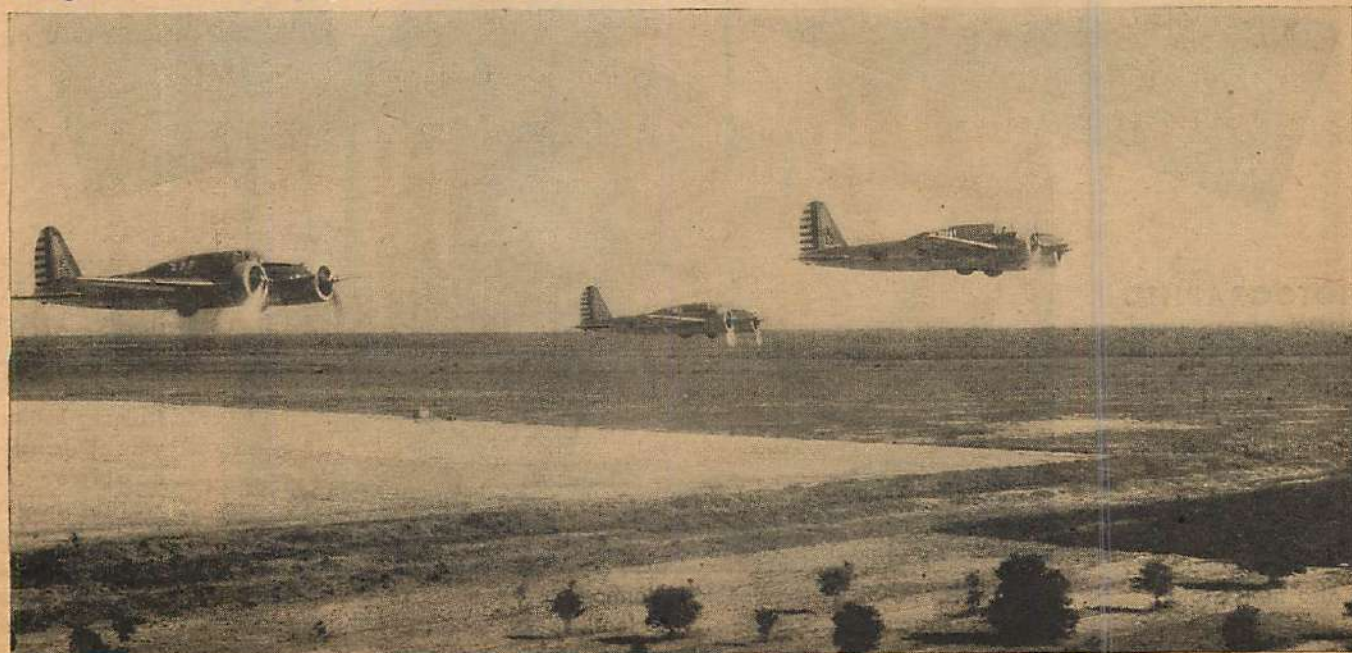


ABOVE, left and right—Freak light planes entered in the French Aluminum-Competition.

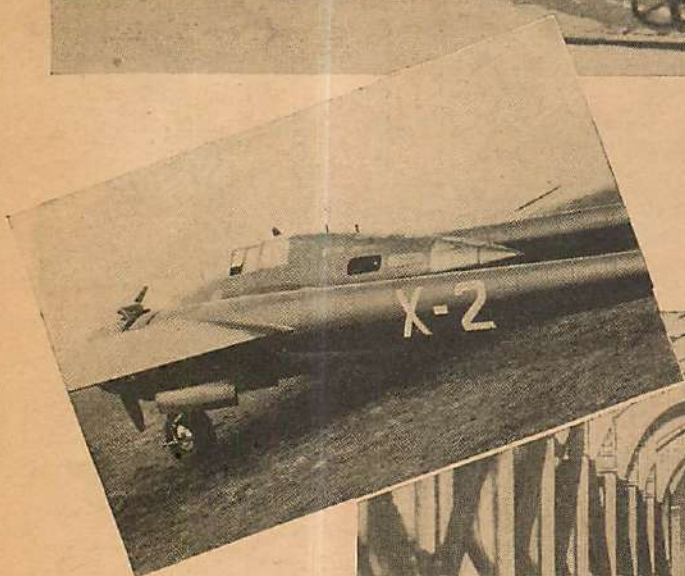


BELOW—Winged death, in the form of the army's newest Curtiss, twin-engined attack ships, roars over the Texas plains in practice maneuvers. Said to be the fastest twin-engined military planes in the world, these ships carry six machine guns and a large bomb load. The engines are 1,000 h.p. Cyclones.

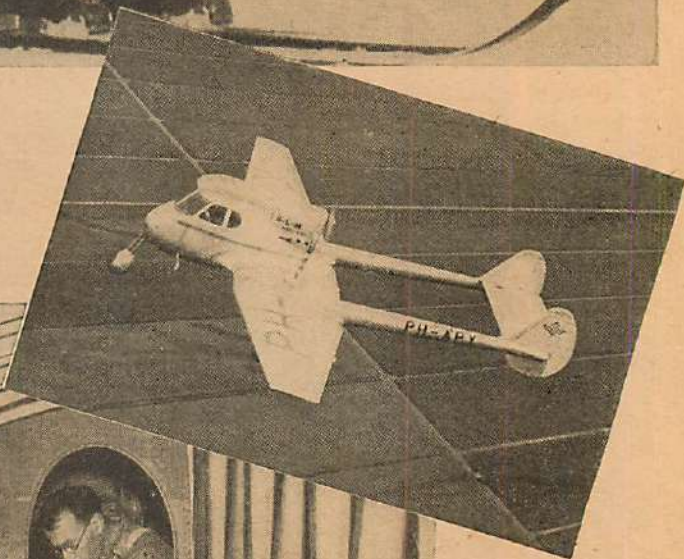
HIGH-SEAS FLYING BOAT is the German Dornier Do-24. Of all-metal construction, the Do-24 does 186 m.p.h. and is capable of riding out exceptionally rough water. The span is 88½ feet, the length 72 feet.



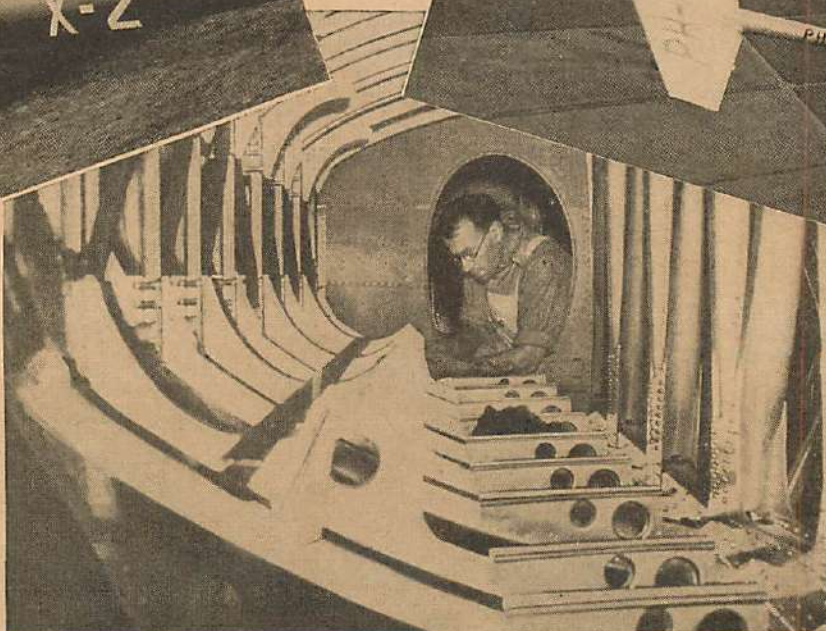
FLYING SKIER glided to a one-point landing—on his nose. Tested by John King, these wings are made of metal and add another thrill to skiing. The trick is probably more difficult than it appears, what with no tail to provide stability.



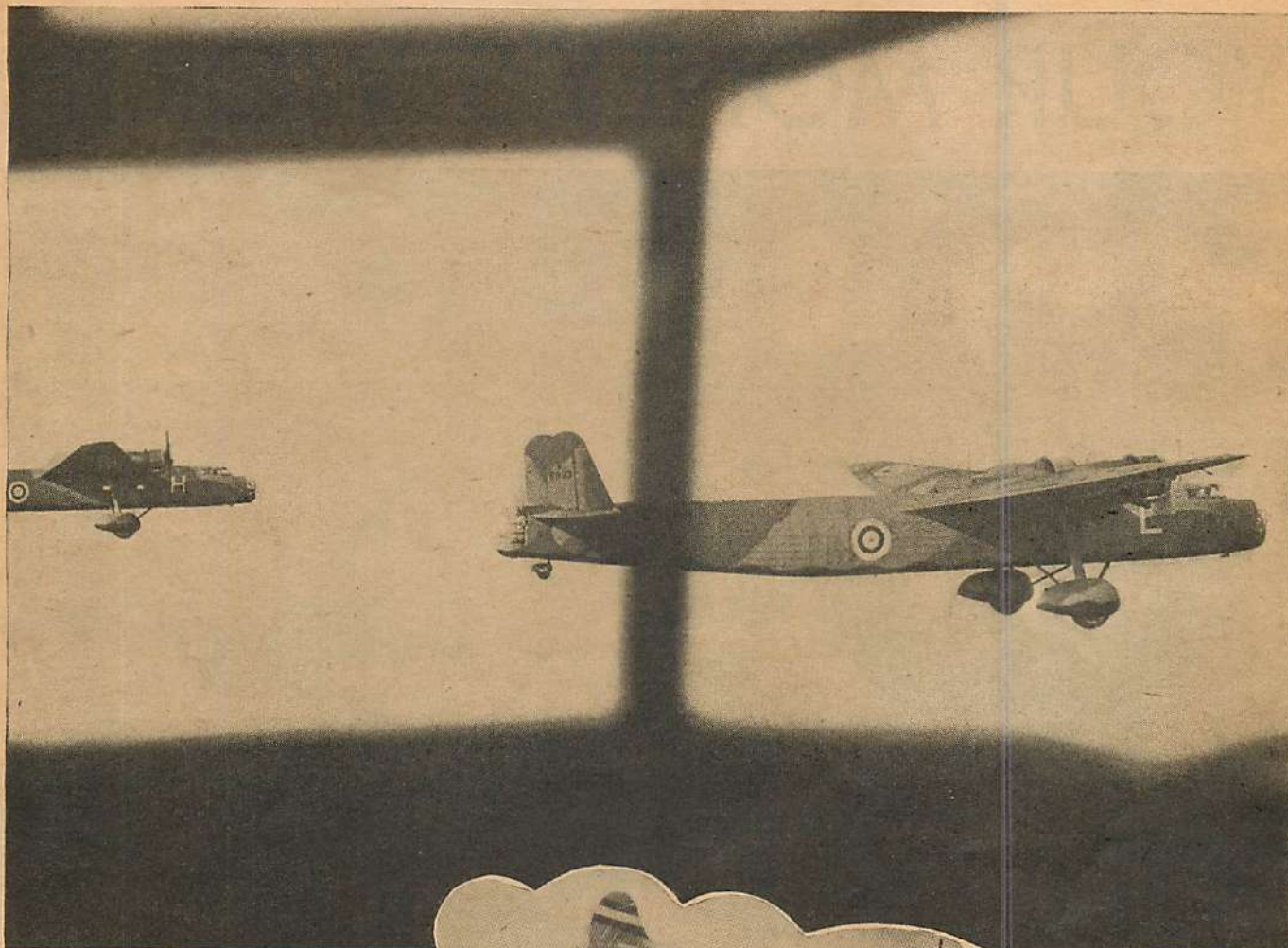
PHOTOGRAPHIC STUDY of the Dutch Fokker G-1 attack plane. The pointed turret visible revolves, keeping the gunner upright regardless of the banking angle of the ship. The many, glass observation panels are also noticeable.



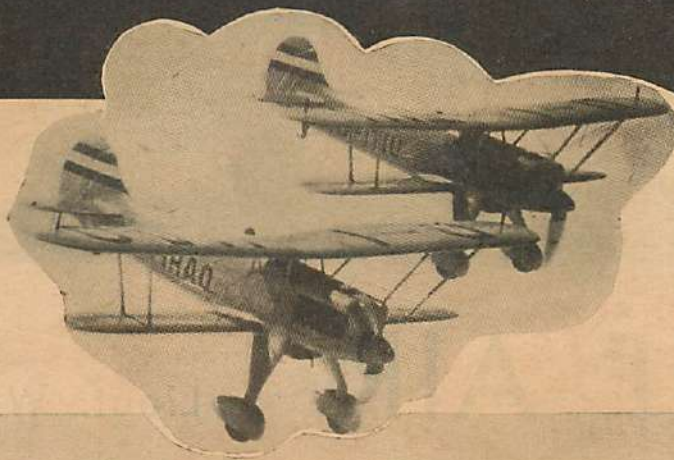
FLYING TRICY-CLE abroad finds the Stearman-Hammond utilized for air-line training in three-wheel landing routine. The world-renowned K. L. M. anticipates the three-wheeled transports, probably Douglas DC-4s.



LEADING EDGE of the Boeing Atlantic Clipper indicates the immensity of the structure. Spanning 152 feet, these seagoing Goliaths will cruise 3,200 miles, carry 50 passengers with sleeping accommodations.



HEAVY BOMBERS, British Handley Page Harrows, seen from the gun turret of a sister ship. The port through which the picture was taken is made of a transparent plastic. The Harrow weighs 23,000 pounds.

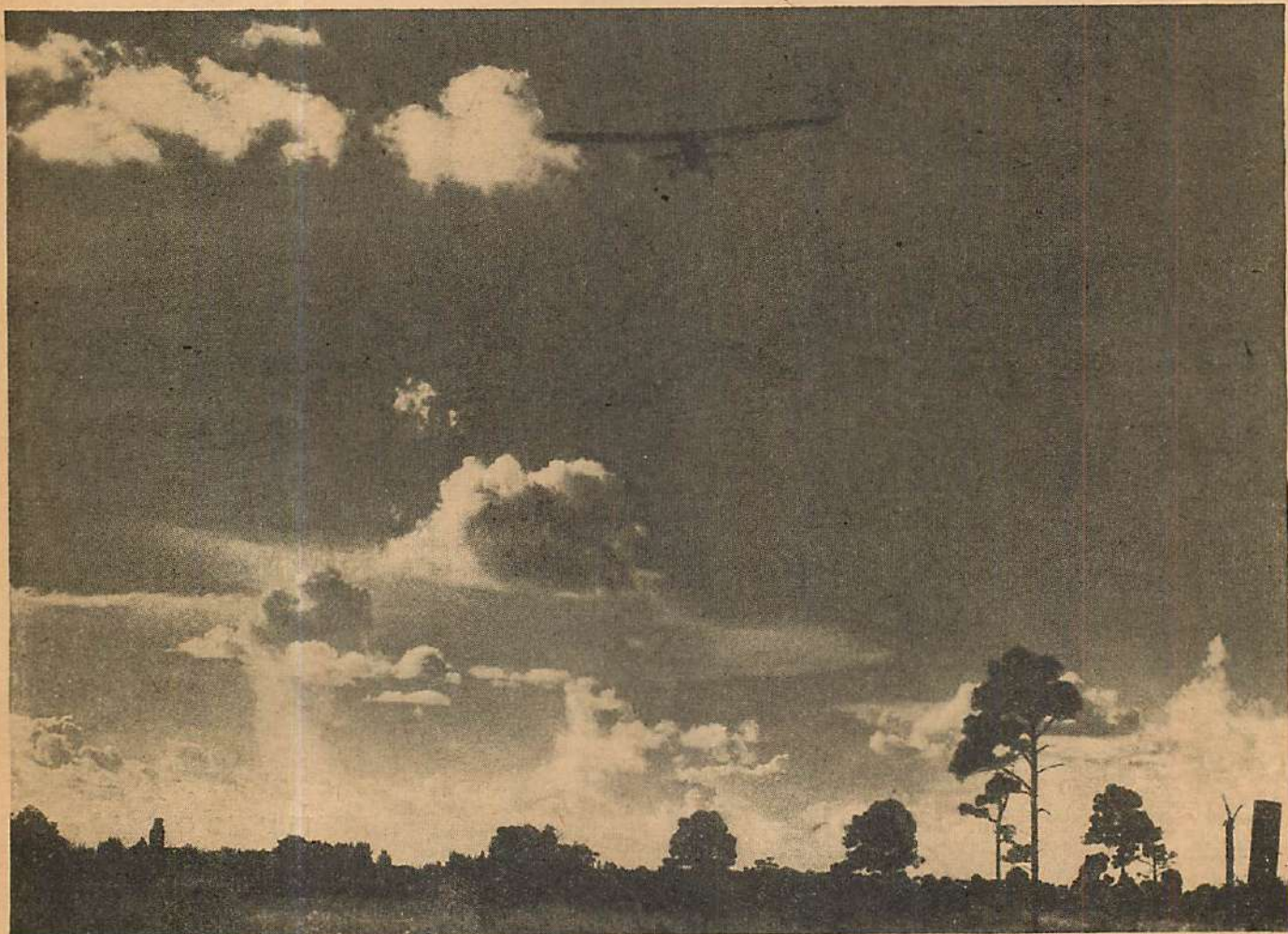


PULLING OUT of a dive in close formation tear two German Heinkel biplane fighters. These ships were the nucleus of the new Richtshofen squadron. Later, low-wing Heinkel replacements break 300 m.p.h. with ease.



BOY SCOUT PATROL becomes an actuality at Ramsgate, England. The scouts are trained how to be of service to the airport manager and pilots. In the formation of new patrols, only those who have reached a high standard of proficiency are accepted. The plane shown in the photo is a two-place, De Havilland Hornet Moth. A 130 h.p. Gipsy-Major engine drives the little ship at 124 m.p.h.

YOUR MONEY'S WORTH



IN THE AIR

By
Lieut. W. M. Wood

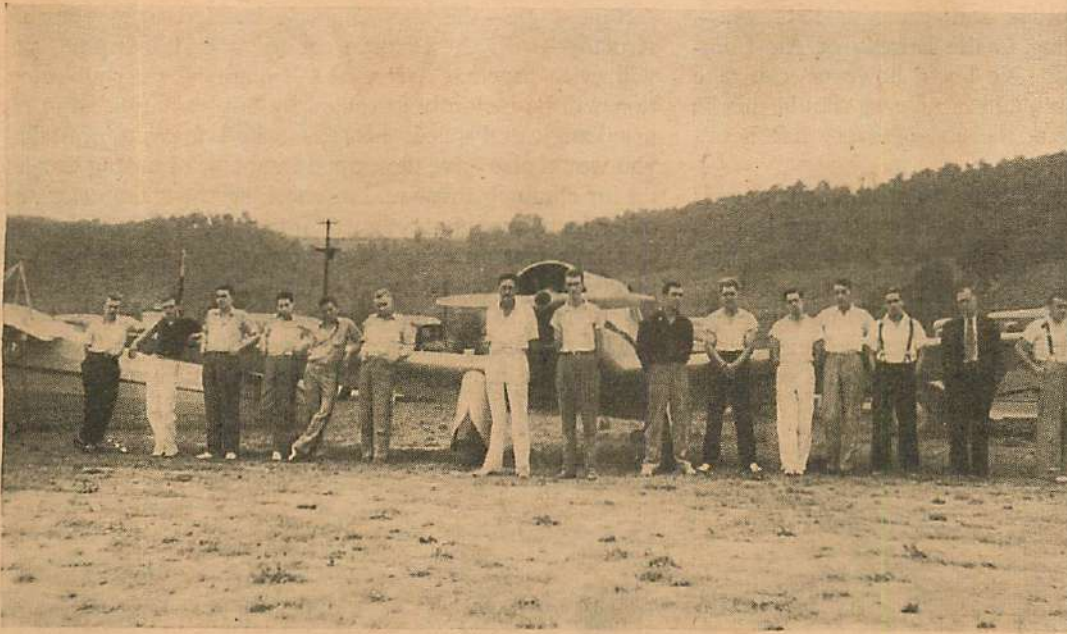
WOULD you go into a store, pay for a complete outfit of clothes, and then walk off and leave the shoes, hat and overcoat behind? Not if you knew it! Yet a great many people spend their hard-earned dollars for flying lessons and solo training and do what amounts to the same thing. A lot of flying students, some of whom I know personally, are not getting their money's worth.

Because of the conspicuous position experience in terms of hours occupies among the requirements for pilots' licenses, many students think too much about "getting in time." I knew a student once at a small city airport who bought a Waco of his own in which to get his time. He took ten hours of dual before solo and thereafter practically no more dual instruction. He would take off and circle round and round over the field, just sitting there keeping the plane in the air. He got in a lot of time—until he cracked up his ship one day trying to land in a cross wind. You see, he had failed to practice landing under normal conditions enough to develop the

skill required to meet a special situation. That boy was paying for his merchandise and coming away with practically none of it.

Every student should plan each flight carefully in advance. The importance of such a plan is fully realized when you remember that even in light planes flying time seldom costs less than six cents a minute. It is essential that you get in as many turns, spirals, landings, figure eights and other maneuvers as possible. This is best accomplished by a steady pace—you can't speed up the maneuvers themselves except by such expedients as cutting down excessively wide circuits in landing practice. But you can often arrange your flight so as to economize time, for instance, by practicing climbing turns or chandelles while gaining altitude for acrobatics.

More important than how *much* you practice is *what* you practice. Learning to fly well is a process first of acquiring *knowledge* as to how the various maneuvers should be performed correctly, and then of acquiring the *habit* of performing them correctly. You learn from your



In a flying club where each member gets flying time slowly, it is doubly important that time be used to the best possible advantage.

instructor, but you cultivate habits through practice. And bad habits can be as easily acquired as good ones.

Students left too much to themselves after soloing are likely to develop not only specific bad habits in preparing for the take-off and performing certain maneuvers, but, more serious, the general and deep-reaching habit of lack of precision, of sloppiness, carelessness, and contentment with low standards. The presence or lack of pride in excellence is an habitual attitude, which is as fundamental as self respect and affects everything the pilot does. It determines his "character" as a pilot. A "weak character" pilot is the kind most likely to take off without enough gas, to spin in or do something else equally inconsiderate of himself and his passengers. And to avoid becoming a weak character, a pilot must set his standards of excellence high to begin with and waste no time in developing the habit of living up to them.

No matter how anxious a beginning solo student is to do things right, he will, at first, always leave some things undone he ought to do and do others he ought not to do. These errors must be corrected before they become habits. The instructor's aid is absolutely necessary and for that reason continuance of dual instruction after solo is most important.

The emphasis which the army and navy give dual instruction is well known. My own Air Corps Primary Flying School logbook, for instance, reveals that I had 40 hours of dual instruction and only 38 solo hours on "A stage." On "B stage," army students get the same old approaches and air work, over and over, in the larger ships. I had 34 more hours of dual instruction. Only after a total of 74 hours of dual instruction—and 107 solo—over a period of eight months, came advancement to Kelly Field and release from close daily supervision.

Of course, many young men and women earning their own money and buying time cannot afford so much dual instruction. For that reason it is particularly important that they pay especial attention on instruction flights, take especial care with their solo work, and think each flight and each maneuver carefully through on the ground before going up. A good book on learning to fly can be of great assistance. A most informative little book is "Avia-



Precision should be a habit in flying. Use a pencil and paper to help you remember exactly what you want to do and how to do it.



The handshake of your instructor should not be one of farewell. His assistance and advice are of great value in early solo work, even in a light plane such as this Aeronca.

tion Training" (Aeronautics Bulletin No. 19), which may be had free by writing to the Bureau of Air Commerce, Washington, D. C. No book, however, can take the place of dual instruction, and in no case should this be cut to less than one hour at the end of every five hours of solo flying.

For most students the greater part of habit forming is done during solo flying. And here the student has his great opportunity—and frequently uses it to cheat himself deplorably. There is only one right way to perform a given maneuver, and a thousand ways to do it wrong. The habit of doing the thing right is strengthened every time you do it right, and weakened every time you do it

certain angle—the correct angle learned from your instructor—with the throttle set for a certain r.p.m., you will, with practice, arrive at the place where your attention will be instantly attracted by any variation from the usual angle and speed. Moreover, in flying with precision, you would also have developed the habit of nosing down a bit for climbing turns and of checking the tachometer and other instruments at frequent intervals.

That's just an example of how important the habit of precision can be in flying. One of its most important functions is to expand your "peripheral awareness."

The medical examiner tests your "peripheral vision," that is, your capacity to see things on which your eyes are



Official Photograph, U. S. Army Air Corps.

In the military services precision is preached in all phases of instruction. Army students study their plane, in this case a Seversky BT-8, and think through their problems on the ground.

wrong. You can do a thing many different ways within the bounds of immediate safety, but will fail to develop the valuable habit of doing it a certain way.

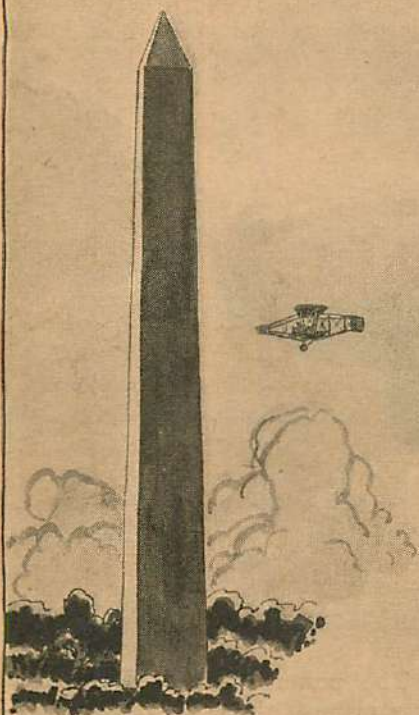
For instance, in climbing, if you climb more or less by guess, with no established throttle setting and no certain and invariable angle, you get used to different speeds and different angles in climbing. Some day your throttle creeps back a little or you decide to make a turn in a climb, and, being used to changes in speed, you pay no attention to the decrease in speed. Perhaps you have approached the stalling point, and about that time a sudden gust knocks the nose up or the high wing still higher, and you are in a spin before you realize what has happened.

But if you have an established custom of climbing at a

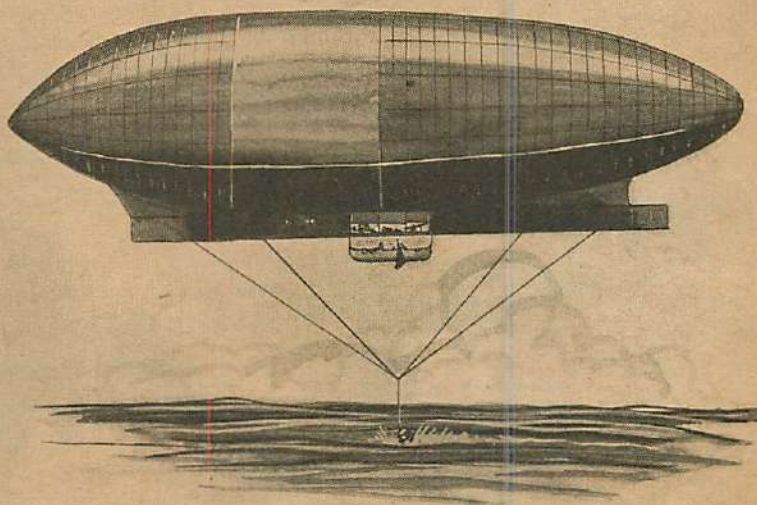
not focused. Your peripheral awareness, that is, your capacity to notice changes in conditions on which your conscious attention is not focused at the time, can be increased by precision flying. If you get used to things being a certain way when you are in a certain maneuver, if you grind into your subconscious mind by constant repetition the feel of things being "right," then any change will be instantly and strongly sensed as "wrong" and will attract your attention. This capacity is one of the most important in safe and truly satisfying flying.

By the time any student gets past his first solo flight it is time for him to be consciously practicing precision. Though he may not yet be ready for the so-called precision landings, he can practice precision in everything he does—even taxiing. For instance, do (Turn to page 78)

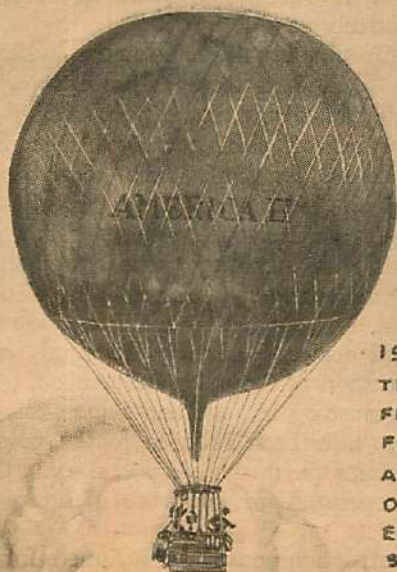
Pictorial History of Man in the Air



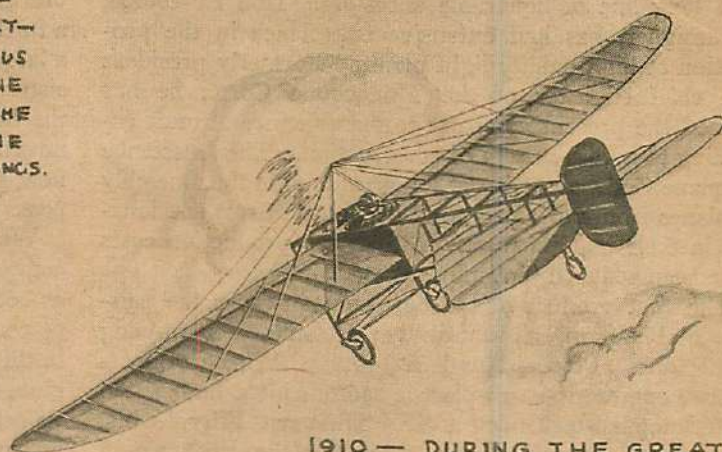
1910 - ON OCTOBER 14TH OF THE YEAR THE FIRST AIRPLANE WAS FLOWN INTO THE NATION'S CAPITAL! GRAHAME-WHITE, THE FAMOUS ENGLISH PILOT, FLIES HIS FARMAN BIPLANE FROM THE BENNING'S RACE TRACK, AROUND THE WASHINGTON MONUMENT AND LANDS IN THE STREET BEFORE THE WAR AND NAVY BUILDINGS.



1910 - ON THE FOLLOWING DAY BEGAN THE ATTEMPTED TRANS-ATLANTIC FLIGHT OF THE DIRIGIBLE "AMERICA" FROM ATLANTIC CITY N.J. AFTER TRAVELING 1,008 MILES TO A NEW RECORD AND RUNNING INTO VARIOUS DIFFICULTIES, THE CREW WERE RESCUED BY THE STEAMER "TRENT" IN MID-OCEAN.

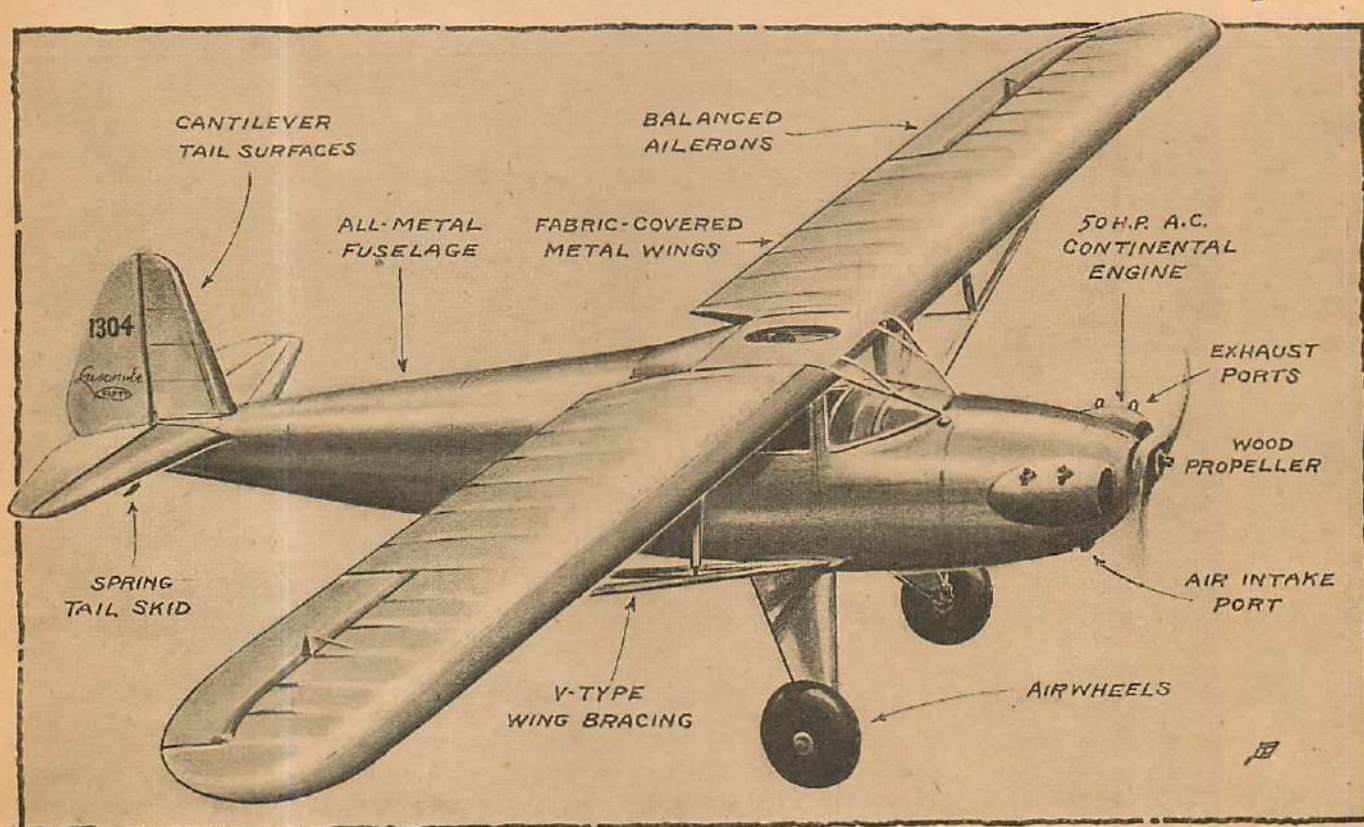


1910 - ON OCTOBER 17TH OF THIS YEAR BEGAN THE RECORD FLIGHT OF "AMERICA II", THE GREAT FREE BALLOON OF AUGUSTUS POST AND ALAN HAWLEY. THEIR FLIGHT OF 1,171.13 MILES IN 46 HOURS, ENDING IN THE CANADIAN WILDS, STOOD FOR YEARS, AND WON FOR THEM THE GORDON BENNETT BALLOON CUP.



1910 - DURING THE GREAT AERIAL TOURNAMENT HELD AT BELMONT PARK, LONG ISLAND, THE LATTER PART OF THE SAME MONTH, COUNT JACQUES DE LESSEPS WON THE GRAND PRIZE OF \$10,000 IN HIS BLERIOT MONOPLANE. THIS PRIZE WAS FOR A RACE AROUND THE STATUE OF LIBERTY AND BACK AGAINST MANY FAMOUS EUROPEAN AND AMERICAN AVIATORS.

The Luscombe "Fifty"



THE newly launched Luscombe "Fifty," featured on the cover of this issue, has the advantage of a long line of honorable ancestors. Don Luscombe, its designer, has had extensive experience in the production of high quality light planes. Formerly president and chief engineer of the Monocoupe Corp., he has formed the present company to manufacture aircraft according to a new system of construction. The Luscombe Airplane Corp. will restrict its operations to the assembly of planes from parts produced by outside firms specializing in their manufacture. In this way production costs have been reduced to a minimum.

The first product of the new company was the Luscombe Phantom, a beautifully streamlined high-wing monoplane. Powered with a 145 h.p. Warner Super-Scarab engine, the two-place Phantom hit a high speed of 168 m.p.h. and landed at 45. The new "Fifty," while smaller and lighter, closely resembles the Phantom in appearance and construction.

Like her elder sister, the "Fifty" is a two-place, side-by-side cabin monoplane with a high wing, braced externally by means of Vee struts. The wing structure is of metal throughout, with two I-section duralumin spars and stamped dural ribs. Fabric is used for covering. The fuselage features all-metal construction of the monocoque, stressed-skin type usually found only in more expensive aircraft. It is designed to permit sectional repair without complete dismantling. The landing gear of the "Fifty" is of the divided type, consisting of two streamlined side Vees and two half axles hinged to the under side of the fuselage. Low-pressure wheels and shock absorbers are provided to soften landing shocks.

By Frank Tinsley

The power plant of Luscombe's new plane is the equally new Continental A-50, enclosed in a cowl of unusual, but highly efficient design. The A-50 engine is a further development of the popular A-40, which powers a large percentage of to-day's light planes. Like its elder sister, the A-50 is an air-cooled, four-cylinder motor of the horizontally opposed, two-bank type. So many innovations in design and equipment are embodied in the new power plant, however, that to all intents and purposes it is an entirely new design.

Weighing approximately the same as the A-40, the new engine provides a 25% increase in horsepower as well as better propeller efficiency, resulting in a 50% greater power output for take-off, climb and level flight. Featured in the A-50 is the use, for the first time in an aircraft engine, of the Welcox-Rich hydraulic tappets. Eliminating tappet adjustment and lash in the valve-operating mechanism, this innovation not only assures the same valve timing, whether the engine is hot or cold, but also permits easy starting, smooth idling and maximum power in flight. With the added features of fully enclosed, automatic engine oil lubrication of the valve mechanism, plus complete sealage against oil leakage and fumes, maintenance and repair have now been reduced to the point where 15-hour inspections are no longer necessary. The A-50 may be safely operated for hundreds of hours between inspections.

Cylinder construction consists of a finned, forged steel barrel screwed and shrunk into the heat-treated Alcoa, cast-aluminum alloy head. The spark plugs are placed between the valves in vents extending into the combustion chamber to avoid possible oil fouling from the pistons.

Luscombe brings metal construction to the light-plane field— about the "Fifty," the plane on the cover.

The latter are permanent mold, Alcoa Lo-Ex trunk-type design with full floating rings. Rocker boxes, each enclosing two overhead Jadson valves, are located in the lengthwise plane of the engine. Ample area cooling fins on the exhaust ports, combustion chambers and spark-plug bosses result in adequate cooling. Tests indicate that maximum head temperatures can be held below 400° F. and cylinder base temperatures below 200° F. with 75° F. cooling air.

The forged, alloy-steel crankshaft is of the one-piece, four-throw type, supported by steel-backed, cadmium main bearings at the center and both ends. Plain thrust faces, formed on the propeller end throw and on a shoulder near the propeller, permit the A-50 to be used in either pusher or tractor installations.

The crankcase is a two-piece, heat-treated casting of Alcoa aluminum alloy, bolted together at the vertical lengthwise plane through crankshaft and camshaft. Rigid transverse webs hold the bearings and journals. A raw-hide seal prevents oil leakage at the propeller. Four engine-mount bosses for 3/8-inch bolts at the rear of the crankcase are adapted for rubber bushings to minimize vibration.

An up-draft Stromberg NA-S3 carburetor, connected to a cast-aluminum X manifold, is jacketed for exhaust hot-spotting. Steel intake pipes connect this manifold to each of the four intake ports. Exhaust outlets are normally placed above the engine, permitting a manifold which carries the noise and fumes over the top of a high-wing plane. An alternate system consists of downpipes at the rear of the engine, joined to a single exhaust outlet beneath the plane.

The A-50 is being produced in three types which, although basically similar, will afford a choice of accessories. Series 1 has a Scintilla magneto, pressure oil pump, tachometer drive and a dry sump with gravity scavenging. Series 3 is identical, except that it is fitted with two magnetos to meet export requirements. A full complement of accessories is offered with the Series 2 engine. These include dual battery ignition, drives for starter, generator, scavenge and pressure oil pumps, fuel pump and tachometer. It is shielded for radio.

All engines in the A-50 series have a 3.87" bore, a 3.62" stroke and a displacement of 171 cubic inches. The compression ratio is 5.4/1. The dimensions are: length (Series 1) 30.41", width 31.69", height 23", weight 150 pounds. As you may gather from its designation, the A-50 delivers a maximum of 50 h.p. at 1,900 r.p.m., its fuel consumption at that speed being 4.5 gallons per hour. Cruising at 85% throttle reduces the consumption to eleven quarts per hour. Oil is consumed at a rate of slightly under one pint per hour. Although 65 octane fuel

may be used, the manufacturer recommends 70 octane or better.

The appearance at the present time of this new plane and engine should provide a healthy spur to existing competition in the low-price field. This, of course, is to the advantage of light plane clubs and pilots who will undoubtedly view the newcomers with the greatest interest. At this writing, Luscombe is still testing the "Fifty."

Editor's note:

Shortly after Mr. Tinsley's article was received, several new 50 h.p. motors have been announced by manufacturers, old in the industry, but new in the light plane powerplant field. He sends us the following data on two of them:

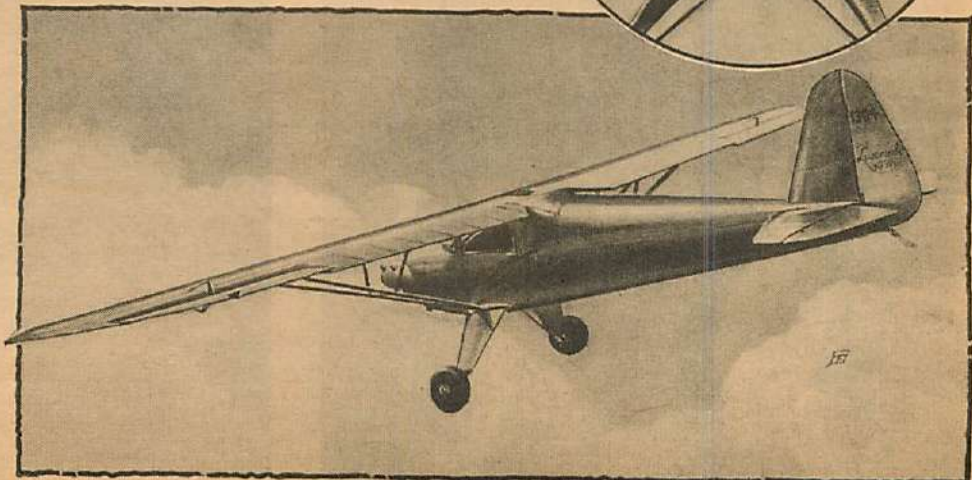
LYCOMING 0-145

Four-cylinder, horizontally opposed, air-cooled, direct-drive engine developing 50 h.p. at 2300 r.p.m. Specifications: Bore, 3.625 in., stroke, 3.50 in., displacement, 144.5 cu. in., height, 19.78 in., width, 29.50 in., length, 23.75 in., weight (dry), 160 lbs., compression ratio, 5.75:1, fuel, 73 octane.

MENASCO M-50

Four-cylinder, horizontally opposed, air-cooled "L"-head engine rated at 50 h.p. at 2550 r.p.m. Specifications: Bore, 3.50 in., stroke, 3.75 in., displacement, 144.4 cu. in., length, 28.25 in., height, 21.16 in., width, 28.37 in., weight (dry), 156 lbs., compression ratio, 5.25:1, fuel, 73 octane.

The nose design of the "Fifty" is interesting. The scoop type cooling of the Continental engine is highly original.



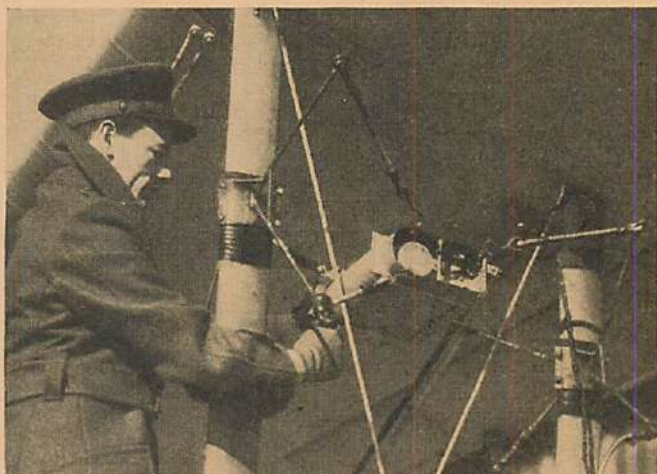
Already famous because of the Phantom, Luscombe's newest design is a capable light plane fitted with the new 50 h.p. Continental engine.

WEATHER TEST PILOT



The weather test plane is wheeled out of its hangar at Mitchell Field, Long Island, each day at dawn, rain or shine.

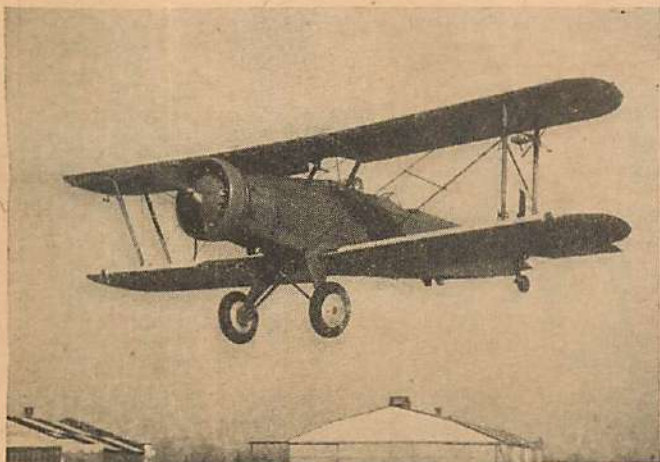
Below—Not the man from Mars, but Lieut. R. W. Catlin, clad in heavy flying suit and special mask to keep his face from freezing. There are slits in the mask for oxygen tubes. High altitudes, open cockpits, and inclement weather make rigorous demands on the airman.



Lieut. R. E. Beebe, in charge of the weather office at Mitchell Field, affixes recording instruments to the wing struts of the weather plane. As the ship climbs to 15,000 feet, barometric pressure, temperature, humidity and other pertinent weather conditions are recorded.

Below—Lieut. Catlin getting into the Douglas BT-2, preparatory to his daily weather hop.





The weather test plane, climbing from Mitchell Field in the early dawn. The cluster of instruments may be seen hanging between the outer interplane struts.



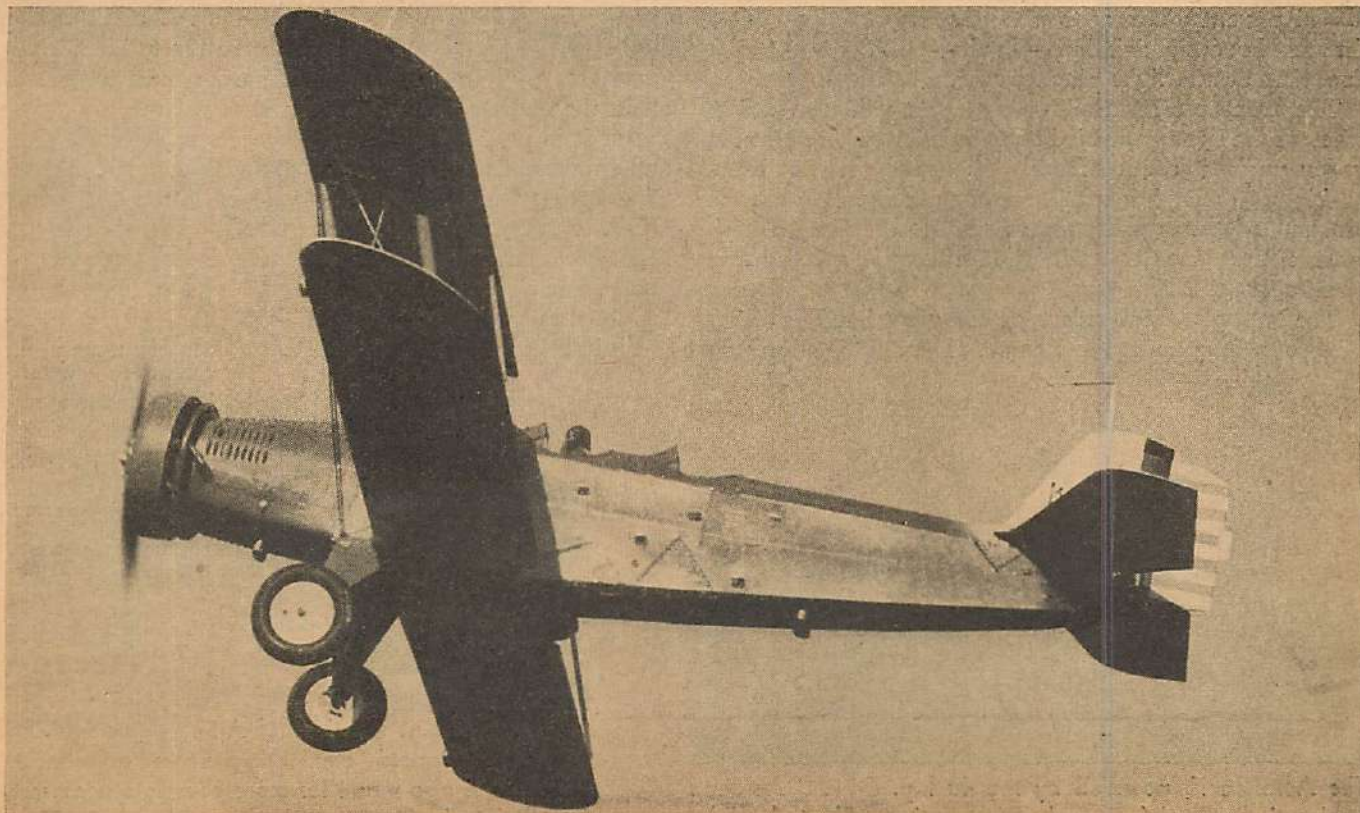
As the plane climbs, Lieut. Catlin keeps in touch with the ground by means of a two-way voice radio. Aloft daily, he can report flying conditions to the ground.



The radio officer on the ground at Mitchell Field keeps in constant communication with the weather plane during its daily observational flight.



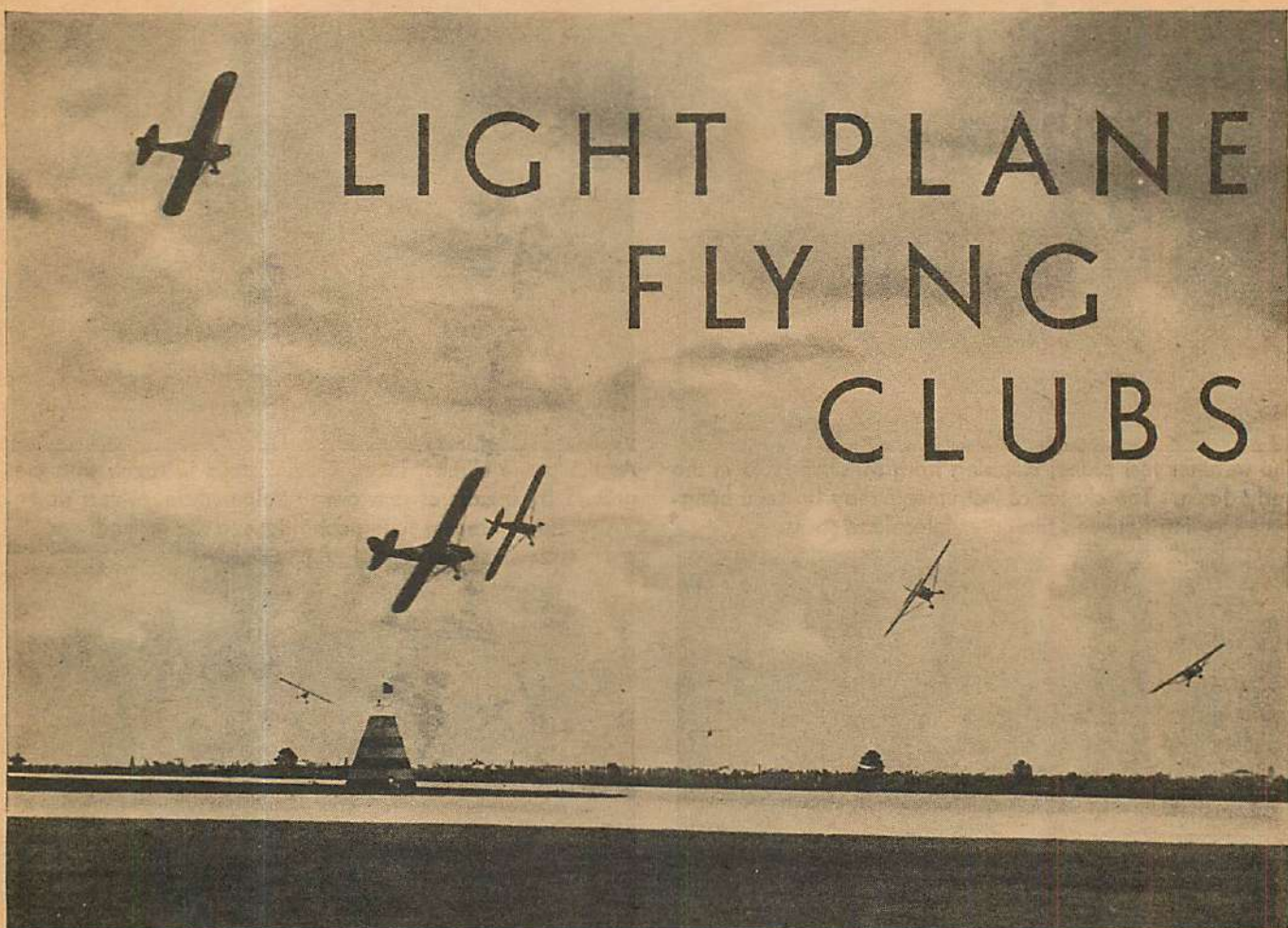
On the ground again, Pilot Catlin checks out, signs report of the weather flight.



The Douglas BT-2 weather test ship, seen from an accompanying plane.



LIGHT PLANE FLYING CLUBS



Light planes were prominent at the 10th Annual All-American Air Races held in Miami, December 4th. Shown above are entrants rounding a pylon in the special light plane racing event.

THE question often comes up when we get on the subject of planes and pilots, as to who gets the most fun out of aviation—the air-line pilot or the light plane owner.

The transport man, of course, gets paid for flying, whereas the light plane bird often wonders where his next gallon of gas is coming from. The transport pilot has a position in life and a certain social standing. He has the air routes kept open for him and flies the finest equipment money can buy. A good transport pilot draws down about \$9,000 a year.

The light plane enthusiast, on the other hand, is something of a mug about the airport. His ship is shoved in

Conducted By
Arch Whitehouse

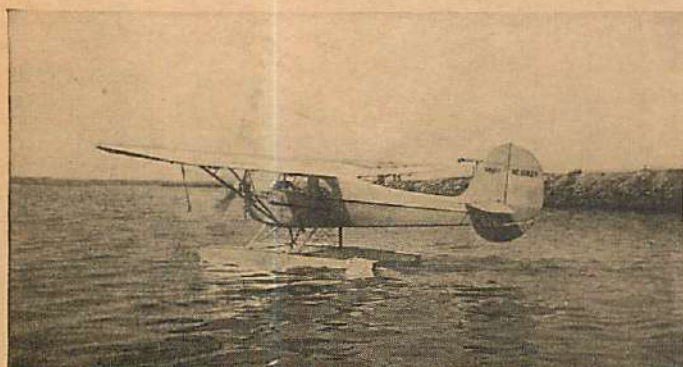
any corner that's available and he usually does most of the servicing work himself. He is limited in his flying scope according to his license and has more trick laws to worry

about than all the air-line pilots put together.

But it is my impression that he gets more actual fun and enjoyment out of his fifty h.p. and 178 square feet of wing area, than the Douglas captain draws out of a DC-3. I may be wrong, but I can't help remembering a little squib that appeared in C. G. Gray's magazine *Aeroplane* some time ago. It went something like this:

Just ahead was my objective.

With relief I switched off the automatic map-feed.



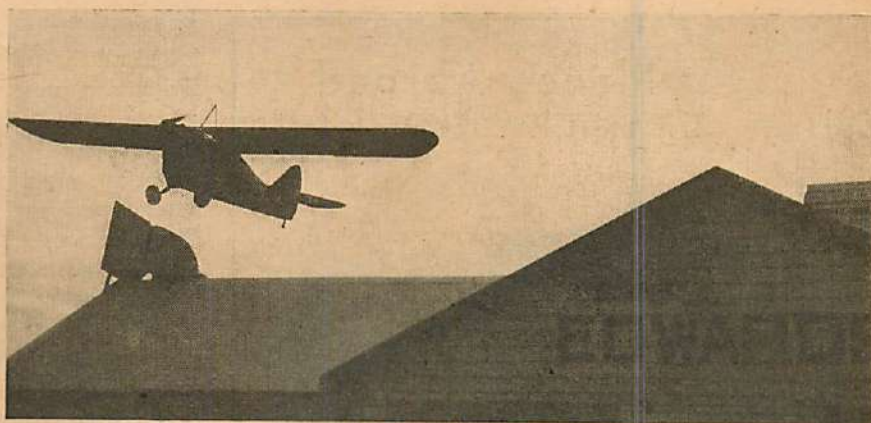
The Aeronca K, powered by the 40 h.p. E-113C Aeronca engine, is licensed for seaplane operation. Floats by Edo.



The new 50 h.p. Continental A-50 engine features hydraulic tappets, eliminating valve adjustment. Provision is also made for more complete accessory installation. The A-50 can be had with dual ignition.

NOTICE!

Due to the rapid growth of interest in light planes we have found it necessary to increase this department to three pages with this issue.



An Aeronca C-3 of the Edwards Flying Service at Flushing Airport, L. I. Edwards operates five Aeroncas—two C-3s, one K, one KC, and one low-wing.

Turning to my radio, I switched in my range beacon.
I wound in the direction finder.
I requested permission to land.
I turned on the infra-red landing lights.
I wound in the aerial.
I protruded the retractable venturi.
I switched off the de-icer.
I switched off the cabin lights.
I unlocked my slots.
I lowered both legs of my retractable undercarriage (I hope).
I wound down the retractable tail wheel.
I altered the pitch of my variable-pitch airscrew.
I switched off the cockpit heater.
I wound down my slotted flaps.
I wound the tail-adjustment wheel back.
I closed the throttle and wound out my landing lights.
I wound in my radiator.
I wound in my retractable oil-cooler.
I switched off the air conditioner.
I looked out again and found that it was the wrong field.

So, opening the throttle, I flew swiftly away, winding everything in and out again as I went.

I'm a modern air-line pilot.

No. They can have it.

I used to hope that some day I could sit at the controls of a giant flying boat and direct a course between New York and London. I could see myself in a swanky cap, tunic and wings. I really believed I would be doing

something for aviation. But it's getting too involved to be any fun any more. I'll take a fifty h.p. Blight Special and be monarch of all I survey. It might only be a ten-dollar compass, a dirty-faced tachometer and an altimeter with a cracked glass, but it will be all mine.

Besides, you don't worry so in a ship that tips the beam at 970 lbs. with its winter underwear on. Let them kid you all they like. When you're flying your own on your own ticket, you're on top of the world. If you don't believe it, take a walk out to your nearest airport any day and see what the crack air-line pilots do once they are released from the cockpits of the airliners.

Sure they do. They trundle out their little Cubs and Aeroncas and take the air—to get back to earth, so to speak.

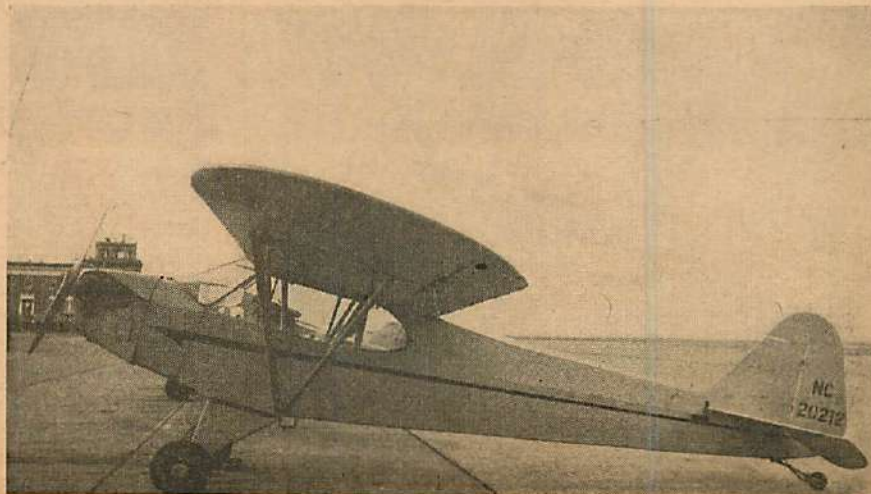
Some of this is on the humorous side, of course. We have to soften up the grind somewhere, but there's a world of truth in it. If you are one of those birds who stands pensively watching the uniformed pilots take the airliners off, hoping and praying that some day you, too, can take the left-hand seat on a Douglas, don't let it get you down. There are many worse objectives in life, of course. But no matter how far you go, you'll never get the thrill you had the day you went solo in your own ship.

I am often asked why it is that so many great War pilots quit the game the minute the last shot was fired in 1918. There are a few—a very few—of the big names of 1918 left in aviation, and there's a reason for it. Once they were taken away from their Spads, Camels and



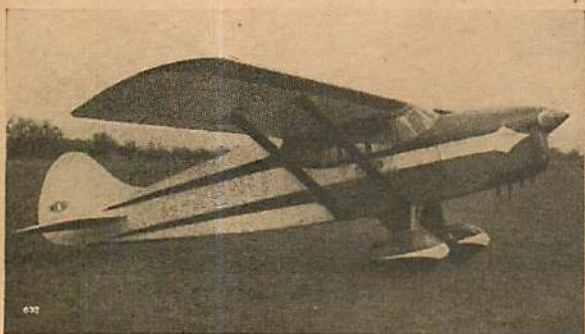
Above—W. J. Viau of the Automobile Club of California, Culver City, with his Rose Parrakeet.

Right—The 1938 Cub incorporates a number of minor structural refinements. This ship is licensed for 1,000 pounds gross load on the 40 h.p. Continental.



Light Planes Abroad

THE BRITISH WICKO



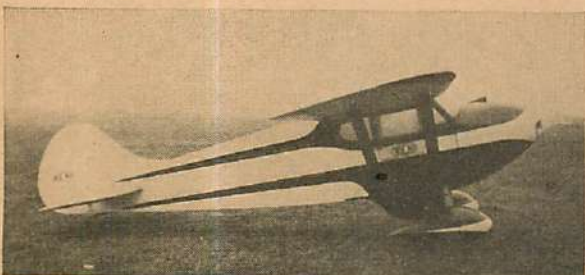
Although Wicko appears to be a rather queer name for an airplane, the ship itself is very easy to look at and also very pleasant to fly. Its make-up is also a little on the queer side, as an Australian designer, G. N. Wikner, produces the plane in England and uses in one model an American Ford V-8 engine in a converted version.

Design of the Wicko is not only conventional, but exceedingly clean. Its high wing has parallel strut-bracing and all-wood construction. The Clark Y. H. airfoil is used for the plywood girder-type ribs and solid spruce spars are the main wing members. A similarly simple type of wooden construction is used for the tail surfaces, which are fabric covered and without external bracing. Wing covering is also of fabric. This applies only to the original model, however, as plywood is forming the skin for the wings of those now being produced.

The fuselage features side-by-side seating for two and is rectangular in cross section—except for the rounded portion at the nose. This is also very simply constructed of spruce framing and plywood covering. A full cantilever landing gear is fitted and equipped with long, tapering wheel pants, with a spring leaf tail skid at the rear.

The original version of the Wicko mounted the Ford V-8 engine, and, reduced 2.3 to 1, it developed a maximum of 85 h.p. at 3,500 r.p.m. As a comparison, it might be well to mention that the Arrow V-8 conversion now being used in our own Arrow F low wing is rated at 82 h.p. with an r.p.m. of 3,075. Next fitted to the Wicko was a Cirrus Minor of 90 h.p., which led to a better job of streamlining because of its lower frontal area. Very popular in Britain, much as our Menascos are here, the Minor is the same type of engine—a four-cylinder, inverted, in-line, air-cooled job. This eliminates the radiator which was required for the Ford engine, and which was placed beneath the fuselage at a point between the landing gear struts—where it naturally added to the drag of the plane. So much better results were obtained with the Cirrus that production is now started with this as the standard motor for the plane. However, it will also be available with the Ford if desired. Tests are also under way using a 150 h.p. Cirrus Major, the Minor's "big brother." But this would remove the plane from the light plane class, which we feel extends only to ships of 100 h.p. or less. While not being as efficient an airplane, the Ford-powered Wicko is less in original cost and more desirable to some persons, who will find that the easy procurement of repair parts and the person to install them is a decided advantage.

In flight the Wicko is quite easy to control and visibility in all directions is sufficient, being aided a great deal by the large skylights fitted to the top of the cabin. Access to the ship is through two doors and a wider cabin is found in the production model than was originally planned. For a normal turn it is unnecessary to use the ailerons, as the ship automatically banks in the proper direction. The original ship landed very nicely, even without flaps, which are now being fitted, however. These should also assist on the take-off, although without their use it, too, is quite satisfactory. At stalling speed the Wicko behaves nicely, although it can be put into a spin if one tries purposely. Plowing along at only a 40 m.p.h. air speed, the ship will sink gradually, but will not nose over or fall off on a wing. If the motor is cut and the ship then stalled, the result will (Turn to page 87)



Top—The Wicko, Cirrus Minor of 90 h.p., does 120 m.p.h. Directly above—The converted Ford V-8 version is capable of 115 m.p.h. Weighs 1,700 pounds.

S. E. 5s, it was all over. The blind routine of schedules killed all the fun there was in it. The supreme feeling of living that came with solo flight in a single-seater, or even a two-seater, could never be replaced by the routine of airline business. It was all over the minute they took the uncertainty out of it. They were asked to be at the field at such and such a time, wearing such and such a thing. They were ordered into the air and told to go to such and such a place and get there on schedule. They had to—

But what's the use?

Let's get really serious about this light plane business.

Every big man in aviation today is complaining that there are not enough pilots available to assure certain defense of the country. Maj. Gen. Frank M. Andrews has said it. Secretary of War Woodring has said it. And many more will say it now that the ice is broken.

It is obvious that the government cannot train 2,000 men to fly bombers, pursuits and flying fortresses in the next year. But 2,000 men can be taught to fly. When you've done that much, you've increased the potential strength of the air services by 2,000 men. It would be simple for us to sit back and squawk about the government doing nothing about the light plane clubs. I have been one of the loudest squawkers in my time, but I am beginning to see the light.

The government can't support something that isn't there!

By that I mean that you must do something about it first. You and I must show someone that there is something to the light plane game—something worth backing up and boosting. We must form light plane clubs and we must fly, even though we have to dig down pretty deep in our own pockets to do so.

The manufacturers are beginning to see the light, too. Have you seen the new Cub? They'll sell you a Cub now, a 1938 model, for \$425 down. On top of that they'll give you a regular course of dual-flying instruction by a government-licensed pilot in your own new Cub—FREE.

You can't ask any more than that.

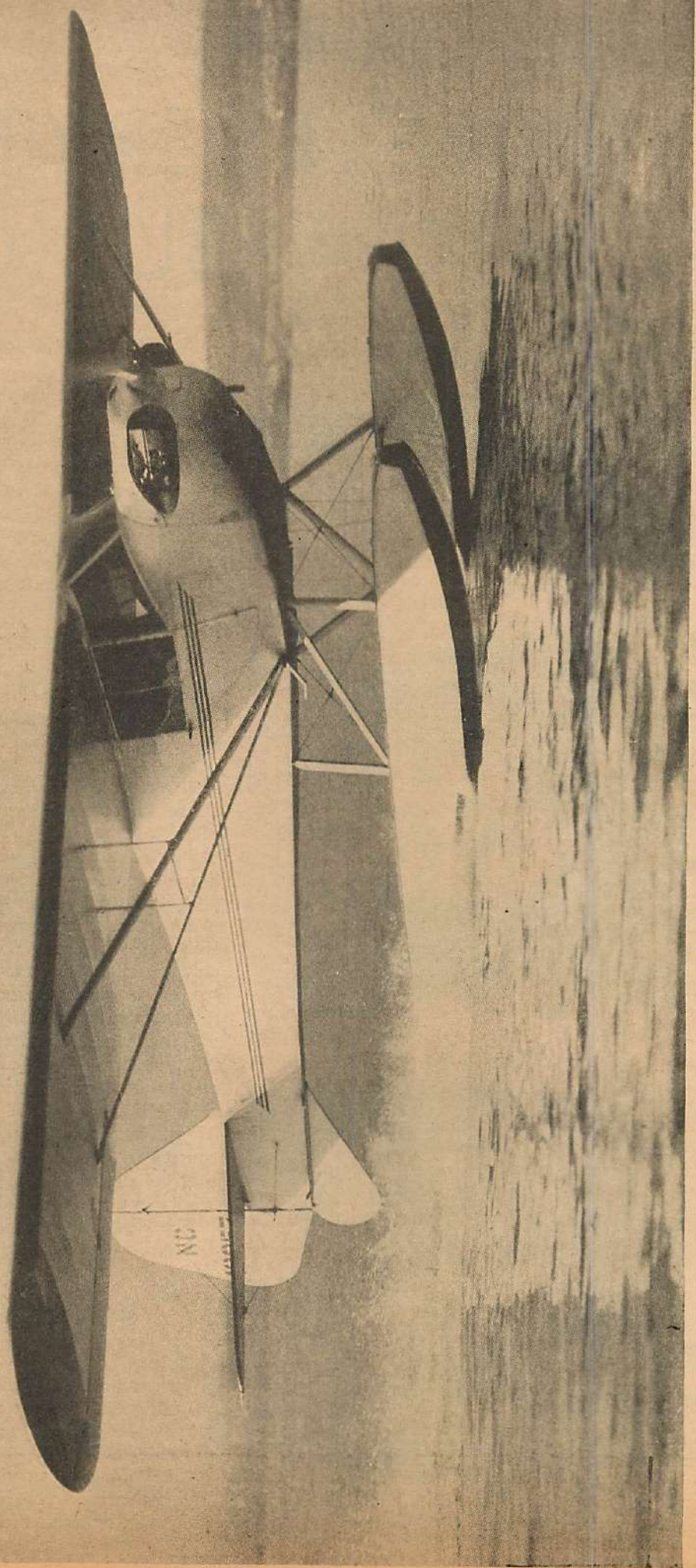
So far as I know, the Piper Aircraft Corp. (that's their new name) is the only light plane outfit to make this offer. But you can bet a wet pack-chute the rest will have to string along, because Piper is going to build and sell 4,000 Cubs this year. If the others want to keep their names up with the Bureau of Air Commerce as manufacturers, they'll have to keep up with Professor Piper.

But suppose you want to fly and can only afford a second-hand job? There's plenty of sound ones on the market. You can get a nice slice of light plane training if you look about. And it won't cost you too much money.

Take the case of Johnny Jurkofsky and Kenny Bates of Alhambra, California. Johnny and Kenny are selling flying training for what used to be mistaken for chicken feed. For \$35.00 these two boys will guarantee to send you solo. Ten dollars of that goes for your student permit. After the solo business, they'll guarantee you an amateur license, which means another five hours of solo, for twenty dollars. Adding it all up, for \$140.00 they'll get you your private license. They start you out on Cubs and let you wind up on a Travelaire.

If Johnny and Kenny can do it, there are plenty more who can at least give it a whirl. As a matter of fact, they are overcrowded with pupils now, so don't say we didn't give you a hint.

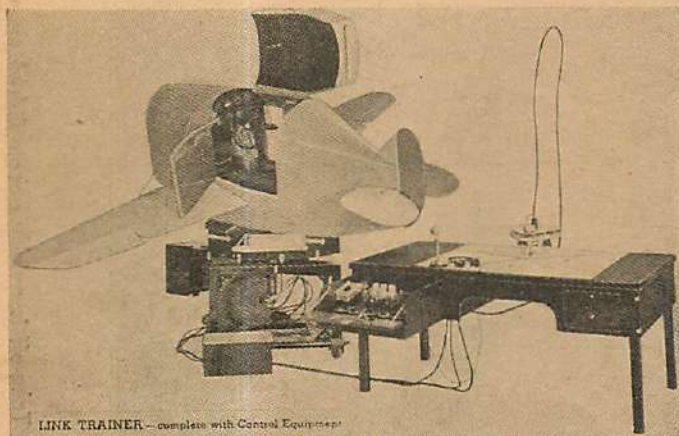
For years we have been trying to kid the light plane makers into putting out a seaplane version (Turn to page 87)



The Taylor Young on Floats

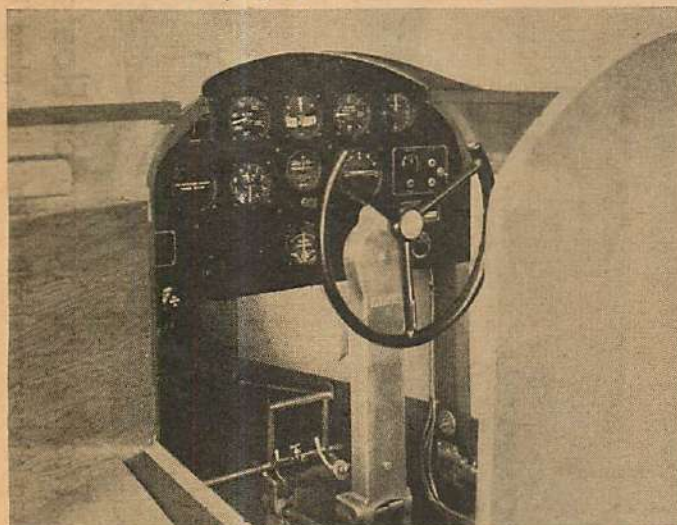
Equipped with Edo floats, the Continental-powered Taylor Young brings a new exhilaration to light plane flying. Take-off is quickly accomplished even from calm water.

THE LINK TRAINER:

IT DOES EVERYTHING
BUT CRASH

LINK TRAINER—complete with Control Equipment

The component parts of the Link Trainer. The Trainer can simulate any flying condition in any locality.



The cockpit, showing the arrangement of instruments and controls as in real plane. The Trainer is completely equipped to reproduce problems of blind flying and air navigation.



Captain Dick Dice, transport pilot, checks the instruments as he levels the Trainer from a moderate bank. The Trainer can assume almost any flight position.

By

Thomas Calvert McClary

IT was at the '36 Los Angeles Aircraft Show that Casey Jones led Art Gooble over to a weird contraption sitting like a hen atop a bellows. He gestured with paternal pride. "That's the baby—growing up!" "THAT!" snorted Art derisively. "Why that kiwi toy can't even fly!" He grinned at Casey's indignation. "Still, just about right for a young ground pilot like you, Casey!"

That homicidal innocence peculiar to "Early Birds" up to no good settled upon Casey's bronzed features. "Give her a spin," he invited casually.

Art hopped in, grinned superiorly, and proceeded to spin. SPIN is the word! When he finally pulled out of an all-time record flat spin, he looked very surprised and very green. He tossed off his coat, rolled up his sleeves and settled down for a full hour's demonstration of the "toy."

This Kiwi, which gave Art Gooble the surprise of his life, has given more than a few old-time aces a jump. It is officially the Link Aviation Trainer. Rooted right to the ground, its simulation of actual flying is so realistic that recently an English army officer stood smack on the rudder bars and broke one trying to avoid the "crash" he was spinning into! When he came out of the Trainer, he was dripping from the "close shave!"

The Trainer is already used by EAL, UAL, AAL, Northwestern, Pan American, TWA, the army, navy and Department of Commerce. Larger lines require SATR pilots to check with the Kiwi every 90 days. Most flying schools are installing Kiwis for advanced courses in instrument, radio and blind flying. And several colleges will inaugurate credit flying courses as soon as trainers are available.

The Kiwi's history began about nine years ago when young Edward Link inherited a defunct player piano and organ factory with a barrel of money tied up in completely useless bellows. He was wondering what to do with those bellows when he stood atop one and did a sideslip.

At least, it was a sideslip to sport pilot Link. To most people, it would have been just a damned fool tumble.

Link got up smiling and set about designing a small fuselage—to sit atop the bellows—which would respond to rudder and stick.

Casey Jones, then vice-president of Curtiss Wright Flying Service, had a private concession of six of these gadgets in an amusement park. It turned out that the

A valuable asset to air lines and military services alike is the Link Trainer, so realistic that even veteran pilots forget they are on the ground and sweat to solve difficult blind-flying problems.

action designed by regular cloud-busters wasn't wild enough for amusement park crowds!

But whenever crack aces climbed into those Kiwis, they spent some time fooling around. They would simulate difficult air maneuvers and climb out grinning—sometimes foolishly, because *the Kiwi had gotten out of hand!* The Kiwi responded sensitively and solely to the manipulation of the pilot with none of the inherent stability of a real plane. You really had to "fly" the Kiwi, and careless control showed quickly.

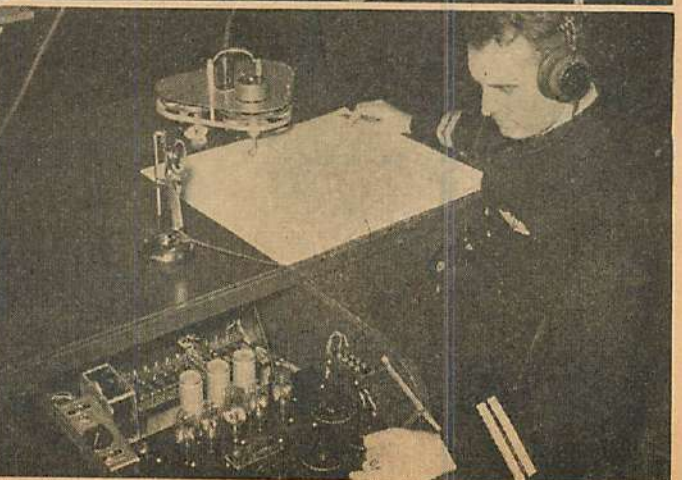
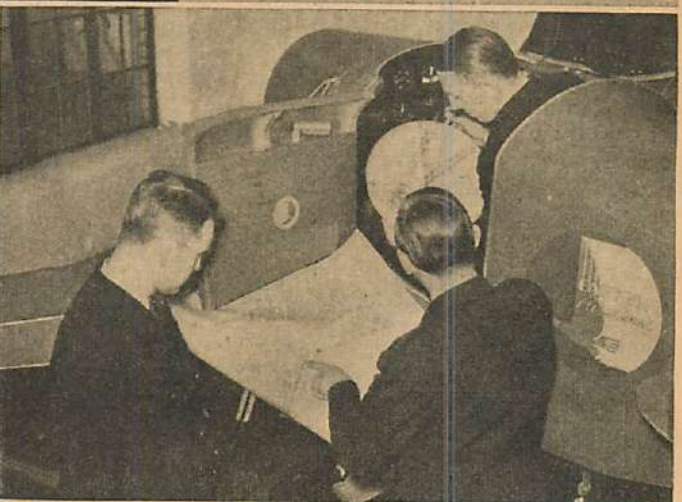
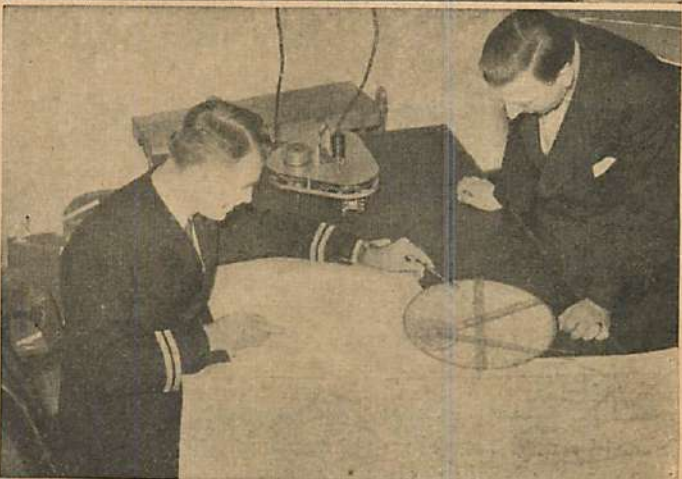
This set Link and Casey to a couple of years of experimenting which nearly corkscrewed their stomachs. They wanted a machine which would simulate any flying attitude, except upside-down. They got it with falls, dives, rolls and spins which turned them parrot colored. At the end of the time they had a machine which could broaden any pilot's experience, because it would simulate any flying attitude or air condition in any locality.

When instrument flying came in a few years back, it changed aviation. Night and all-weather schedules, blind flying and radio navigation caught many old-time pilots unprepared. Some crack aces had no idea what instrument flying was all about. And flying big transports with passengers aboard was no time to find out!

Very quietly, the mail, transport and instrument companies were working out the technique of precision flying. The army air mail calamity, which sent fourteen unprepared army pilots to their death, made the world instrument conscious.

Suddenly the Kiwi was urgently needed. Gone were the days of sheer "bird sense" and ace piloting. With air lanes getting thick with traffic, no "bird sense" was going to warn of a second plane approaching along the same air line. No ace was good enough to know at precisely what point beneath the clouds and fogs an airport lay, nor how to come in at zero-zero. (Turn to page 88)

Top to bottom: First—Captain Dice prepares for take-off. The hood is lowered for blind flying. The fan visible in hood is for ventilation; second—Instructor George Bevins and Hubert Huntington brew up a synthetic storm for a veteran pilot. Bevins points out the new radio bearings finder invented by Huntington; third—The instructors, with Dice, go over the map and the flight plan before the theoretical hop. Dice is holding the air navigation plotter; bottom—Instructor Bevins, listening in to a query from the Kiwi, controls beam volume to give the student a cue to position.



What's Your Question?

By CLYDE PANGBORN

Wing Commander



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

Question: Do you know of any company that sells models already made up? How can a boy in a wheel chair get into aviation? K. J. S., Elmhurst, Illinois.

Answer: The Miniature Aircraft Corporation, 83 Low Terrace, New Brighton, N. Y., issues a catalogue on models already made up, and I suggest that you write for it. I do not know what chances there are in aviation for a boy confined to a wheel chair, but I know of several cases of men and women who have overcome certain physical handicaps, even greater, to do the things they desire. You might get into the advertising end or do advertising designing. You might make a study of traffic or despatching. There will be several openings you can fill by preparation now. I wish you the best of luck.

Question: Will there be an Air Show in New York City this year? K. L., Staten Island, New York.

Answer: As far as I know, there will be no Air Show in New York City,

owing to the fact that a large one was held in Chicago.

Question: Why isn't the triplane used today? R. L. R., Hannibal, Missouri.

Answer: The triplane was most suitable for conditions encountered during the War, and does not fit requirements today. The triplane requires considerable skill to rig and keep in service condition, which is one of the reasons it is no longer desired in any military service. It has no place in commercial aviation.

Question: Can you tell me when the air races at Selfridge Field were held in 1937? C. B., Toledo, Ohio.

Answer: In the November 1937 issue of AIR TRAILS we gave the date of the Selfridge Field races as September 18th.

Question: Would a Canadian who wished to join the United States army or navy have to first obtain his citizenship papers? What is a supercharged engine? G. D. L., St. Catharines, Ontario.

Answer: Yes, you must first obtain your citizenship papers if you are

foreign-born and wish to join the army or navy. A supercharged engine is one equipped with a blower device to provide air to the carburetor at high altitudes at the same pressure as would be experienced at sea level.

Question: Has a person with a weak heart any chance of obtaining a position as an air pilot? How long is the average life of a transport pilot? A. E., New York.

Answer: I am afraid you stand little chance of even getting a student permit to fly if you have any heart trouble. So far, we believe a transport pilot can fly regularly for about fifteen years. However, this period may be increased as flying conditions improve.

Question: Is there an American trimotored ship that carries 70 passengers? If so, how fast does it go? R. S., Sioux City, Iowa.

Answer: I believe there are two and possibly three planes being built in this country which will be able to carry 70 passengers. But it is not likely that they will be loaded to that limit when they are put into transport use. Boeing, Martin and Douglas are all building large planes—but they are all four-engined jobs.

Question: Can you tell me where I can get a good course in airplane mechanics, somewhere near where I live? Can you advise me who makes the baby biplane shown on Page 6 of the September issue? A. J. W., Braueron, Oregon.

Answer: By all means apply to the Boeing Aircraft School at Seattle, Washington, and get their course catalogue. The ship you refer to was built by the Payne Aircraft Co., of Chicago. That's all I know about it. (Turn to page 84)



Grumman's midwing navy fighter at Bethpage, Long Island, where the ship was dive tested by Lee Gehlbach.

SPLIT-SECOND ACTION

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



LEONARD JAMES WAS FLYING OVER WATER NEAR CUBA WHEN-



A BIRD SHATTERED THE PROPELLER,



THE PLANE CAUGHT FIRE,



HE WAS FORCED TO "BAIL OUT". HE



LANDED AMID A SCHOOL OF SHARKS AND



BECAME ENTANGLED IN HIS PARACHUTE.



A SEAPLANE COMING TO HIS RESCUE HIT A SHARK AND WAS DISABLED.



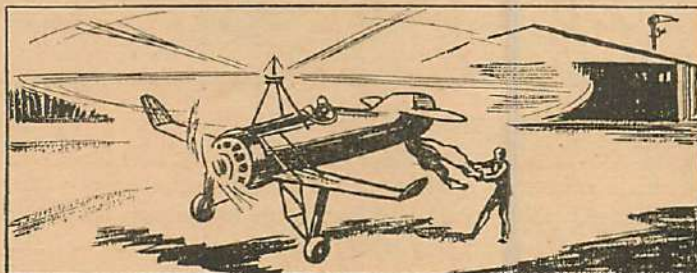
A MAN SWAM FROM THE SEAPLANE AND FREED JAMES FROM HIS 'CHUTE.



THEY CLAMBERED ABOARD THE SEAPLANE WHICH WAS,



FINALLY, TOWED TO SHORE BY A MOTOR-LAUNCH.



THE ABILITY OF AN AUTOGIRO TO HOVER NEARLY STATIONARY IN THE AIR PREVENTED A POSSIBLE ACCIDENT. ON TAKING OFF, THE 'GIRO'S TAIL SKID HAD CAUGHT AND CARRIED WITH IT A BOUNDARY MARKER. THE PILOT NOTICED THE ENCUMBRANCE AND DESCENDING CLOSE TO THE GROUND, HOVERED THERE WHILE AN AIRPORT ATTENDANT REMOVED THE LOAD.



CHIEF CARPENTER'S MATE NOONEY LOST HIS INSIGNIA BUT KEPT HIS HEAD WHILE HELPING TO LAUNCH A SEAPLANE. PUSHING ON A STRUT HIS HAND SLIPPED AND HE FELL TOWARD THE WHIRLING PROPELLER. THE BLADES CLIPPED THE C.P. OFF HIS CAP BUT LEFT NOONEY UNHURT.



THREE HUNDRED MILES OFF THE FLORIDA COAST ON THE U.S. SURVEY TRANSPORT REPUBLIC AN OFFICER, DESPERATELY ILL, NEEDED AN IMMEDIATE OPERATION TO SAVE HIS LIFE. THROUGH TERRIFIC HEAD WINDS, RAIN, LIGHTNING AND FOG CAME A COAST GUARD PLANE GUIDED BY THE SHIP'S RADIO AND SEARCHLIGHT. THE SICK MAN WAS TAKEN ABOARD THE PLANE-AND A HALF HOUR AFTER ARRIVING AT THE AIRPORT WAS ON THE OPERATING TABLE. HIS LIFE WAS SAVED.

JON L. BLUMMER

GLIDING AND SOARING

THE GLIDER CAMP IDEA

ONE of the prime reasons why our country lags behind others in gliding activities and number of licensed pilots is that motorless flight cannot, because of its very nature, be a one-man sport.

True, many of the early pilots of motorless craft taught themselves to fly in hang-gliders at the expense of broken ankles and, in some instances, necks. But gliding and soaring, in the modern sense, cannot be learned alone.

Unlike a marksman who can train himself to shoot, or even the swimmer who can learn after trial and error to swim, the glider pilot—and later the soaring pilot—must have the intelligent cooperation of others to aid him. He can not learn to fly alone.

This cooperation is not only invaluable in the design, construction and repairing of motorless craft, but who ever successfully ran out both wings of a shock cord, rushed back, released the tail rope, climbed into the cockpit and sailed into the air amid the shouts of the farmers in the next field?

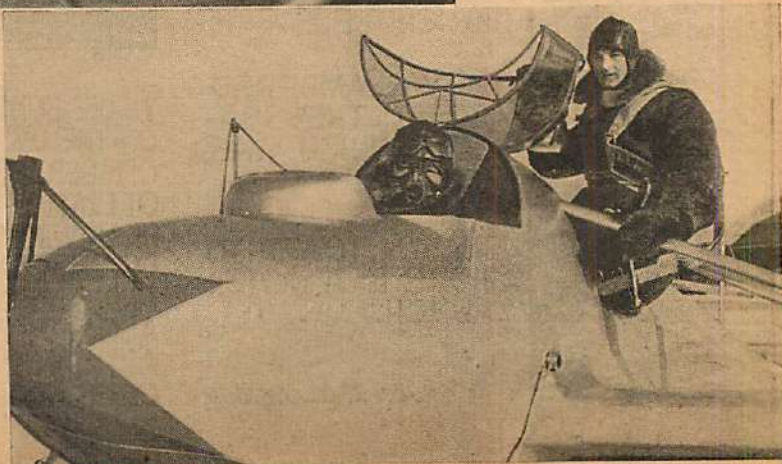
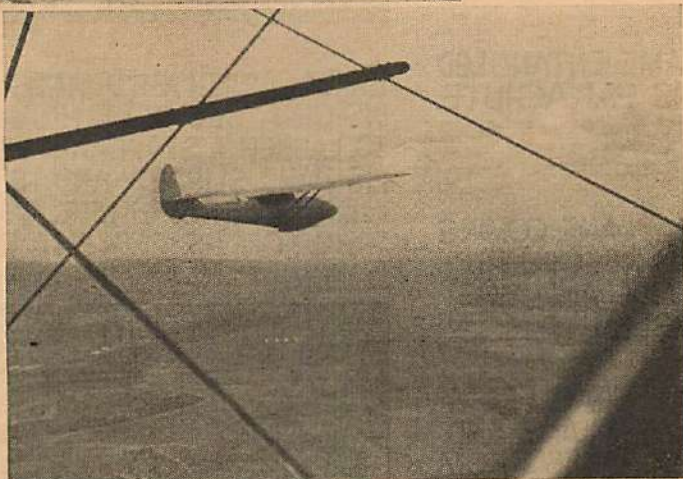
The popularity of this department, the letters we receive, and the interest in such meets as the annual one at Elmira testify to the enthusiasm that there is for motorless flight, even if the majority of spectators and would-be glider pilots are stopped for one of the following reasons: lack of gliders and lack of cheap, reliable instruction.

The first will be taken care of as soon as the latter is rectified. Trained pilots, having once tasted the thrills and beauty of either gliding or soaring, will naturally look about for ships of their own. This rapidly widening and expanding market will make compulsory the production of safe, reliable planes. Such a demand naturally will be met by manufacturers and everyone will profit by the new supply-and-demand situation.

At present, this particular happy condition can only be brought nearer

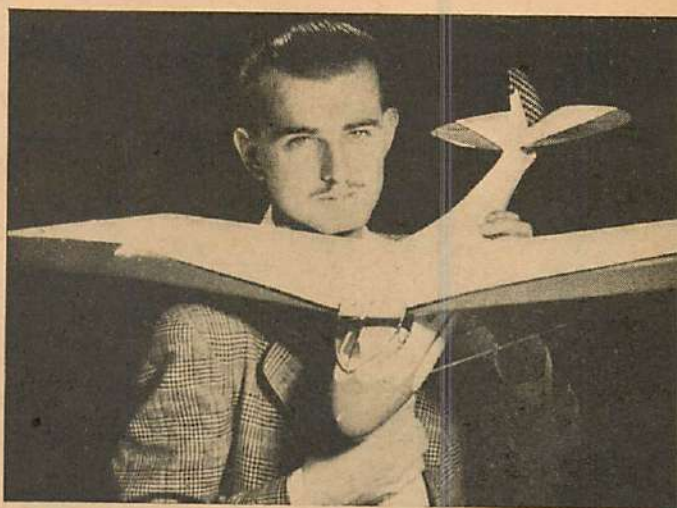


A novel sky train was tried recently in Russia. A twin-engined transport towed a two-place glider, to which, in turn, was attached a one-place sailplane. Once in motion the sailplane took off, first followed by the intermediate craft, and then the tow-plane. Circling twice over Moscow to reach an altitude of 15,000 feet, the tow-plane payed out cable to intermediate craft, which also payed out cable to the second sailplane. Both gliding craft were soon out of sight overhead—one at 18,000 feet, the other at 21,000 feet. The transport remained at 15,000 feet. Finally both gliders were released to descend to a safe landing. An attempt to soar in the stratosphere is soon to be made by the same train. The pictures show: top—the sky train at the Moscow airport; middle—the sailplane in flight thousands of feet above the tow-plane; bottom—the two-place stratosphere glider, intermediate member of the train. The flights to these higher altitudes necessitate the warmest of clothing for the glider pilots. Note the turretlike cockpit and its hinged enclosure.



Discussing the school problem—what is being done abroad, and can be done here to train non club members to fly motorless craft.

Conducted by
Alexis Dawydoff



Don Stevens, holding a model of the five-place sailplane now in design stage.

realization by the rapid broadening of the instruction phase of gliding and soaring.

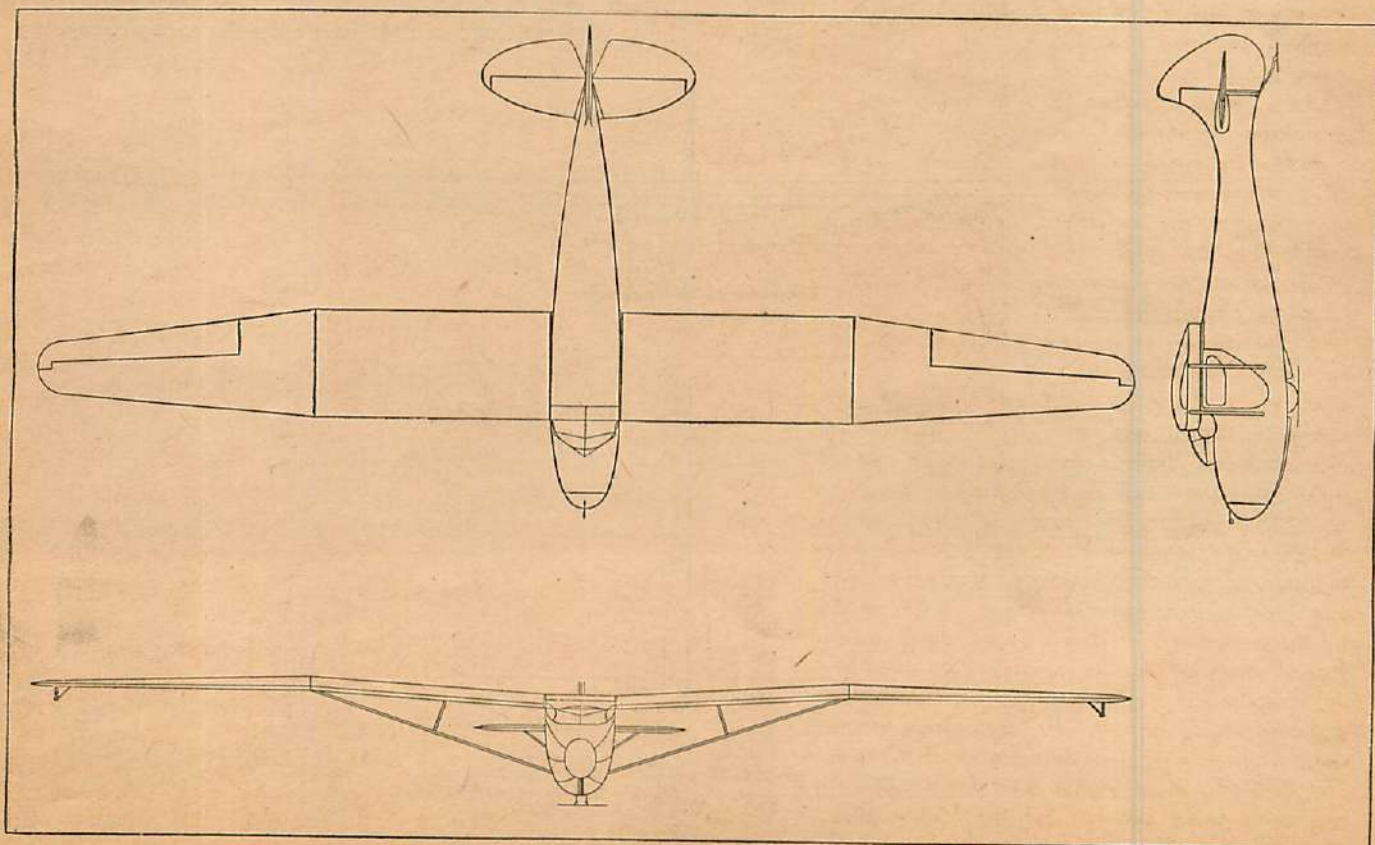
A great number of would-be pilots want to learn to fly, but are handicapped in the forming of clubs by the lack of opportunities to learn under safe and economical conditions. Our country is so huge in area that a few additional schools and training points will correct this condition only locally.

A widespread program of school establishment would entail such a tremendous layout in equipment and personnel that government aid would, of necessity, have to be solicited. In Europe this has been obtained with the result that literally thousands of young men and women have been safely and economically taught to fly, repaying far-seeing governments with an equal number of poten-

tial military flyers and aircraft workers—surely good interest on a government investment.

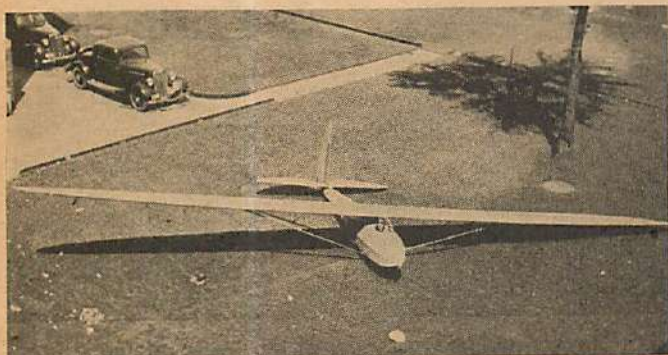
Already our Federal Government, taking a tip from these foreign-ruling agencies, has appropriated much-appreciated funds for the development of the Harris Hill glider site at Elmira. President du Pont and Manager Barringer of the SSA are continually trying to prove to our government the advantages and dividends from similar investments in other accepted gliding and soaring localities. We fervently hope that other federal aid will eventually be possible to help carry on this great nationwide activity, at present so needlessly handicapped.

The acceptance by the Bureau of Air Commerce of the recommendations for the rules in licensing glider pilots drawn up at the last National Contest (Turn to page 82)

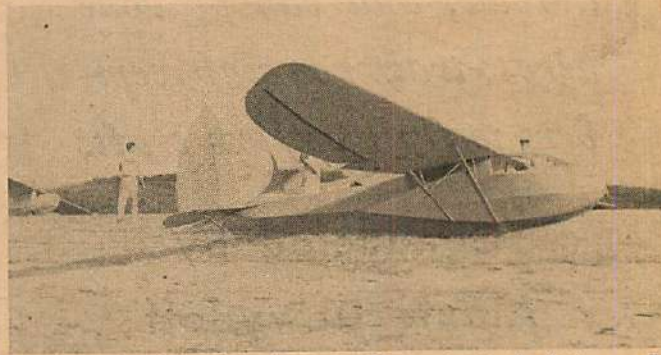


The three-view drawing of the Stevens-Wilcox sailplane.

The A. B. C. Sailplane



Designed as a utility sailplane, the A. B. C. Sailplane is especially efficient in weak thermals and slope winds.



Profile view of the ship that won first prize in the Warren E. Eaton Memorial Sailplane Design Competition at Elmira.

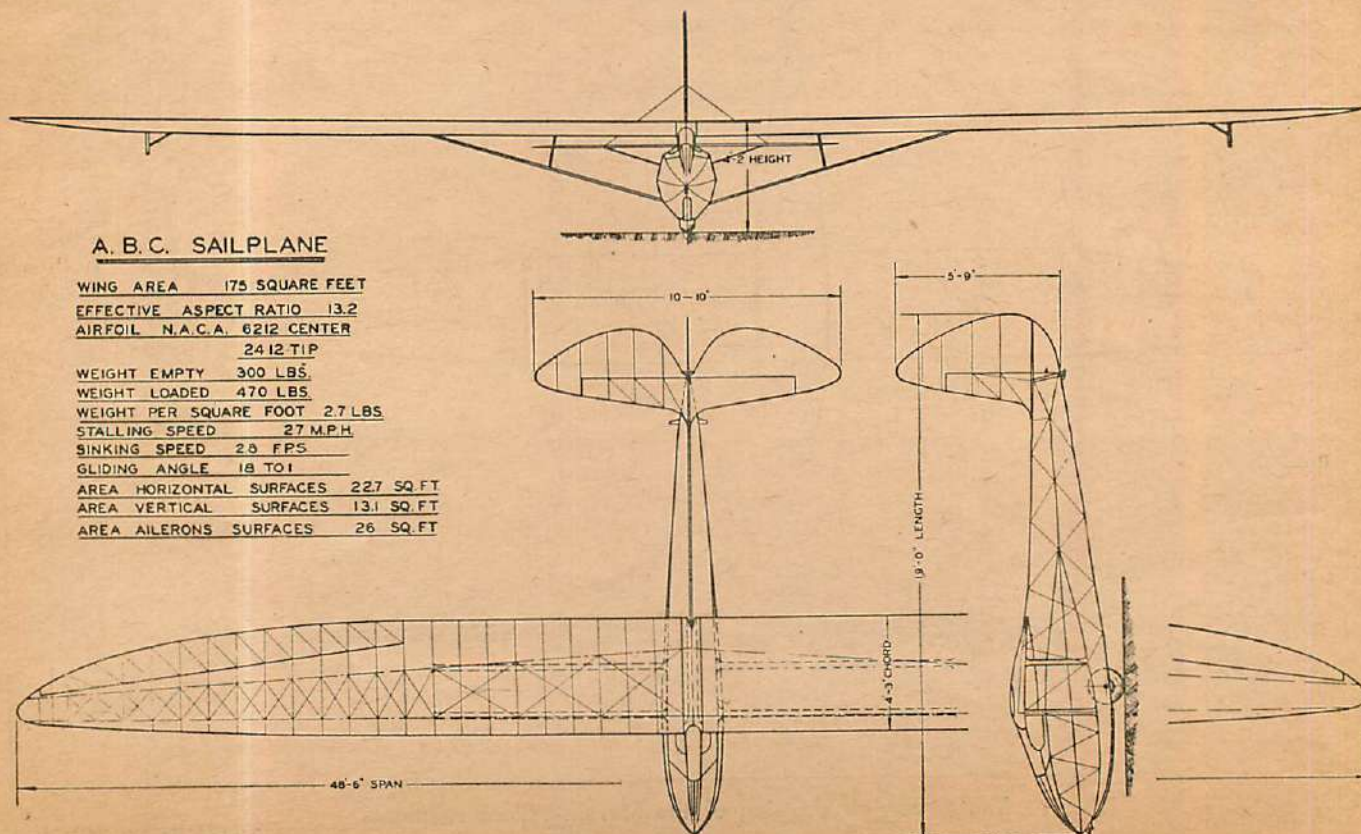
THE A. B. C. Sailplane is the winner of first prize in the Warren E. Eaton Memorial Sailplane Design Competition at the Eighth Annual National Soaring Contest at Elmira, New York, 1937, against a field of seven other entries.

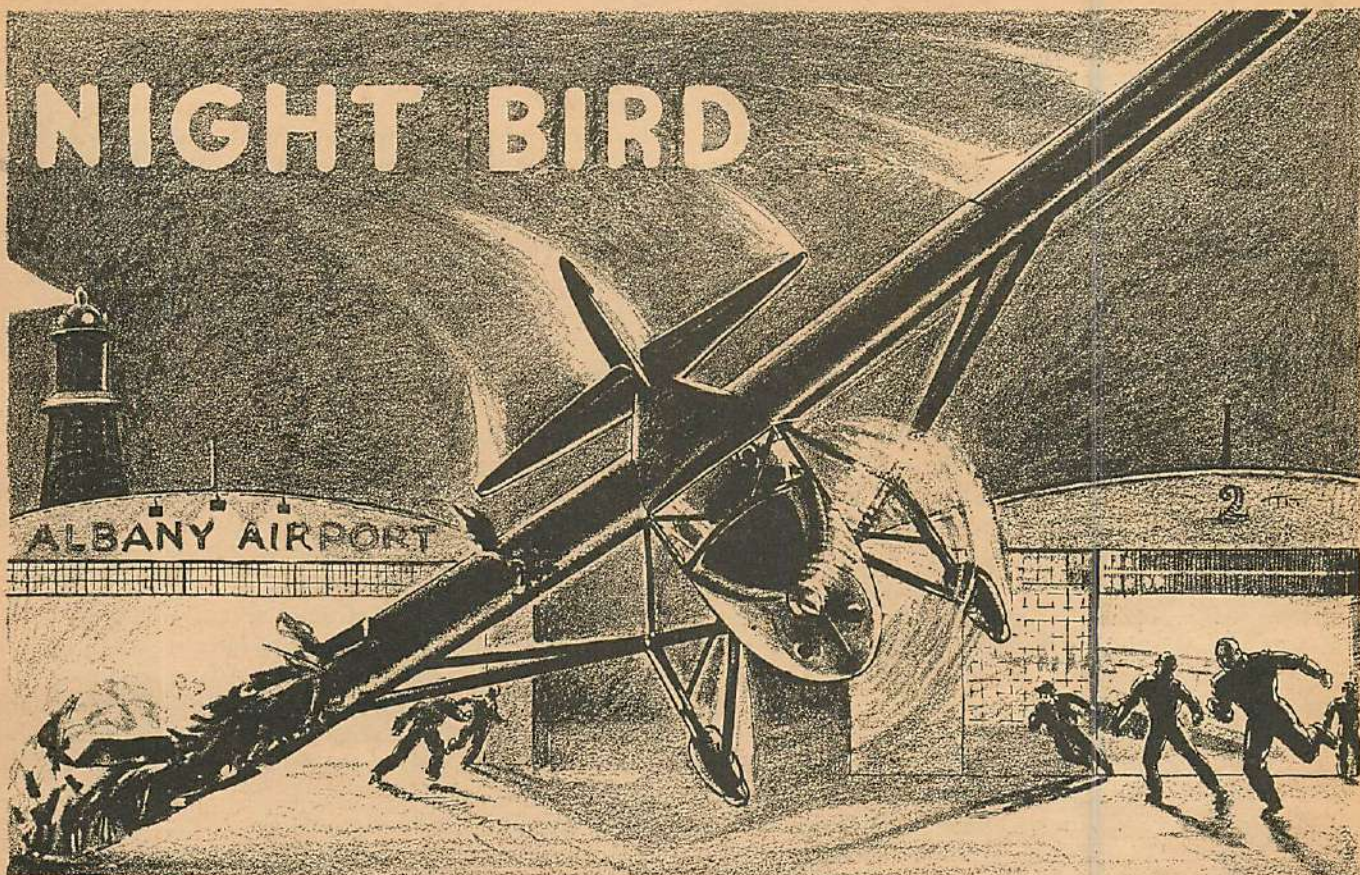
The purpose of the contest was to encourage the development of new American gliders and sailplanes. The basis of rating was as follows:

1. Points won on basis of point award system	35%
2. Stability, maneuverability, controllability	5%
3. Adaptability to home construction	25%
4. Completeness of drawings and analysis	10%
5. New and unusual features	10%
6. Ease of assembly, disassembly and trailering	10%
7. Workmanship on ship at contest	5%
Total	100%

The A. B. C. Sailplane is designed as a utility sailplane. Its performance approaches that of a high-performance sailplane and its construction is like that of a utility. Classed with German designs, its performance is about the same as the "Wolf." It is not designed for fast, cross-country performance, but more for soaring light slope winds and weak thermals. Its capacity for accomplishing this purpose was demonstrated very well at the National Contest.

Stability, maneuverability, and controllability were well demonstrated by aerobatic performances at Elmira, where it was looped, spun, and otherwise tested to the complete satisfaction of a Bureau of Air Commerce inspector. It has very good control in a stall and recovers from right or left spins in half a turn. It was dived at 90 miles per hour with no trace of flutter. It can be (Turn to page 90)





There was a sickening thud, a ripping, tearing sound as the wing tip raked the ground—

By Joe Archibald

JOHNNY MILNER stood out on the edge of the cow pasture of his father's small Vermont farm and watched the plane skim across the roof of the world. The sun had long since gone down and the firmament was streaked with great flying foxes—long slender wisps of clouds that raced along over the face of a three-quarter moon. Johnny's eyes bulged and there was a singing in his heart that harmonized with the steel-throated tune the night plane was humming far above the nocturnal terrain. Wings. Wings were Johnny's very existence. He thought that men who flew were far greater than those knights of the long ago about whom he had read in story books.

The plane that Johnny was gazing at had flown over twice a week for the past two months, its schedule never varying. Johnny had known the first time he saw it that it was a Fairchild.

Johnny had never been very far from home. His thirst for knowledge about flying had been slaked at the local Bankville Airport where there was a Stinson cabin job, a Waco, and a Fairchild 24. All the hours he could steal away from the farm he had spent learning how to fly—with the manager of the airport as teacher.

Listening to the increasing drone and watching the Fairchild loom up bigger and bigger in the sky, Johnny Milner muttered something about: "Though wind and rain and snow and sleet—" It was hard for him to remember all that slogan that he had read in a book about mail flyers. Johnny had never been considered very bright in the village where he lived. The teachers

complained that all he knew was airplanes. He would never amount to anything.

"Lan' sakes," more than one native had commented, "thet Johnny Milner don't help his folks like as he oughter, an' them apullin' like all git-out to make one end meet t'other. He'd oughter do his work 'stead of runnin' off to the airport. Like as not they could pay off the debt some day. Farmin's comin' back—"

In a way they were right. Johnny knew nothing—cared about nothing—but airplanes. He had flown that Fairchild out there at Bankville two or three times, but he had never dared mention it to his folks. Now the Fairchild was overhead and Johnny waved to it. It was more of a salute, a stiff-armed salute that a man would accord the grim dictator of a foreign land. It was a sort of ritual with Johnny. The mail was going through and nothing could stop it from going through. Over at Bankville he had been told that it was not a government plane he had been seeing every night. It was thought to be a private job owned by a colony of millionaires up along the Canadian border. But whatever mail it was, whoever's it was, it was still mail and there would be stamps on all the letters that marked it as such.

A gruff voice brought Johnny down off the fence. He ran his fingers nervously through his corn-colored, unruly hair as he faced his father.

"Gawkin' at thet plane ag'in, huh?" the older man ground out. "You wuthless li'l cuss!"

Johnny was not little. He was a head taller than his father. For a kid of seventeen he was unusually big.

*"Dope" was his nickname and his salvation!
In which a farm boy flies the mail—almost.*

His muscles were flattened hard against his bones and he was stronger than he looked. The odor of the cow barn on his father's clothes was repellent to a kid who yearned for the scent of engine oil and burning gas.

"No chores done! Cows ain't milked, an' you out here! You know what folks call you? Dope! That's what they call you!"

"What do I care what they say?" Johnny said.

"Dope hain't wrong, nuther," his father bit out. "Git in there an' finish up!"

That night, when his distasteful chores were done, Johnny went to his room and pored over his treasured books and periodicals. He read how the army had to take over the mails a few years back and how a lot of the pilots had died seeing that the mail went through.

Three nights later Johnny Milner was back in the cow pasture watching the Fairchild come droning through the dusky sky. The name "dope" had been repeated again at supper. His father had said that he was going to take Johnny out of the high school in Bankville, that he was just wasting his time. Let him, Johnny mused as he feasted his eyes on the ship. They did not teach him anything about flying there. Suddenly Johnny's lower jaw dropped. The plane up there was acting strangely. The nose dipped and the ship slanted downward. Up it went again and began to circle raggedly. The even song of the motor broke as the Fairchild came down toward the big cow pasture. Johnny tried to figure it out. That pilot ought to know that there was a real airport at Bankville, yet he was going to land right in the Milner pasture.

Johnny started running across the field with a lantern he had carried with him, ostensibly on the way to the barn. He waved it around his head as he ran. The Fairchild was only a few hundred feet up now and was fishtailing in. The pilot got the front wheels down perilously near the edge of a long line of brush. The Fairchild bounced high, came down again and Johnny's heart was in his mouth. The tail hit hard and the ship ground-looped and escaped cracking up by a miracle.

Out of the cabin staggered a man. He wore a gray suit and a leather helmet. Johnny got close to him and held the lantern high. The man's face was contorted with pain and Johnny gasped: "What's the matter, Mister?"

Beads of sweat gleamed on the stricken pilot's face as he suddenly bent double and fell at Johnny's feet. "Listen, k-kid," he gasped, "g-get a doctor. A doctor! Hurry—"

Johnny froze where he was for several moments. The man struggled to his knees and fell against him. "Come on, kid—up to the h-house. Help me. The p-pain—it's got me in my side. For heaven's sake, help—"

The farm boy half carried the man to the house. His mother and father had heard the noise and had the door open. Johnny called frantically: "Telephone the doctor, Ma! He—this man's pretty sick."

Twenty minutes later the doctor, having examined the patient with knowing fingers, clipped: "We've got to take him to Bankville General Hospital. Acute appendicitis. No time—"

The stricken pilot struggled feebly. "I got to get out of here. I got—" He fainted. Johnny's father and the doctor carried him to the car.

Johnny looked toward the cow pasture where the plane stood. It carried mail, maybe papers of terrific impor-

ance. The pilot was sick—might even die. Johnny Milner told himself that he was a flyer. He could fly that ship. The mail had to go through. Johnny gritted his teeth, already running across the yard. He felt a little scared at his decision, but he was going to try it. He would fly that plane into Albany and turn it over to the authorities. A regular mail plane could go on from there. Albany was not far. He felt his spine curl as he climbed the pasture fence. Perhaps he would be too scared to get that plane off the ground. Then he thought of the things people had said about him. Dope! Dope!

Johnny Milner climbed into the idling Fairchild's control cabin and oriented himself. The gadgets were familiar to him and he jammed the throttle in. The plane started moving. Johnny swung it halfway around and headed across the pasture. He kept feeding it gas until the prop reached a crazy pitch. A patch of woods was streaking toward him, seemed ready to crash into him when he lifted the wheels clear of the bumpy turf. Teeth set, his eyes fixed straight ahead, Johnny gradually got the Fairchild clear of the Milner wood lot.

Johnny knew that he could spot Albany all right. The sky was clear and down on the sliding panorama light clusters blinked as he skimmed over towns. He settled back in his seat and let the Fairchild fly itself. Albany would show before long. He was hitting a hundred miles an hour. Albany would be right across the river.

Johnny looked down, saw the river below him. Off to the left he saw a great swath of light cut across the sky. The beacon! Johnny corrected his course and headed toward it. Cutting speed a little, he went down to two thousand and at that height skimmed over the roofs of a city that was bigger than anything he had ever seen.

Johnny came in to the Albany airport, his nerves beginning to tauten. Reaction was setting in and it made his teeth chatter. Down on the ground he saw tiny figures moving. He saw a big ship getting ready to go out. Johnny forgot a lot of things that the boys back at Bankville had told him when he put the Fairchild down. There was a sickening thud, a ripping, tearing sound as a wing tip raked the ground. He fought the controls wildly as the ship ground-looped and then turned over. Something banged against Johnny's head and he sank into blackness, with a terrible bedlam ringing in his ears. Men shouting. A siren shrieking—

Johnny woke up in a hospital. Save for a broken arm and collar bone and a big bump on his head, he was all right. The nurse did not smile, though, when he spoke to her. Three grim-jawed men stood near his bed waiting for him to become rational enough to stand a grilling.

"I—I made it," he mumbled. "I brought the mail in."

"Mail?" one of the men repeated. "Listen, kid, that was *some* mail—letters we've been lookin' for around here for almost two months. Now we'll tell one. What's your name?"

Johnny told him.

The men laughed icily. One said: "He looks dumb, but maybe that's part of the act!"

"I live in Vermont," Johnny gulped. "I—I took the plane when the pilot was forced down. He got appendix trouble an' the doc took him from my father's house to the General Hospital. I can prove it. Honest, Mister, I know I oughtn't to have flown that ship. I ain't got a license, but mail has to go—"

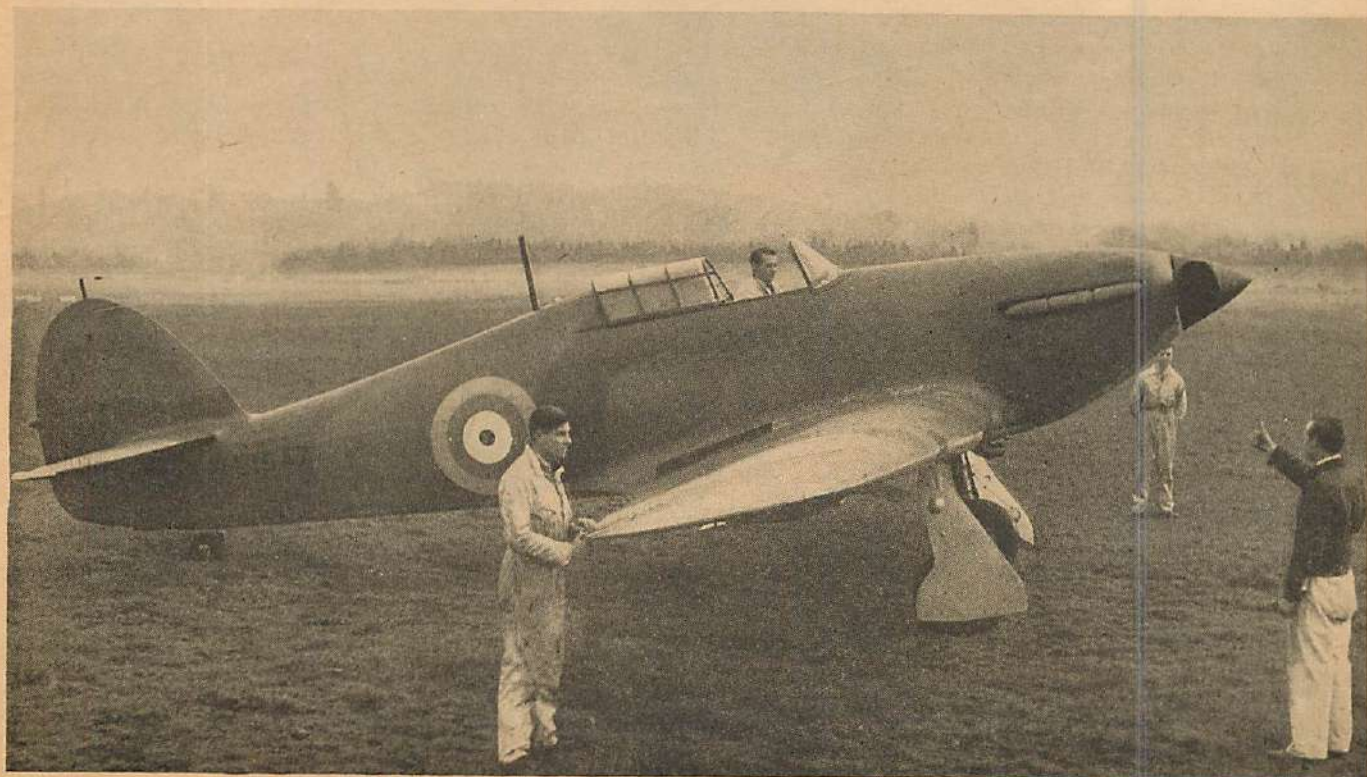
A big man said slowly: "He's not (Turn to page 83)

The Air Trails Gallery

Three full pages of photographs of modern planes.



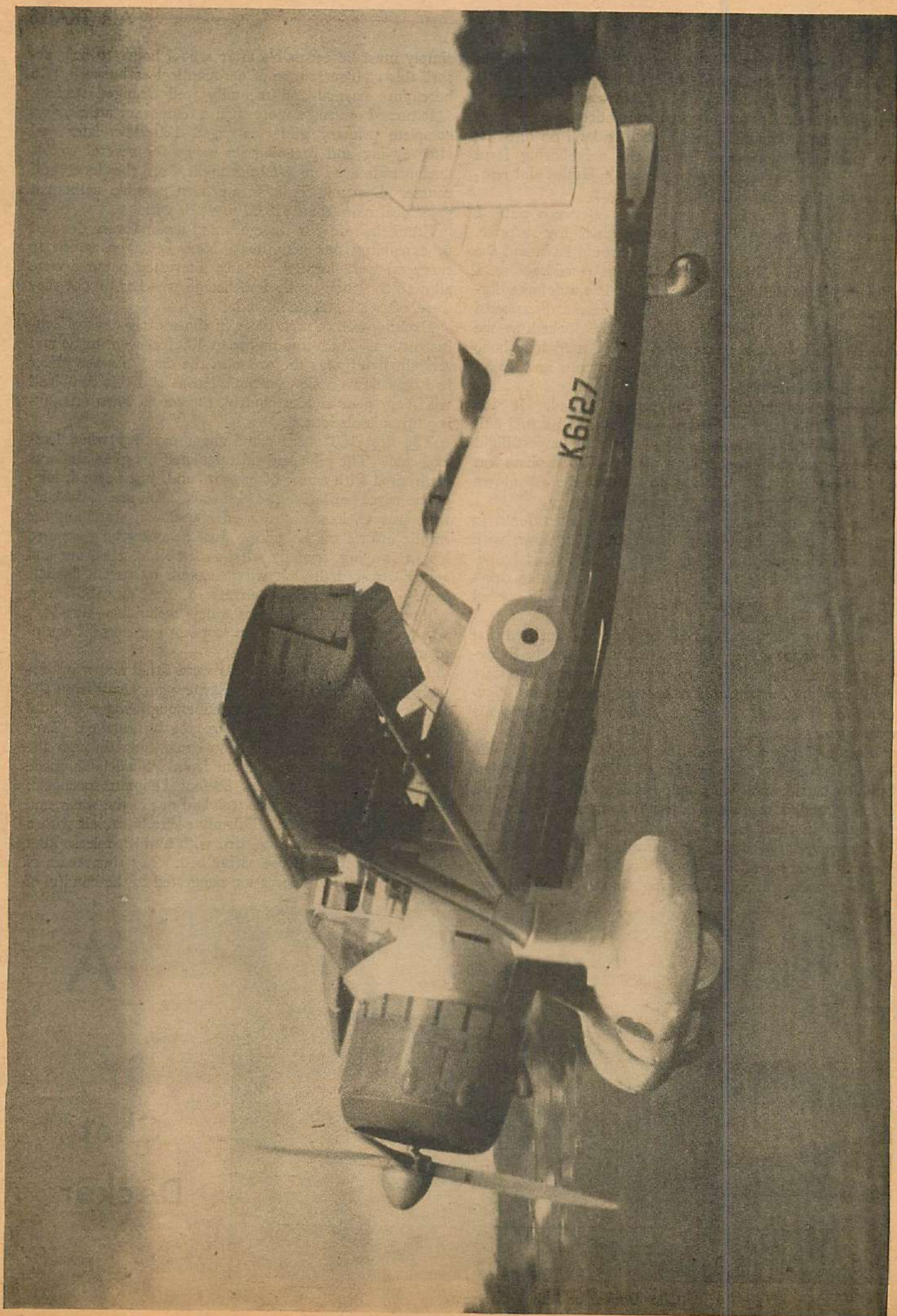
The Wendt W-1, newest light plane, is powered by the Warner 90 h.p. Scarab. A one-place job, the Wendt weighs 1,500 pounds, lands at 38 m.p.h., and hits 140 m.p.h. top.



The first of the British Hawker Hurricanes reaches squadron service. The 1,000 h.p. Rolls Royce Merlin drives this demon at speeds far in excess of 300 m.p.h.



The Seversky P-35 overhauls the photographer's plane. Powered by the 1,000 h.p. Twin Wasp, the P-35s are the fastest service pursuers in the world. Featured in the book "The P-35" by the author of "The P-35" is the first Pursuit Ground at Selfridge Field. Eighty-five of these planes are now being delivered to the Army Air Corps.



A remarkable action photo of the British Westland Lysander, taken at the instant of landing. Slots open, flaps down, elevators up, tail wheel yet off the ground, the 825 h.p. Bristol Mercury-powered Lysander slides in for a low-speed landing. Note the landing lights in the wheel pants.

STIFF and weary, I lifted myself from the cramped sitting position I had endured for 5 hours in the cockpit of my sailplane "Albatross." Where, I thought to myself, is the airport I had noticed on my map? This baseball diamond I had chosen to land on must be the week-end rendezvous of all the neighboring farm hands. It was scattered with empty pop bottles and remnants of half-eaten hot dogs.

A man came running toward me. Between puffs I learned that this level patch was, much to my surprise, the airport. Had I wired ahead he would have had the wind sock out. Thanking him for his consideration, I explained that the soaring pilot rarely has a definite destination. Upon learning that I had come a distance of almost 150 miles without a motor, he looked at me queerly. He remained skeptical until I used his phone to call Elmira, New York, and had my crew and trailer promptly dispatched.

Several moments later the phone jingled. It was Contest Headquarters at Elmira again. An excited official on the other end told me I had made the longest flight of the contest and clinched first place. Also, a plane was on its way down to pick me up. Be at the Allentown Airport in an hour and a half, was the message.

The now thoroughly convinced gentleman offered to drive me to Allentown, but first I must sit down with him and his wife and enjoy some Pennsylvania home-cooked corn and potatoes. My heart was full to overflowing toward them, but my empty stomach needed those corn and potatoes.

After a most enjoyable meal my kind host insisted that I stretch out for a few moments' relaxation on the living-room divan. The room was warm and hours of exposure made my face burn. I lay exhausted and content. Several times I dozed. Finally, I could no longer keep my eyes open.

Events of long ago paraded before me. I dimly remembered that day in the early part of 1929 when the glider-building bacillus reached a vulnerable spot, rendering me, a young student at that time, totally unfit for further participation in the pursuits of academic accomplishments.

A serious-faced Board of Education was hastily summoned together for the purpose of readjusting the routine of the metal- and wood-working shops. It seems they

simply must be accessible after school hours to help absorb this sudden release of aeronautical enthusiasm by a heretofore normal and mentally well-arranged student.

It turned out to be more than a temporary attack, as a complete primary glider emerged 120 days later and after drying and preening its wings for several weeks, demonstrated its new-found ability on the local golf course. Dynamic flight was proven possible without a great deal more than \$50.00 to work with.

From then on our thoughts and actions were devoted to expanding our activities. New fields on which to carry on were located. Many interested persons were allowed to watch us fly and decide whether or not they were, after all, still interested.

Exciting events took place in those early days of self-instruction. Auto-tow flights to 400 feet were made and straight flying was the order of the day. As the glider had only down action on the ailerons and this combined with very poor rudder control, the result when attempting turns is obvious.

The first 180° turn came about one day when least expected. The pilot had miscalculated his glide and was confronted with a row of hangars and, just beyond, telephone wires bordering the highway. Full use of the controls was useless. We stood speechless, watching the frantic efforts of the pilot. Just as everything seemed lost, a swaying, friendly wind-sock pole reached out and gently caressed the left wing, enough to start a flat left turn. Ah! Aerial maneuvers, a complete 180° turn without mishap, the birth of a new technique—turns—it was proven, were within the scope of our present equipment.

Later on that year pontoons were fitted and many attempts were made to break the new rig away from the water. The pontoons displaced enough water to hold up the glider and pilot but were poorly designed. Tremendous power was needed to drag them through the water. A sporting gentleman from Philadelphia made available to us a 250 h.p. 28-foot Dolphin speedboat. Without delay the tow line was laid out in the water and I climbed into the seat. I firmly secured myself with a short length of clothesline, tied with a quick-release knot to act as a quick-release safety belt. My squareness of jaw and martyred expression suggested to the handful of



Chet Decker and his "Albatross."

A
By
Chet
Decker



spectators that here, possibly before their very eyes, history was being made. As we gathered speed, the spray thoroughly soaked me and the knot holding me to the seat. Several seconds passed. The glider shook itself free and ballooned up 50 feet as soon as the water suction was broken. We climbed quickly to 300 feet, almost directly above the towing boat. It was a glorious feeling to be up there. The contrasting colors of blue sky and water, white wake, clouds and beaches, combined with the action was a most satisfying experience. I had not taught myself to level off before releasing, so with the stick well back I hesitantly reached to release the tow line. The next few moments I shall never forget. The tow line dropped away; the nose of the glider, suddenly released, shot up and up—even higher went this pilot still securely tied to the seat. The seat and pilot, no longer a part of the glider, were taking their own direction. My past raced before me. Scenes of my childhood and unkind words spoken in a moment of thoughtlessness came back to mock me. But had I not lived a good life? Did not the kind deeds outweigh the unkind on the scales of rectitude? It seemed like hours before a reconciliation was arranged and the two units joined again and continued on down to a landing together. That episode thoroughly quenched my fierce enthusiasm. I had passed through the wringer of thrills and been left emotionally dry. I decided against any further flying for a few days.

Months followed. The pontoons were taken off and we again started land operations. Broken wires and jammed controls gave us a little excitement. Many uneventful days of flying followed which served to strengthen our ability and increase our knowledge.

Years passed in which we designed and built many utility types, always endeavoring to advance ourselves. Soaring was the next logical step and the most commo-

With many hours of soaring packed under our belts we turned toward national competition as the natural course of events.

I think the first distance flight a soaring pilot makes thoroughly cements him to the sport and good soaring weather is a pleasure to him, whether or not he is able to fly at that time. It's that way with me and my feelings are, I believe, somewhat near the average.

Back to the story. The National Contest in 1935 gave me my first distance flight which covered 17 miles.

In my excitement I flew through many good thermals. Getting up to the cloud base and seeing the world from 4,000 feet for the first time, feeling cold and happy, shouting to yourself, being all alone and not lonely with all motion seemingly at a stop—it's a marvelous thrill and will always remain vividly real in my mind.

An hour later and 17 miles down wind I was gliding into a hay field. A farmer and his boy were diligently pitching hay when they spied me. The old gent dropped his pitchfork, his arms and his lower jaw. The quick-witted son reached for the horses drawing the hay wagon to discourage any intention they might have of undoing his work and dashing the wagon to pieces.

The soaring movement rocketed that year. Reports of newly developed soaring sites and much flying came from all corners of the United States.

Feeling the urge to fly the world's highest performing sailplane, I mortgaged my material possessions and purchased the Bowlus-built Albatross sailplane. I have never, for an instant, regretted that decision. I can easily remember the first distance flight with my new ship, always being careful to keep an airport under me to insure a large area in which to get this extremely sensitive and high-performing craft safely down to earth. I had never ventured away from my point of release.

Late one afternoon I was soaring over the Chemung

SOARING PILOT DOZES

A well-known pilot looks back—

tion occurred one winter day when my chin became entangled in a barbed-wire fence. The fence surrounded a farmer's field that had been chosen as a landing spot. I made the approach correctly, just the right amount of slip, a gentle touch to the frozen ground. But, to my dismay, I suddenly realized that a few hours of sun had thawed a layer of earth—making the landing skid ineffective as a brake on the slippery ground. Nature has a way of compensating for man's errors in judgment and the fence unceremoniously halted our headlong plunge. Several of the fence posts were loosened and the wire barbs lacerated my chin. The ship, fortunately, was only slightly damaged.

valley at 5,000 feet, having released from airplane tow at 2,500 feet and rising easily to that altitude. The temptation to turn to the north and go downwind was overwhelming. A last look at the American Airways' airport and I pointed the nose toward the Finger Lakes and the setting sun. Encountering a cloud street, I rode it for 70 miles and 2½ hours. Eventually the problem of landing arose. My map showed an airport at Rochester, 10 miles distant. I was at 1,000 feet and could see the city and Lake Ontario. Could I make it? It seemed doubtful. All the lift was gone from the air and my graceful, birdlike machine was slowly sinking toward the earth. Peering intently over the side, I (Turn to page 90)

AIR ADVENTURERS

The Honor Roll For April

FLIGHT LIEUTENANTS

Leonard Hiedebrecht, Vermillion, Alta. Can.
John Koch, N. Wyoming, Pa.
Sherl Rhinesmith, Midvale, N. J.
Buddy Stricker, Sand Springs, Okla.
Terence A. Taylor, Featherston, Wairarapa, N. Z.
Joseph Thompson, Denver, Colo.
Macklin Wilson, Shelton, Wash.
Andrew J. Vangalis, Wausau, Wis.
Bill Calhoun, Glendale, Cal.

ENGINE MECHANICS

Harold Aaron, Richmond, Ind.
Walter Dinteman, Martinsburg, W. Va.
Anthony Lenac, Ottawa, Ill.
David Keith Miller, Toronto, Ontario, Can.
Chas. Sidlowski, Brooklyn, N. Y.

LaVerne Cressman, Kitchener, Ont., Can.
Melvin DuPont, Rutland, Mass.
Eugene Hackett, Chicago, Ill.
Max Couche, Adelaide, S. Australia
Jack Miller, Baxter, Kan.
Harold E. Grathwohl, Southampton, N. Y.

AIRPLANE MECHANICS

Robert F. Clark, Indianapolis, Ind.
Norman Dawber, Toronto, Ont., Can.
Bill Weil, New Orleans, La.

PHOTOGRAPHERS

Jack Efferth, Lakewood, Ohio
Robert Gray, Hot Springs, Ark.
Chester Wrobel, Chicago, Ill.
Milton Rockwell, Jersey City, N. J.
Robert Currey, Toronto, Ont., Can.
Roy Kaufman, Bridgeport, Conn.

Henry Triwush, Chicago, Ill.
Warren Vreeland, Pittsfield, Mass.
John Wojciechowski, Brooklyn, N. Y.
Warren C. Allen, Jr., Swarthmore, Pa.

OBSERVERS

William Langshaw, Seattle, Wash.
William Greeley, Milton, Mass.
Dana Roy Cunningham, Old Town, Me.
Bobby Beall, Sherbrooke, Que., Can.

TOPOGRAPHERS

Chester Ancar, Prince Albert, Sask., Can.
John E. Barriger, Owasso, Mich.
James Caffrey, Waterbury, Conn.
Jack Buehler, King Manor, Pa.
Charles Ed Duffy, Shady, N. Y.
Norman Hopper, New Westminster, B. C., Can.

Let's Face The Facts!

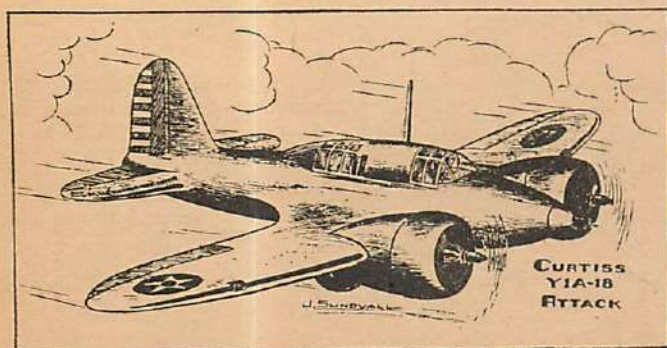
COME right in and shut the hangar door before this April shower blows the lockers right out onto the field. Just park the 'chutes and flying gear in the corner and I'll be with you in a jiffy.

Now, then, let's get right down to brass tacks and wind socks. Speaking of socks, the aviation industry seems destined to continue to take it on the chin every so often in the way of tragedies. The unfortunate part of it is that they all seem to be so hard to analyze as to cause, although the effect is always the same—a setback to the industry as a whole and another reason why many will not take both feet off the ground at the same time.

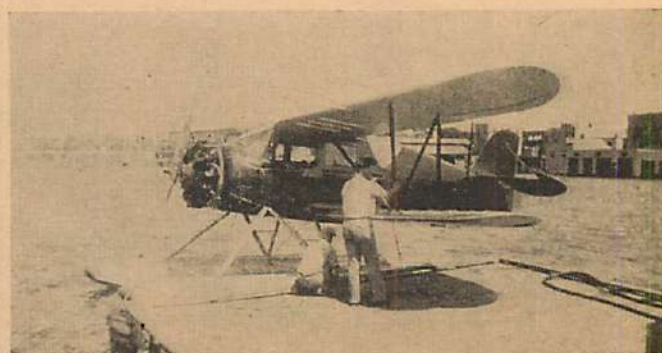
There seem to be two reactions within the industry as to the way to treat these tragedies. One group seems to favor the hush-hush attitude regarding them, carefully

keeping all details from the public and glossing them over with statements and counterstatements—sometimes even at the expense of the reputation of the pilot involved, when it is too late for the chap to defend himself. This group also seems to think it wise to issue several "reasons" that conflict, so that no one seems to have any real idea as to WHAT caused the crash. The reaction to this latter propaganda is one of complete nonconfidence on the part of the public in the ability of the industry to even know themselves why the crashes happen and so will be unable to take precautionary measures in the future.

The second and, to my way of thinking, the far more sensible and intelligent attitude is that of the group who insists upon full publication of the findings of the inves-



Drawing of a Curtiss Y1A-18 Attack by John Sundvall of Plainfield, New Jersey.



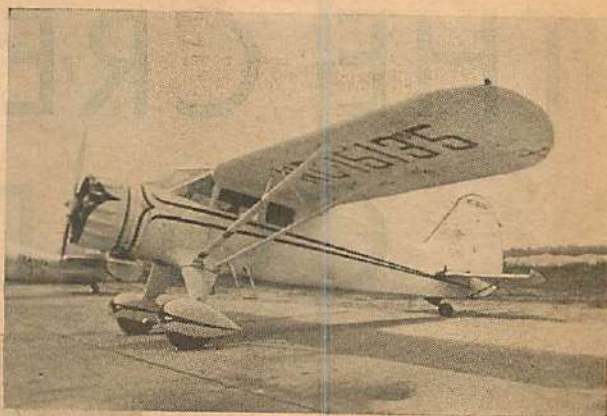
A Waco on floats by Air Adventurer Harold Ferguson, Kenova, Ontario.

gating boards and the complete responsibility being placed upon those responsible—whether within the industry or without, whether mechanical, structural, or human.

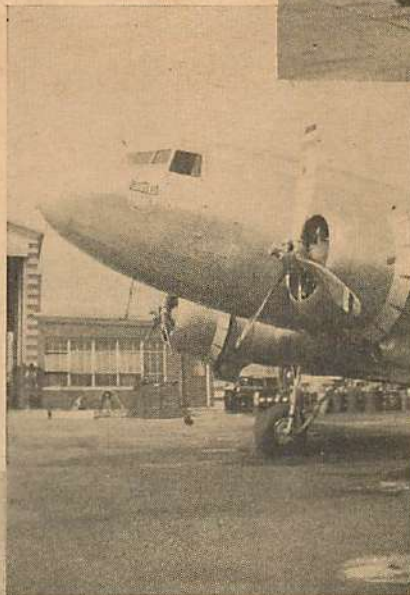
Take the example set by the railroad industry years before aviation was heard of. You, yourselves, have read in the papers of minor and sometimes major railroad accidents and have noticed that almost the first paragraph gives the *reason* for the crash.

"Split Rail Causes Minor Wreck" and "Broken Switch Derails Train" are just samples of the types seen. No beating about the bush, no counteralibis or statements. My helmet's off to the railroad industry on that very attitude—and the railroads still do business!

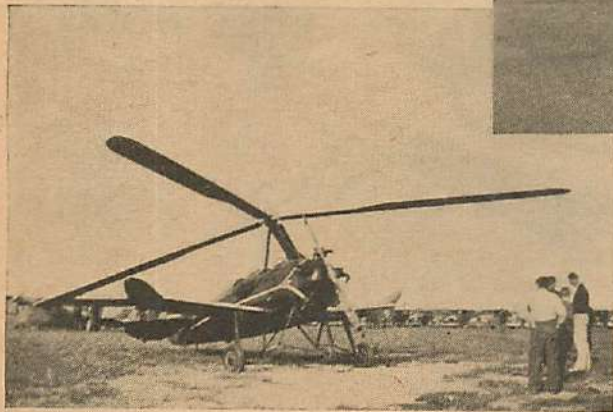
I know what you are thinking—how can we tell what causes the aviation accidents when the plane is a total wreck, with no living witnesses to the crash to testify? That's one unfortunate angle that we do have to contend with. However, there are means of finding from the tangled wreckage of an airliner or private plane some clue as to the whys and wherefores of the collapse. Instrument condition, position of controls and switches, condition of breaks in



Stinson Reliant by Edward Gukesch of Chicago.



Above—Douglas DC-3, by Robert Williams of Verona, New Jersey. Left—Pittcairn autogiro, by Bob Eggersman, Seymour, Indiana.



control wires and struts, even the way a propeller breaks, to the expert, all add a bit more to the collection of evidence. This must be sifted and analyzed and then put into form as the solution of the crash.

I do not want you Air Adventurers to feel that I am trying to excuse air crashes—I'M NOT! There are no excuses for air crashes—but there are REASONS. The reasons may be mechanical or human, but they are there. Neither the public nor the industry should be content with excuses, and neither are entitled to less than the FACTS and REASONS.

Public reaction will be logical, as you Air Adventurers can imagine. If a plane was found to have crashed for a particular structural failure, the public, so informed, will know that such a failure will be unlikely in the future. After crashes due to mechanical failure have been eliminated, as they will undoubtedly be, and the human element has been eliminated through the perfection of mechanical controls, we will find ourselves looking back upon this secrecy regarding crashes as one of misguided good intentions coherent with the rapid growth of a new and vigorous industry.

As I fly about the country, I find a new and healthy attitude regarding the "crash-reason secrecy." Even

among the industry members it has been hard to find the reasons for crashes. In some cases it is that they didn't know, and in others that they were afraid that someone's toes would be stepped on if they ever let out why such and such a crash took place. Now I find that one can find out why a crash occurred by asking those who would logically know.

If, and that's a mighty big "if," the industry would go a step further and voluntarily TELL the real reason—as soon as it has been definitely established—why they occurred not only to those who ask, but to anyone they could get to listen, the whole industry, you Air Adventurers, and the dear old public would all have a much sounder and more sensible attitude toward what at present is a tragic, but necessary growing pain of aviation.

As soon as we are able then, let us find out WHY these are happening and spread the word about, not to malign any plane or company, but to spread assurance that they will be prevented in the future. Remember and spread the proven saying that the safest time to fly is after a crash whose reason has been found.

(Turn to page 86)

(MEMBERSHIP COUPON)

To the Flight Commander, Air Adventurers,
79-89 Seventh Avenue,
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I am interested in aviation and its future developments. To the best of my ability I pledge myself to support the principles and ideals of AIR ADVENTURERS and will do all in my power to further the advance of aviation.

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

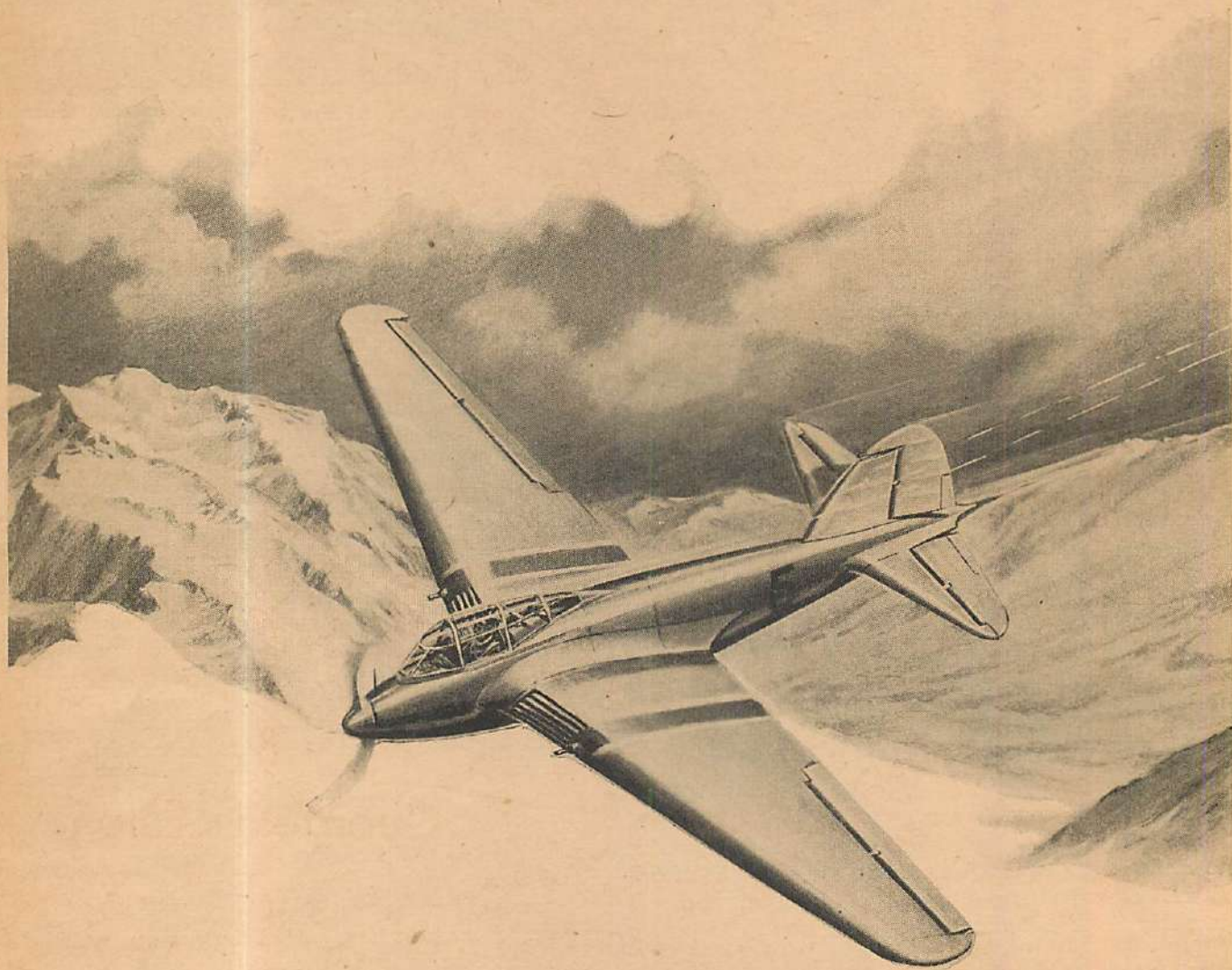
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THE CREST OF THE CORDILLERA



*A sinister force sides with death
above the silent crags of the
Andes to test the mettle of Bill
Barnes and his gallant band—*

A Complete Bill Barnes Air Novel



When he dived on the speeding green ship it crabbed from under his sights as though some unseen hand had flicked it out of danger—

By
George L. Eaton

BILL BARNES stretched his powerful arms above his shock of thick, blond hair, pushed his heavy, tan brogues out in front of him and edged down in his chair so that he was sitting on his spine. His rugged, bronzed face was wrinkled in a luxuriant grin.

"This," he said to young "Sandy" Sanders, the youngest of his famous squadron of fliers, "is what makes life worthwhile. No job on the books, nothing to worry about, plenty of money in the old sock and a chance to pick up the loose ends around the field."

"I'll be glad to catch up with a number of things I've been wanting to do," young Sandy said, his freckled face serious. "One thing in particular."

Bill glanced at him and wondered what fantastic idea Sandy had in his mind. He chuckled, inwardly, as he waited for Sandy to go on. He specu-

lated on whether there was any hobby Sandy hadn't tried.

"Do you ever listen to the radio, Bill?" Sandy asked in a moment.

"Occasionally." Bill waved his hand at the little set in the corner of his living room. "A speech I want to hear, some good music, a football game or a prize fight. I'd like to have time to listen to more than I do."

"Have you ever heard Charlie McCarthy—Charlie Frankenstein McCarthy, the New York Times called him in an editorial?" Sandy asked.

"N-o-o," Bill said. "I don't believe I have."

"He's a ventriloquist's dummy," Sandy explained. "He's the biggest sensation on the radio right now. The ventriloquist who created him is a mighty clever man. I sometimes think I'd be smarter if I—" A slow flush

crept over Sandy's face and he stopped talking.

"If you what?" Bill asked, his eyes gleaming suspiciously.

"You remember when I was practicing ventriloquism?" Sandy said, changing his method of approach.

"Yes. I remember the time you threw your voice and made a gunman, who had an automatic stuck in my stomach, look around. It gave me time to clip him on the chin. That was when we were giving Mike Morales a hand down in Samerra."

"Sure," Sandy said eagerly. "And it worked that time with that bunch of natives out in Madagascar. Remember, they were stealing up to surround the transport-carrier when I was the only one aboard? They were going to get one of the transport's eggs and fly on it after it hatched?"

"Yes," Bill said, laughing. "What are you leading up to, kid?"

"I was just thinking," Sandy stammered, "that I ought to take it up again. Here I am wasting my time flying from here to there and getting no place."

"Flying from here to there and getting no place!" Bill roared at him. "Do you realize—" He stopped speaking and reached for the telephone as the bell jangled.

"Hello. Barnes speaking," he said into the mouthpiece.

"Hello, Bill," Tony Lamport, chief radio operator and superintendent of communications on Barnes Field, said in his ear. "Some bird who won't give his name wants to speak to you. He won't tell me anything. Do you want to talk to him?"

Bill groaned and said, "Put him on, Tony."

"Barnes speaking," he said again when another voice came on the wire.

"You were prudent to speak to me, Mr. Barnes," a pleasant voice said in his ear. "You'll save yourself a lot of grief if you take my advice."

"That's what all people who want to give advice think," Bill growled. "Who are you?"

"That doesn't make any difference," the voice said. "I want to advise you very strongly not to touch that South American job."

"What the hell are you talking about?" Bill wanted to know.

"That," the voice said, "is all I have to say. Don't touch that South American job or you will deeply regret it."

"Listen!" Bill shouted. But he was shouting into a dead connection. A click on the other end of the line told him that the person had hung up.

"What—what was it, Bill?" Sandy asked.

"Nothing!" Bill snapped. "Just some dodo trying to spoil the first day of rest I've had in two years. South American job!" he exploded. "I wouldn't tackle a South American job with your Aunt Hester's ice pick, kid."

Sandy frowned and shook his head. Sometimes he didn't quite understand this flying wizard who was his guardian and boss. He decided to ignore the South American angle and go back to Charlie McCarthy.

"I've been experimenting a little recently," he said to Bill, "and I find that I can still throw my voice. It's something you born with, I think."

"What's that, kid?" Bill asked, frowning. He hadn't been listening to Sandy. He had been thinking about that pleasant-voiced threat to lay off a job in South America. Who the hell wanted a job in South America? He shook his shoulders impatiently and tried to concentrate on what Sandy was saying.

"I was saying," Sandy began, when the telephone bell rang again.

Bill reached over to pick the instrument out of its cradle, hesitated involuntarily, then grasped it.

"Yes," he said. He knew what was coming a moment later. He could feel it deep down inside him.

"Hello, Bill?" a voice said.

"Bill speaking."

"This is Buzz Harding, Bill. How are you, you old parsnip?" the voice said.

"Hello, Buzz!" Bill said. "It's something to hear your voice again! Where are you?"

"In New York, Bill. I came up by plane via Miami and just landed at Newark. I want to see you right away."

A million things flashed through Bill's mind as he remembered the last thing he had heard about "Buzz" Harding. And Bill knew before Buzz said anything more that this was the job the anonymous voice had warned him against. He steeled himself to refuse to have anything to do with it, even though one of his best friends was concerned.

"What's on your mind, Buzz?"

"I don't want to talk about it over the telephone," Buzz said. "I'll get a ship here and fly over there immediately."

"Give me an idea," Bill persisted. "If it's something about a job in South America, I won't touch it. I won't touch anything for six months. I have too much to do here on my own field. I'm up to my neck in work."

"Listen, Bill," Buzz said softly. "This is something. I can't talk about it over the phone. I'll be over there in a shake."

"No! I'll be glad to see you any time, Buzz. You know that. But I won't talk business with you. I won't even listen."

"You've got to listen to this, Bill," he said earnestly. "You know I'm with the Rodriguez-Thompson people in Peru. Commercial stuff, of course. We have a big contract on our hands, but we can't carry it out because—well, it's something that is right down your alley."

"No!" Bill said again. "I won't listen to you, Buzz."

"You've got to help me," Buzz pleaded. "Everything was going fine on a job we contracted, until about a month ago. Then—"

Bill heard Buzz Harding's voice break off abruptly and then rise to a horrible sound that was half a gasp and half a scream.

"Buzz! Buzz!" he shouted into the mouthpiece.

But no voice answered him. He heard a dozen voices talking excitedly, so he raised his own voice and shouted

as loudly as he could into the mouthpiece.

"Hello, hello," a nervous voice answered him.

"Hello," Bill snapped. "What happened to the man who was talking to me?"

"Someone," the voice said, "stabbed him in the back. If you're a friend of his, you'd better get here quick."

"You're talking from Newark Airport?"

"Yes."

"This is Bill Barnes talking," Bill said. "I'll be over there immediately. Tell the field manager to do everything he can until I get there."

II—THE SAVER OF SOULS

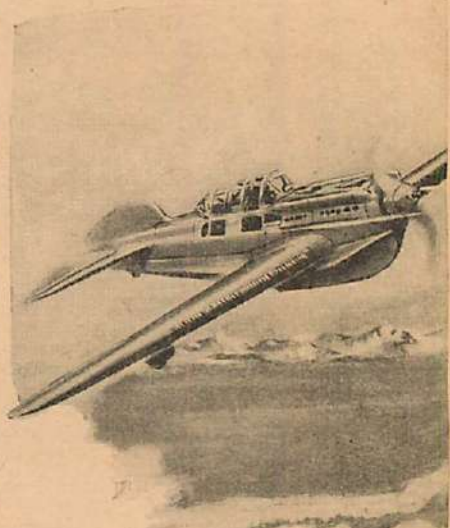
BILL played a quick tattoo on the saddle-bar of the telephone to get his own operator. The grin was gone from his face now and his expression was one of fixed intensity.

"Hello, hello," he snapped. "Give me Scotty."

When "Scotty" MacCloskey, major domo of Barnes Field, came on the wire, Bill spoke to him in the clipped, staccato manner that was characteristic of him when he was going into action.

"Check the Lancer and warm her up, fast!" he said. "I'll want her ready to go in ten minutes."

A half dozen grease monkeys and mechanics were swarming over the big



sesquiplane that was the Silver Lancer when Bill and Sandy ran around the corner of the administration building and onto the apron. Large, sticky flakes of snow were flattening themselves against the metal skin of the ship as her twin opposed props ticked over slowly in the wintery dusk.

Old Scotty MacCloskey's sharp, quizzical eyes peered at them from the folds of his hooded overall as he climbed out of the pilot's cockpit.

"She's ready to go?" Bill asked.

"She's always ready to go, boy," old

Scotty said, reproof in his voice. "Has anything serious happened?"

"Don't know," Bill said. "Going to Newark. I'll check back with Tony. Get in there, kid," he shouted at Sandy.

He climbed into the forward cockpit, checked his flares and gunned the three thousand horses in the twin Barnes Diesels while his eyes glanced over his instrument panel.

The next instant the big ship began to roll down the shadowless, sodium-vapor lighted runway. In the center of the field, where the main runways converged, he tapped his rudder to kick the ship into the wind. The engines blasted and the flaps came down. Fifty seconds later the retractable landing gear slid up into the main float and the wing tips, and the big ship became a silver bullet.

Long Island and New York harbor faded away, a dim mass of blurred lights below them. Bill made contact

field manager came running across the apron. Bill dropped to the ground and the manager came puffing up, his face red and glistening.

"What the hell is this all about, Bill?" he wanted to know.

"Where's Harding?"

"At the Anglo-French Hospital," the manager said. "He asked for you the last thing."

"Is he dead?"

"They said he had a chance. What's all—"

"Is there a taxi at the gate?" Bill interrupted.

"There's one waiting with his motor running," the manager said.

Ten minutes later Bill was standing at the bedside of his old friend, Buzz Harding. But he was not the round-faced, congenial Buzz Harding Bill had last seen. His face was pale and lined and twisted with pain. Bill could see that death was in his eyes.

"Hello, socker," Buzz said to Bill and he tried to grin. The effort seemed to drain the blood completely from his face. A nurse gazed at him anxiously and placed a hand on Bill's arm.

you can, Buzz," Bill entreated. "Who stabbed you? Do you know?"

Harding's eyes fluttered shut again for a moment and a trace of a smile curled the corners of his mouth.

"He calls himself 'The Saver of Souls,'" he whispered. "One of his men did it. I don't know who he is. But—but I can't talk about that now. I've got to tell you what has happened and what you must do, Bill. You remember Ned Bunyon, my partner?"

"Yes," Bill said and he shuddered at the way Buzz Harding was fighting desperately to bring order in his delirious mind.

"He's down there—alone—with the thing that calls itself The Saver of Souls," Harding whispered. "You've got to go help him, Bill. You've got to go!"

"O. K., Buzz," Bill said. He gripped his wrist tightly and wondered what manner of mad delirium had seized him. He moved his lips as he repeated in his mind, "The Saver of Souls." The name had a sinister sound.

"I'm going to begin at the beginning," Harding whispered through dry lips. "It began way back, Bill, before the days of the Conquistadores. The Inca kings mined gold and silver from mines deep in the gorges of the Andes. When the Spanish conquered them, they took it out and forced the Indians to go back in and bring out an endless stream of treasure. Only the Indians and their Spanish conquerors knew the locations of the mines.

"The Spanish used the forced labor of the Indians to bring the gold out along precipices that towered a mile high, and over the great peaks of the Cordillera. Llamas could carry only a hundred pounds through the rarefied air. They carried out millions and millions for their conquerors.

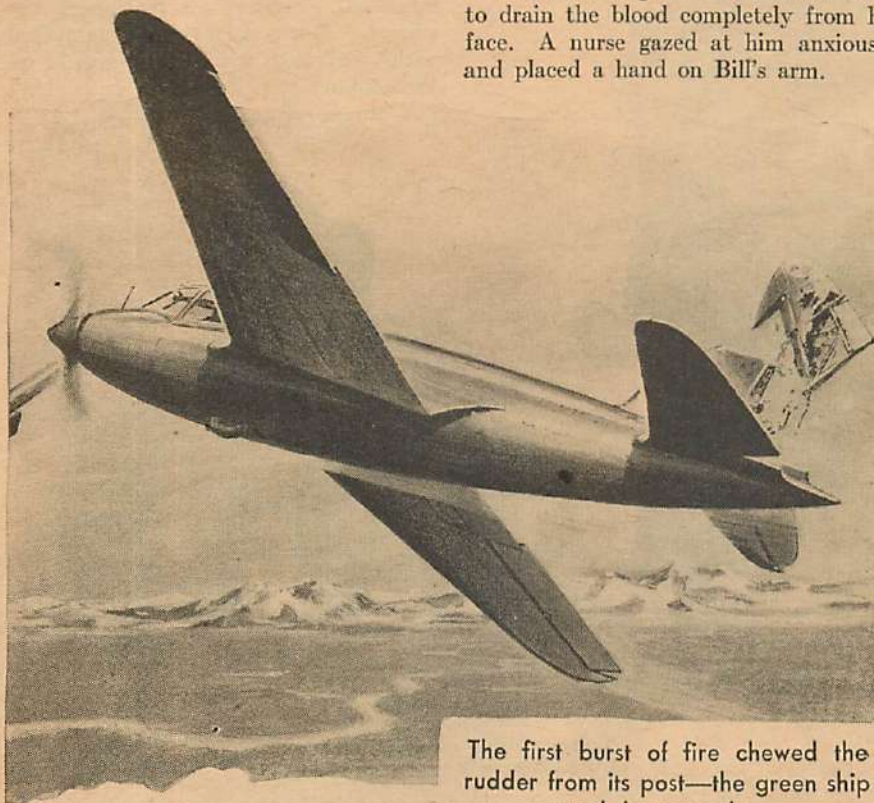
"The mines have not been worked for two centuries. Men have been trying to find them and then figure out a way to work them. Without forced labor it is impossible to get natives to carry the heavy gold over the Andes."

Harding stopped for a minute and fastened his feverish eyes on Bill's face, asking him if he understood.

"Do you get the picture, Bill?" he asked.

"I get it, Buzz. But take it easy, man. What do you have to do with it?"

"A year ago the Maroma Mining people came to Ned Bunyon and me with a proposition. We had a general passenger and express business between Lima and Iquitos in Peru. They offered us a contract to take nearly a million pounds of machinery and men over the Andes into the Maroma Valley in Peru. They told us it would take them ten or fifteen years to take the



The first burst of fire chewed the rudder from its post—the green ship yawed dangerously—

with the operations officer in the control tower of the Newark Airport.

"O. K., Bill Barnes," the operations officer told him. "Wind—northwest nine. O. K. to come straight into northwest runway. Taylor Cub coming in from southeast—five miles away. I can see your ship now."

"O. K.," Bill said. He kissed the flooded runway with his landing wheels and spoke to the operations officer again, asking for instructions.

"Turn to your right, Barnes. Taylor Cub is landing on your left; taxi on to Gate Number One."

Bill locked his wheel brakes as the

"You mustn't stay long," she whispered. "He—"

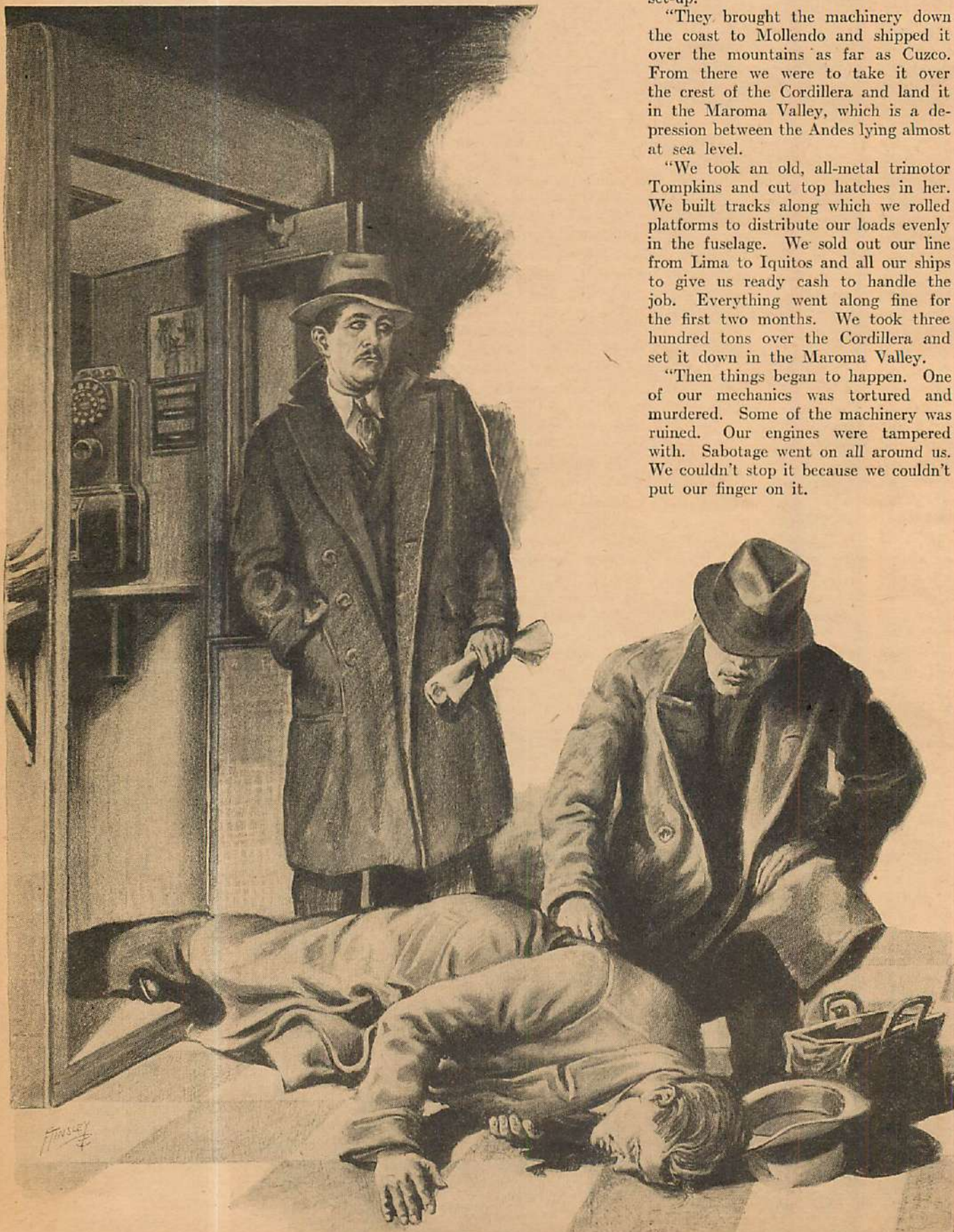
"Go away!" Harding barked at her. "I've got to talk."

"Right, Buzz," Bill said. "Take it easy, though. Save your strength."

A clock struck softly down the corridor as Buzz Harding closed his eyes for a moment to gather his strength. To Bill, watching the labored fall and rise of his chest, it seemed like all eternity. When Buzz's lids fluttered, Bill leaned forward to catch the words as his lips began to move.

"Speak slower and more clearly if

"Buzz! Buzz!" he shouted into the mouthpiece. He heard a dozen voices talking excitedly—



machinery in over the mountains. After the mine was in operation we were to have the job of bringing their gold out to the coast. It was a swell set-up.

"They brought the machinery down the coast to Mollendo and shipped it over the mountains as far as Cuzco. From there we were to take it over the crest of the Cordillera and land it in the Maroma Valley, which is a depression between the Andes lying almost at sea level.

"We took an old, all-metal trimotor Tompkins and cut top hatches in her. We built tracks along which we rolled platforms to distribute our loads evenly in the fuselage. We sold out our line from Lima to Iquitos and all our ships to give us ready cash to handle the job. Everything went along fine for the first two months. We took three hundred tons over the Cordillera and set it down in the Maroma Valley.

"Then things began to happen. One of our mechanics was tortured and murdered. Some of the machinery was ruined. Our engines were tampered with. Sabotage went on all around us. We couldn't stop it because we couldn't put our finger on it.

"Then this—this thing that calls himself The Saver of Souls began to threaten and warn us. We couldn't put our finger on him. But we had heard about him. We had a time limit on our contract to take that machinery in. That's why I'm here, Bill. It's the end of both of us if we don't finish the job."

"Who is trying to stop you?" Bill asked.

"It's another faction that is trying to get control of the mine. Get it away from the people who employed us," Harding said. His voice was desperate now. "We can't accuse anyone. Their agent is the madman who calls himself The Saver of Souls. We thought we had him stopped, when he struck his finishing blow. Two of our extra pilots were flying a ton of machinery over the crest when they were attacked and shot down. We've never been able to get into the gorge where the ship crashed, but we found Indians who saw the murder committed."

"That was the end until I thought of you, Bill. I thought of you and that heavy-armed transport-carrier of yours. I knew you'd step in and help us save everything we have in the world. I flew up here to get you and they followed me. They knew what I was going to do. We must have let someone know, someone we thought we could trust. I——"

His voice rose and ended in a choking sob. The nurse stepped over beside Bill again.

"You must go now," she said. "He won't have a chance if you don't. We'll give him a hypo to quiet him. It's his only chance."

Buzz Harding opened his eyes wide and fastened them on Bill again. His mouth was twisted into an unnatural snarl.

"Go send his soul to hell, Bill!" he begged. "Don't let me down. Ned Bunyon is waiting at Cuzco for you if this Saver of Souls hasn't knifed him in the back, too. You'll go, won't you, Bill?"

His bloodshot eyes were sparkling with fever now and Bill hesitated for only an instant before he answered. But during that instant he thought how things had been that morning—nothing on the books but picking up the loose ends around Barnes Field.

"I'll go, Buzz," he said quietly. "You take it easy, fellah."

III—A GOOD INVESTMENT

AT the head of the perfectly appointed table in the dining saloon of his one-hundred-and-eighty-foot oil-burning yacht, *Haman*, sat Mordecai Murphy.

The wives of the government officials and United States navy and army officers seated around the table watched Mordecai Murphy's adroit handling of the dinner party with envy. The food was superb, the wine excellent, the service perfect. On top of that, Mordecai Murphy's conversation and wit were positively brilliant. He was able to carry on a conversation with one person and at the same time detect the wishes of another person at the table. He was the perfect host.

His knowledge of affairs ranged the whole gamut of the world. He was informed about everything from peach growing to government pump priming and he was not offensive about it. He managed to avoid the odious "I" in relating his experiences and contacts. He seemed to have a working knowledge of and a personal contact in every part of the globe.

His age might have been anywhere between forty-five and sixty. His hair was gray at the temples and his face was both ethereal and strong. His smile was one moment pensive and the next as hard and brittle as winter sunshine on ice. He wore his clothes draped on his lean, powerful frame as only a Bond Street tailor can drape them. His hands were long and thin and yet they had strength.

He was a most amazing man.

One moment he could carry his guests into his rollicking humor by great bellows of hearty laughter. The next moment he could freeze them and make them feel as though they had ice water creeping up their spines.

No one knew anything of his antecedents. And he was not the kind of



man you could ask. Many people preferred to believe that his grandfather had been one of those dashing young Irishmen who settled in South America to conquer the *pampas* and the daughter of a Spanish don. His enormous fortune was supposed to have come from South American oil and emeralds.

He was known to have a finger in affairs in every part of the world—but no one knew which finger or which part of the world. He had been decorated by three nations and awarded a medal for explorations.

It was known that he made his home aboard the *Haman* when he was not visiting one of his half dozen homes scattered across the globe. Many items appeared about him in the press. But never anything definite.

The guests who were dining with him on this night were the high officials of the Canal Zone, and their wives. They knew as much about Mordecai Murphy as the next person. They met him at their clubs and dined aboard his yacht. They never knew just why they were invited to dine with him when the invitation came. Sometimes they didn't know until months later. Sometimes they never knew. But they always knew he was after information of one kind or another. They seldom knew when they gave it to him.

He was truly a man of mystery.

At ten thirty Mordecai Murphy stood on the main deck of the *Haman*, bidding his guests good night. The Commandant of the United States Naval Base at Coco Solo followed the Governor of the Canal Zone down the brass-railed steps to the waiting launch. Before he stepped into the launch he called back to Murphy: "I'll expect you tomorrow for luncheon to look over those new bombers that just flew down from San Diego."

"I'll be there," Murphy answered.

They waved good night and the launch pulled away across the roads toward Cristobal. Looking back, the dozen guests gazed with envy at the *Haman*. Riding low in the water, she was as spick, span and trim as an English greyhound.

Mordecai Murphy turned and went back into the lounging saloon of the *Haman*. There was just a trace of a smile on his lips as he selected a cigarette from a mahogany box and put it between them. The smile was both cynical and amused.

"He'll tell me all about it tomorrow," he mused. "It may cost me fifty thousand to save him, but one of these days he'll pay me back."

He rang a button and went into a room adjoining the lounge and closed the door behind him. He crossed the soft Bokhara rug that covered the deck and sat down behind the large mahogany desk placed against a bulkhead.

A slim, pale-faced man, who looked as though he might be tubercular, got up from another desk and closed the door that led into a radio room.

"Anything new?" Murphy said to him.

"BC bungled the job at Newark Airport," said the pale-faced man, who was named Sneed. "They got Harding to a hospital. Barnes called on him and there is every reason to suppose Harding talked to him."

Mordecai Murphy tapped on the desk top with his fingernails for a moment. His expression did not change.

"KR was to telephone Barnes," he said. "Any report on that?"

"KR reported that he telephoned Barnes according to instructions. That was all," Sneed said.

"Did we give BC any explicit directions as to Harding?" Murphy asked.

"No," Sneed answered. "He was or-



Mordecai Murphy.

dered to prevent Harding from talking to Barnes."

"Get BC's case record," Mordecai Murphy directed his secretary.

Sneed went to a series of steel files, pulled one open and took out a flat folder. He took it to Murphy's desk. Murphy glanced over the typewritten pages in the folder and handed it back to Sneed.

"Enter under 'Qualifications'—cannot be depended upon to carry out lone assignment," Murphy said. "Make a record of this incident, also. Instruct SP in New York to inform BC that he has failed grievously and that I, personally, am very much disappointed. But first give me PC's case record."

Again Sneed went to a steel filing cabinet and pulled out a folder which he placed on Murphy's desk. Murphy's long, graceful fingers flipped back the cover. His gray-green eyes danced over the typewritten sheets. He read:

NAME: Pedro Cassata. Age, 36. Mixed parentage. Dark, keen-eyed. Nice appearance, slightly on the hard side. A good mixer. Does not talk too much. Can be trusted.

OCCUPATION: Aerial freebooter

and soldier of fortune. Has well-equipped squadron of six hard fighters. Has done work in South America, China, Morocco.

WEAKNESS: Women and desire for money to spend on them.

WHERE ENCOUNTERED: Nicaragua, 1926.

DIFFICULTY FROM WHICH SAVED: Captured by Trujillo. About to be executed. Was very grateful for intervention. Promised to repay debt upon request.

METHOD OF APPROACH: Money only. Would not react to an appeal to his gratitude alone.

RECORD OF SERVICE:

There the record ended. There was no entry under RECORD OF SERVICE. Murphy closed the folder, leaned back in his chair and closed his eyes. After a moment he opened them and said to Sneed, "Look through your records of location and see if you can find out the present whereabouts of PC."

"Yes, sir," Sneed said. "Offhand, I believe he has just returned from Spain."

"Make sure," Murphy said. "I want one of our agents to contact him tonight. Let me have the case record of MH."

Again Mordecai Murphy flipped typewritten sheets.

NAME: Martin Hogan. Age 40. American. Light-complexioned, weak face. Did excellent work with United State Squadron 466 in France. Too much drinking and easy life softened him up.

OCCUPATION: Aviator. Test pilot for Morton Aircraft for a time. Became manager of their Pittsburgh field.

WEAKNESS: Himself and liquor.

WHERE ENCOUNTERED: Pittsburgh through agent RM.

DIFFICULTY FROM WHICH SAVED: Embezzlement. Had sold equipment of Morton Aircraft and kept money. Was about to be indicted and jailed. RM managed his release. Was very grateful for intervention. Promised to pay debt upon request.

RECORD OF SERVICE: None. (Is well acquainted in aviation circles because of his war record. Is close friend of such notables as Bill Barnes, Ernest Friend, Red Gleason, etc.)

"Have RM, Pittsburgh, contact MH at once," Murphy said to Sneed. "Tell him to stand by for orders."

Mordecai Murphy leaned back in his chair and closed his eyes again. Through his amazing brain marched a long line of faces in single file. Some of them he knew by sight, others only by their initials.

They marched from around the world and joined in one long line in his agile brain—Americans, Englishmen, Frenchmen, Spaniards, Germans, South Americans—nearly every race.

A long array of men whose destiny he once held in the palm of his hand. Men whom he had saved from paying the penalty of their crimes. Men who had promised him great things in return for his acts of charity and kindness. He had snatched them out of jails, dungeons and the jaws of death to give them a new lease on life. To them he was the great emancipator. The great savior of souls.

But he had not saved them for themselves. He had saved them to serve as grist in his astounding mill of evil.

IV—DEPARTED

BILL BARNES' blue-gray eyes gleamed as he blasted the two fifteen-hundred horse power, supercharged Diesel engines in their nacelles aboard the huge carrier-transport "BT-4." The two million-candle-power landing lights cut a path through the black night as Bill flipped a switch. An instant later the transverse bands of yellow-and-black pigment painted across the runways became visible, as huge floodlights were turned on in the traffic tower.

Fifteen minutes after Bill and Sandy had landed back on Barnes Field the place had been converted from a sleeping airport to a place of feverish activity. Bill had made contact with Tony Lamport on his way back from Newark and had given him orders.

"Tell Scotty to have the carrier out on the apron and ready to go in fifteen minutes," he had said. "None of the crew, except Miles, to work the take-off and landing mechanism."

"O. K., Bill," Tony said. "Anything else?"

"No. We'll only be out a short time. Just long enough for Sandy to take the Eaglet out and bring her in under her own power. Tell Scotty I'll want some sheet metal men to reinforce the deck under the Eaglet's hangar. It will have to be done tonight. We're shoving off for South America in the morning without the Eaglet inside."

Bill checked the revs on the tachometer. He checked the interior of the bridge with one swift glance and threw the switch on the interplane telephone.

"Are you standing by, Miles?" he said into his mouthpiece.

"Ready, sir," Miles answered.

Above and behind Bill's head was a circular platform on which was mounted a rapid-firing one-pounder that could throw over one hundred one-inch shells in the space of a minute.

In the midship section was the hangar of the Eaglet, Sandy's fast little fighter. Suspended on its hook from

an overhead girder, it was locked rigidly in place on the girders and hung with its cockpit just above the level of the deck.

Behind the Eaglet's hangar was a retractable machine-gun turret that could be lowered below the bottom of the fuselage. Farther back were showers, lavatories, dining salon, with seats that could be converted into berths for the crew. In the tail was the galley, with an electric stove, ice box and a machine-gun turret where old Charlie, the cook, held forth.

On the bridge of the monster were dual controls and instruments, Sperry automatic pilot, wireless equipment, Kreusi radio compass "homing device" and every modern appliance known.

From the bridge and pilot's compartment steps led downward to the machine gunner's cockpit in the nose. Beneath his feet were the bomb sights



Ned Bunyon.

and releases. In each of the wings, abaft the engines, were inclosed machine gunners' pits similar to the one in the nose. A runway connected these two cockpits with the main fuselage. The big ship was a bomber, a flying fortress, a carrier all in one.

Bill slipped his boots into the rudder stirrups and gunned the engines again as Sandy came on the bridge. He flipped his radio switch and asked Tony Lamport if the field was clear.

"O. K., Bill," Tony said. "Let her ride."

He eased off on his right wheel brake and blasted his starboard engine to spin the nose around into the wind. The monster transport rolled down the runway like some great beast. Two hundred yards from the electrically wired fence surrounding the field Bill eased back on the wheel and took it into the air in a long, low climb.

Far off to the right the spires and turrets of New York's lighted skyscrapers gleamed above the city. Sandy stood gazing at them out a port window. Suddenly he wheeled and his eyes were wide and anxious.

"You know, Bill," he said, "I think

it's going to be bad luck to take the Eaglet out of her before we get down there."

"Phooey, kid," Bill said. "We've got to reinforce the deck if we're going to carry machinery over the Andes. We have the equipment here to do it in jig time. Down there it may be a different matter."

"We'll never bring her back if——" Sandy stopped.

"Take the controls, kid!" Bill snapped. "I want to make a check before you take off. Level off at five thousand."

"O. K., sir," Sandy said, automatically.

A few minutes later he was back and dropped into the commander's chair.

"All right," he said to Sandy. "Wrap it around you!"

Sandy was on his feet immediately. In another instant he was in the cockpit of the little fighter that had literally been built around him and was fastening his safety belt.

Bill throttled his engines as Sandy waved a hand at him and signaled to Miles to throw the switch that would bring the powerful suspension gear into play.

As Miles threw the switch, the floor of the transport divided into two segments and swung downward. Then the telescoping crane supporting the tiny fighter moved slowly downward and the Eaglet slid through the opening.

When the little plane was about twenty-five feet below the undercarriage of the carrier, Sandy turned a crank that operated a high-speed worm manipulating the folding wings. There was a metallic click as the locking lugs turned; then the wings began to turn on their hinges. Another click and the gull-type wings were locked in flying position.

Bill held the ship steady while he waited for the blast of Sandy's engine. As the roar of the powerful nine hundred and fifty h.p. twin Wasp joined the crescendo of the two supercharged Diesels, a smile flitted across his face.

While Sandy warmed up his engine, he tested his controls. When he flicked a hand above his head, Miles pulled the release lever. The Eaglet dropped away into the night in a steep glide, leaving the transport far behind.

Bill exhaled his breath explosively. It was always a decided relief to him when the kid got his ship away safely. He flipped the key on his short-wave radio panel.

"Everything O. K., kid?" he asked.

"Everything is as sweet as a baby's breath!" Sandy said ecstatically. "She's a breeze, Bill. I wish we could take her along."

"Follow me in," Bill said. "We have a lot to do before morning."

He chanted Tony Lamport's call let-

ters in his microphone until Tony answered him. "Tell Shorty, Red and Bev I'll want to see them in my bungalow as soon as I get in," he told Tony.

"O. K., Bill," Tony said. "Shorty just checked in."

"Shorty" Hassfurth, who had been I. Kinter Hassfurth to his parents, was Bill's chief of staff and right arm. He was a round-faced man of thirty-eight who looked thirty-two. He wrinkled his hard-bitten blue eyes as the telephone rang in his quarters.

"Probably that blue-eyed baby with the million in the bank who wants to marry me," he said to "Red" Gleason, the carrot-topped Barnes pilot, who had been Shorty's pal since the days they had flown S. E. 5s and Spads over the German lines.

"Yeah," Red grinned. "It's probably some dame who wants to know when you're going to pay her back that twenty bucks."

"Hello, sweetheart!" Shorty said into the mouthpiece.

"Hello, you ape," Tony Lamport said in his ear. "Bill wants all hands on deck in his bungalow in fifteen minutes. Tell Red and Bev."

"They're told," Shorty said.

He hung up the receiver and rubbed his hands together. His broad Pennsylvania-Dutch faced glowed with anticipation. He was like an old war-horse champing at the bit. He could smell action in the tone of Tony Lamport's words.

"Run across the hall and tell Bev," he said, "Bill wants us over in his bungalow. It sounds as though we might be going places to do things."

"Where and what?" Red asked, his eyes gleaming.

"What difference does that make?" Shorty wanted to know.

BILL glanced around the little circle of faces in the living-room of his quarters. His eyes rested for a moment on the handsome face of Beverly Bates, the brown-eyed Bostonian who had become a veteran combat pilot during the time he had been with Bill.

"I'm afraid I'll have to ask you to forget your new photographic plane for a bit, Bev," he said. "I've taken on a job that I couldn't very well refuse."

"That will be quite all right with me," Bev said in his precise Harvard accent. "I'm getting a bit stale fooling with that aerial camera."

They all fastened their eyes on Bill's bronzed face and waited for him to go on. He told them about Buzz Harding and Ned Bunyon and the situation that confronted them. He didn't dramatize the thing, just told them the facts and waited for their reaction.

"What time do we shove, Bill?" Red Gleason asked when he had finished.

"Dawn or soon after as possible,"

Bill said. "But what about it? Do you think I could refuse to help them?"

"Hell, no," Shorty said. He got to his feet, stretched his arms above his head and yawned. "I'm going to get some sleep if I have to get up that early."

"If you don't have the guts to go speak up and you can stay home," Bill seemed to say.

They all looked at him with startled expressions on their faces. And his face was quite as startled as theirs—as though he couldn't believe he had said such a thing. Color surged around Shorty Hassfurth's collar and mounted to his face. His hands clenched and unclenched as though he was trying to keep control of himself, afraid of what he might say.

"I didn't say I didn't want to go, Bill," he began. "I—"

"Yeah," Bill's voice said. "You're gettin' old, but you don't want anyone to know it. You're losing your grip. When men get old they begin to tremble!"

"Why, damn you!" Shorty roared. "What's the matter with you, Bill?"

But Bill wasn't listening to Shorty. He was looking at Sandy and he was pointing his finger at him angrily.

"Listen, kid," he said. "I'll give you a ten second start to get out of here before I tell 'em!"

Sandy didn't stop to argue. He knew what would happen to him when Shorty knew the truth. He grabbed at his helmet and made a dive for the door. Bill swung a boot at him as Sandy went out the door. When Bill turned around he was laughing. He looked at the enraged Shorty and began to laugh the harder.

"I'm sorry, Shorty," he said in a moment. "I didn't say those things to you. It was Charlie Sanders McCarthy talking. He's been practicing up on his ventriloquism again. He put the words in my mouth."

"Why the lousy little lug!" Shorty said and then they all began to laugh. "I'll Charlie McCarthy him!"

The sixteen-foot props of the big carrier-transport gleamed dully in the false dawn as a mechanic blasted the two powerful Barnes Diesels the next morning.

Two low-wing, all-metal Snorters, whose twin opposed props were idling in the dim morning light, stood beside the BT-4. Above the rims of the fast amphibians jutted the goggled, white-helmeted heads of Bev Bates and Red Gleason.

As a white light flashed in the control tower and Bill's hand shot above his head, Shorty Hassfurth took the Lancer down the runway and into the air. The retractable gear rose smoothly to disappear into the main float and the wing tips.

An instant later the two Snorters raced into the wind and joined the Lancer far overhead. Bill could see their navigating lights silhouetted against the winter sky.

"I'll keep in touch with you by radiophone," Bill said to Scotty MacCloskey. "That's a nice job you did reinforcing the deck."

"It will stand a lot of weight," Scotty said. "Good luck to you, boy, and be careful."

"I don't anticipate any trouble before we reach South America," Bill said. "Perhaps not then."

They shook hands and he waited until the port gangway had been withdrawn and the port door sealed. Then he flipped his intercockpit telephone switch and checked his crew: Old Charlie, in the tail; Miles, who operated the retractable machine-gun turret when the Eaglet was not aboard; Martin, up in the nose, who could knock a speck of dust off a gnat's nose with his bombs at two hundred and twenty m.p.h.; McCoy and Neely in the two machine-gun cockpits abaft the engines. Above and behind Bill's head young Sandy rode the circular, glass-enclosed one-pounder turret.

Then Bill took the big ship down the runway with the lugubrious grace of a charging rhinoceros and bounced it into the air.

At ten thousand feet the two Snorters fell into a tight little formation, one on each side of him. Two thousand feet above and a little in front rode the Silver Lancer.

Bill made contact with the three ships on the radiophone, gave them their cruising speed, course, wind, drift and direction and told them to take it easy.

"Just keep your eyes open," he said. "We'll follow the coast to the tip of Florida, cross Cuba and Jamaica. Then there is an open water hop of about six hundred miles across the Caribbean. We'll lay over tonight and refuel at Barranquilla, Colombia."

He threw the key and called Sandy down from the one-pounder turret to take over the controls.

"We'll be out of this cold weather in a couple of hours," he said. "Just let her ride easy. Don't force her."

"O. K., Mr. Barnes," a voice said behind Bill. "I won't use my whip."

Bill whirled to find no one behind him. Then he glared at Sandy. "Listen, kid!" he exploded. "Save that stuff until you need it!"

MORDECAI MURPHY'S lean, tanned face was wreathed in contented smiles as his motor launch bounced over the waves, taking him back aboard the *Haman* after having had a very enjoyable luncheon with the Commandant of the Naval Base.



Black smoke belched from the engine housing and the rugged fighter became a roaring inferno—

The luncheon had cost him, Mordecai, a matter of forty-five thousand dollars. That was the amount the Commandant was short in his official funds. Mordecai chuckled to himself because he knew just how he could get that forty-five thousand back, ten times over. He was in close touch with a foreign power that would pay twenty

times the amount, if necessary, to secure information the Commandant would give him within a few days.

Mordecai got to his feet as the skillful crew of the launch brought it up alongside the gangplank on the lee side of the *Haman*. His secretary, Sneed, was waiting for him at the top of the gangplank. He fell in step beside him and

they walked together to the lounging salon.

"Barnes will be in Barranquilla tonight," Sneed told him. "MH could not make contact with him before he left New York, but found out where he is going and when he will arrive. He relayed the information to us."

"Excellent," Mordecai said. "An obliging fellow, that Barnes. You have been in touch with PC?"

"He is on his way to Cartagena with his men and will report as soon as he arrives there."

"This is going to be easier than I expected," Mordecai said. "But we mustn't be too confident. This man, Barnes, has an amazing record, Sneed. He mustn't be underestimated."

"He has been singularly free from your attention," Sneed said, his pale face twisting into what he imagined was a smile.

"That's true," Mordecai Murphy said. "That may have something to do with his good fortune. We have never concentrated on him before. You gave PC some idea of the job we wanted done?"

"I told him very little about it," Sneed said. "But he seemed anxious to do whatever you wish him to do."

"That is real gratitude," Mordecai beamed. "You mentioned that he would be well paid, of course."

"Yes, sir."

"When he reports, I will talk to him," Mordecai said. "I will give him explicit directions, then there will be no slip-up."

"Yes, sir," Sneed said.

The man was not boasting. He had complete confidence in himself and the success of anything he might undertake. That he would have any difficulty in stopping Bill and his men did not enter his mind. He was the complete egoist, a machine of systematic and scientific selfishness.

V—RECEPTION COMMITTEE

AT eight o'clock the next morning Bill laid the nose of the carrier-transport on the foothills of Sierra de San Jeronimo, the first of the towering Andes. He intended to follow the route of the Pan American Airways from Medellin to Buenaventura and down the coast through Ecuador and Peru to Lima and Cuzco. He figured the total distance at about twenty-six hundred miles and estimated they would reach there before dark if they cruised at two hundred and fifty miles an hour.

He gave his men their course over the radiophone and then turned the controls over to Sandy. He gazed down through the starboard window and could see the small steamboats moving slowly along on the sluggish waters of the Magdalena River in the

beautiful Cauca Valley. Brilliant lakes dotting its banks were overgrown with hardwood trees and jungle. To the left and the right the great Cordillera of the Andes stretched upward reaching for the sky. The little towns of Magangue, El Banco, and Gamarra flashed beneath them. At Puerto Berrio Bill told Sandy to get upstairs. At Buenaventura he checked his course and instruments. Far below the Pacific gleamed a dark blue as he altered his course south by west. The snow-capped tips of the high Andean peaks rose majestically behind the Quito plateau. At Tumaco he checked his course again and knew that he was getting sleepy. Humid, enervating air rose from the too-luxuriant vegetation and vast stretches of marshy, unwholesome swamps. He fought to keep his eyes open.

"I've got to get a nap, kid," he said to Sandy. "I'll relieve you in about an hour."

"Yes, Mr. Barnes," a high squeaky voice said behind Bill.

He didn't whirl this time. He just gave Sandy a dirty look and started down the steps toward his cabin. He was halfway along the runway beside the Eaglet's empty hangar when it happened. He knew what it was when he heard that first high-pitched wail that told him planes were diving on them from overhead with their power on.

He went back up the steps to the bridge in two jumps and grabbed at the intercockpit telephone.

"Battle stations!" he shouted.

Machine-gun bullets tore through the tip of the starboard wing. The big ship reeled dangerously and shuddered like a battleship that has been raked by a broadside.

"Keep the controls, Sandy!" Bill bellowed. "Hold her steady on her course. I'll handle the one-pounder." He threw the radio key and spoke to Shorty, Red and Bev.

"Come back and protect the transport, Shorty," he shouted into the microphone. "Bev and Red, break up the formation when they come back. Give 'em hell!"

Martin, in the forward gunner's cockpit, thumbed the sun and swung his gun like a weaving grizzly bear going into action at that first call. Old Charlie leaped to his station in the tail cockpit and Miles let himself down in the cylindrical turret beneath the belly of the carrier. Their guns were ready, but the little squadron of six green fighters that had attacked them got in their devastating spray of lead and were away before they could get their guns on them.

Bill went up the steps to the one-pounder turret as the six green emphibians pulled out of their long, deep dive and hung their ships on their

props to take them back upstairs. He cursed himself because the winding rivers flowing tranquilly through the endless jungles below them had given him a feeling of false security and of being immune from any possible attack.

His eyes glittered and his fingers fastened tight around the guard of the trip on the one-pounder as he watched Shorty whip the Lancer through the roaring heavens to prevent those six ships from getting the advantage of altitude again.

Green planes skidded crazily out of Shorty's path, to escape the lightning acrobatics he used to bring them under his sights. A green ship zoomed upward and went far over on its side, with its rudder biting the air for its life to get away from Shorty. But the first burst of fire from his powerful .50-caliber guns chewed the rudder from its post. As the green ship yawed dangerously and skidded away, Shorty pounced on it like a cat on a mouse and smashed its center, his fire raking forward. The pilot came up in his seat screaming, as that hail of lead tore into him. His body sagged across the rim of the cockpit, dangling half in and half out of the stricken ship as its nose dropped and it plunged toward the verdant valley below.

The other five ships did not try to re-form the Vee in which they had first attacked. Instead, they were trying to lure Bev Bates and Red Gleason away from the carrier-transport where they would be safe from the explosive shells of the rapid-firer.

Two of the fast, green ships hurtled down on the tail of Red Gleason's Snorter, as Red leveled off to get above the transport. As their bullets ripped the air above his head, he kicked his ship out of range. Then he brought it around in a tight loop on the tail of one of the green planes. His tracers drew a lazy pattern above the head of the pilot, but he was away and out of range before Red could correct his aim.

Then they were both on him again, trying to get him in a cross fire. Their crisscrossing lines of tracers showed that he was outmaneuvering them while he tried to get them in a position for an attack.

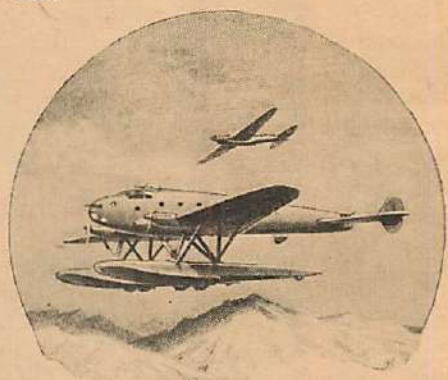
Bill's fingers clamped down on the firing trip of the rapid-firer as they worked in toward the transport. It bucked and trembled as he fired burst after burst at the two ships. But they were out of range, as they managed to get Red within the vortex of their fire and prepared to annihilate him.

Bill watched with anguished eyes as it seemed there was no escape from their trap for Red. He cursed like the buccaneers who had sailed the waters below three hundred years ago must

have cursed. Another green ship had joined the other two now, trying to draw Red inside the circle they were tightening around him.

Then he shouted aloud as Red, with the calm concentration of the seasoned fighter, saw his chance. He came up and over in a flashing Immelmann and up again to come back in a screaming chandelle. He tore that little circle of green ships apart with his guns chattering lead and death. They broke their circle and fled wildly away from the madman they thought they had softened up for the kill.

Far off to the right Bev Bates was riding his Snorter with the calm, deadly efficiency characteristic of him. Bill saw him following a green monoplane as it pulled steeply up into the sky to flash back in a dazzling turn with its guns yammering. He saw bullets rip through the port wing of Bev's Snorter, as Bev slapped his stick forward and went into a dive to escape that hail of lead.



They crossed the Cordillera at 20,000 feet.

Then Bev yanked his control column back into his stomach and zoomed vertically up and over on his back. Neutralizing his controls for an instant, he waited for the green monoplane to level off while he hung on his safety strap. He dropped his nose and poured soup into his engines as he got the tail of the green ship under his telescopic sights. With his head hanging downward in an inverted position, he tripped his guns. His powerful .50-caliber bullets ripped into the tail surfaces of the green ship and crept forward, as the pilot tried desperately to skid out of range. But he tried too late. His helmeted head disappeared as Bev's bullets crept along the fuselage and bit into the back of his neck. The ship stuck its nose straight up in a vertical climb—then came over on its back and began a spinning dive to its death.

At the same instant Red Gleason went back to his attack on the three green ships that had held him in the vortex of their fire. He singled out one ship and tried to finish him off with a single burst of fire. His bullets chopped through the starboard wing of the ship

and, before he could correct his aim, the other two were on him. They had come around in flashing chandeliers—one to the right, the other to the left. Their bullets tore into his Snorter, pounding it with an unmerciful hail of lead. He tried with all the skill of which he was possessed to throw it out of range of their bullets. But they were in for the kill now and they hung on his every move, with their guns vomiting fire and lead.

Bill leaped for the stairs to the bridge and threw the key on the radio-telephone as he realized that they had succeeded in shooting Red's Snorter out of control.

"Shorty!" he screamed. "They just got Red! His ship is falling out of control. He's trying to bail out. Get in close to him and protect him!"

"We've got to get in this some way, kid," he said to Sandy as Shorty acknowledged. "No! Hold her steady on her course. Get upstairs. I wish to Heaven I'd let you keep the Eaglet inside her!"

He went back up the steps just in time to see something shoot out of the cockpit of Red's tumbling Snorter. A white streamer came out behind, which a moment later became a great white ball of cotton. He wished that he was riding the Lancer as he had never wished anything before.

He saw Shorty go plummeting down on the two murderers who were circling Red's swinging body, slipping his shrouds to throw himself out of range of their fire. They dived, zoomed and skidded to get out of the way of Shorty's stuttering guns, as he dived on them like a swooping hawk. They fought with a desperation born of fear as they tried to feint him into a mistake.

But this was the day Shorty was making no mistakes. Hanging head downward, with all his weight on his safety strap, he carefully lined up one of the green ships in his sights and clamped down on his gun trips. As the ship skidded away from the center of his fire, he threw his stick and rolled right side up. The Pacific Ocean seemed to rock into the sky with him. He came around in a tight, vertical bank and again the green ship was under his sights. This time he did not miss. His bullets drove into the engine block of the green fighter until oil spouted. Then black smoke belched from the engine house as fire—crimson jets of fire—licked out and back toward the white-faced pilot. The nose dropped as a tank exploded, and what had been a rugged fighter became a roaring ball from hell.

Then Bill became aware that two of the remaining ships had peeled off from the fight and were closing in on the transport. He swung the rapid-firer

around as machine-gun bullets beat like hail on the bulletproof glass above his head. But they were away and below him before he could clamp down on the trip. They dived underneath the carrier and came up from below with their guns snarling.

But Miles was down there in that steaming hothouse that was a retractable machine-gun turret. As the first green plane came within range his finger tightened on the firing trip of his heavy .50-caliber gun. The air between the single-seater and the turret was suddenly laced with white streamers. They swerved as Miles corrected his aim. The zooming monoplane took the full force of the shattering impact of those powerful bullets. The ship yawed wildly and barely missed the starboard wing of the transport before the nose dropped away and it began a sickly, fluttering descent to the waters of the Pacific.

For the next forty seconds Miles thought he was inside an annealing furnace as he fought off the attack of the second green ship.

McCoy and Neely tried desperately to get the ship under their fire as it zoomed up and back to the attack.

Then Bev Bates came out of nowhere and pounced on the courageous pilot of that lone plane. For a matter of two minutes they maneuvered while Bill tried to rake the green ship without hitting Bev.

Bev's guns drew a track from hub to tail of the green ship in that fleeting instant that was enough. The pilot of the green ship was dead before his plane plunged.

The last of the six green monoplanes was a fast disappearing speck far to the north as Bill shouted his elation and praise at Bev.

"Stand by Shorty while he picks up Red," he ordered Bev over the radio-telephone.

Shorty Hassfurth was circling downward as Red Gleason plunged into the smooth, glassy waters of the Pacific. As he struck the water, he managed to struggle out of his parachute harness and keep afloat.

But because of the smoothness of the surface of the water, it appeared to have no top to Shorty's eyes. He knew that unless he could create some rippling to dispel the transparency and monotony of the water's surface he might dive the Lancer into it or level off fifty feet above it.

At a thousand feet he pulled a leaded code book from a pocket beside him and threw it over the side, then spiraled down to a landing right in the center of the ripples the book had made. He taxied as close as he dared to the struggling Gleason and idled his engine until his props were barely ticking over. He dropped down on the main float and

threw out a sea anchor, which Red used as a line to pull himself aboard.

"How are you doin', fellah?" Shorty asked him as he helped him up on the float.

Red didn't answer because he couldn't. He was exhausted and so angry he could only curse. It was the first time anyone had ever shot a Snorter out from under him. When he was in the after cockpit of the Lancer he got Bill on the radiophone.

"I ought to have my ears pinned back," he said to Bill. "I never should have lost that ship, Bill. He used one of the oldest tricks in the game to outfox me. He—he—"

"Let it go, Red," Bill said. "I'm thankful he didn't get you. He was smart, that boy. He was the one who peeled off at the end. It was my fault, anyway. I was getting careless. I thought there wasn't a chance of any trouble. Now I know differently. I'm proud of all three of you. No one could have done any better."

VI—ARRIVAL

"WHO do you think they were, Bill?" Sandy asked after Bill had made a thorough inspection of the carrier to be sure that no serious damage had been done.

"Your guess is as good as mine, kid. All I know is they're working for the same people who are trying to keep the Maroma mining people from getting their machinery over the Cordillera, and who knifed Buzz Harding in the back."

"Who's going to pay for the Snorter we lost?" Sandy asked.

"Again your guess is as good as mine," Bill said. "But someone is. You get a rest, kid. I'll take the controls. I want to think."

Bill took his place in the commander's chair and let his thoughts wander as he studied the topography of the land below them. Off Cape San Lorenzo, the country had a gray, bleak appearance until they sped over the island of Puna at the mouth of the fever-infested Guayas River. From the isle of Puna, slightly trees raised graceful heads above the general expanse of grass and low shrubs. Once across the Gulf of Guayaquil, the mainland shore at Tumbes in Peru, with its chain of hills, divided the hot and humid country to the north from the hot and arid country to the south.

Bill knew, as he noticed the changing thermometer on his instrument panel, that this was due in large to the fact that the cool Humboldt current, sweeping northward along the western shore, turned in a westerly direction by the conformation of the land south and of the hills which tended to pocket the winds and to make stagnant, moist heat possible to the north—the heat that had almost caused him to be caught

asleep when those six green ships struck.

He checked his position again as they came over the coastland desert that stretches from northern Peru into northern Chile. Lengthwise of the seaboard, long unhurrying rollers beat ceaselessly on the fifteen hundred miles of barren desert interspersed with westward-dipping streaks of green nestling in valley bottoms. Gulls, gannets, pelicans and cormorants filled the air with movement. Sharks, porpoises and dolphins rose to the surface of the shimmering Pacific.

Chimbote, then the great city of Lima, flattened itself out below their wings while Bill speculated on the identity of the man Buzz Harding had raved about—the Saver of Souls. Up until now Bill had thought the name was part of Harding's delirium. Now he knew that Harding's fears were real—that he had been desperately afraid when he had staked his last chance of success on appealing to Bill.

"He's not only real," Bill said aloud, "he's resourceful and dangerous. He doesn't mean to let me take that machinery over the Cordillera. But we'll see," he said grimly.

He flipped his radio key as he corrected his course and laid the nose of the carrier on Cuzco, high over the Cordillera Occidental.

"You'll have to get at least twenty thousand feet under you to clear the tips of the mountains," he said. "Make it twenty-five thousand and don't forget your oxygen. You're going to need it."

Mounting steadily to eastward above broad, bleak, wind-swept ridges, the three ships roared to twenty-five thousand feet as thunderclouds growled on two sides of them. The great black clouds in the northwest were studded with brilliant and jagged streaks of lightning.

"Zowee!" Sandy said as he came back on the bridge. "Not much chance for us if we have to land."

"Those storms are a hundred miles away," Bill said.

They glided down the other side of the first range of the Cordilleras into a valley in which Indians were cultivating grain and potatoes. Their little huts were surrounded by fruit trees on the sides of terraced slopes.

Swinging down the canyon of the Apurimac River, they roared through the deep canyons above foaming, lashing water until the great precipices fell away and green hills loomed up on each side of them—hills that were cultivated and dotted with little native villages. Here and there the ruins of an ancient building showed itself through the tangle of jungle and gum trees. Once stained by the blood of ancient battles between the Conquistadores and Incas, the valley now had an air of peace and comfort. From time to time small volcanic craters and their deep, black flows of lava flashed under their wing tips.

As the mountains began to close in again, the end of their flight came in sight spread out under steep hills in a basin-shaped hollow—Cuzco, that ancient capital of a vast empire that once stretched southward from the equator for two thousand miles and embraced all of what approached civilization in South America.

A few minutes later they circled above the great plaza, which occupied the center of the ancient Inca town and was bordered on two sides by cathedrals and churches whose altars were of solid silver. But gone was the ancient Temple of the Sun with its enormous golden sun disk, incrusting with emeralds and other precious stones. Gone, too, were the days when the Inca king was captured by the Spanish Conquista-

dores and fourteen million dollars in gold was paid to them as ransom.

All those things flashed through Bill's mind. It came to him that probably all that gold came from the same mine the Maroma people were trying to reopen with the machinery he was going to larrup over the Cordillera.

"I'll go in first," he said as he circled above the crumpled ramparts of the fortress that had once stood on Huamansac Hill. He closed his radio key, zoomed the nose of the carrier up for an instant, then stuck it down in a long glide.

The big ship settled on the field without a jolt and Bill taxied it over to the apron. He saw Ned Bunyon's serious face among the crowd of people who stood watching him come in and knew that he had received the telegram he had sent him that morning.

"YOU mean," Mordecai Murphy said to the pale-faced Sneed, "that this man, Barnes, shot down five of Cassata's men?" His expression was incredulous.

"Cassata was the only one to get back to Cartagena," Sneed said. "Barnes destroyed the rest of them."

Mordecai Murphy got to his feet and paced the length of the *Haman's* lounging saloon. His lean face was a study in concentrated fury.

"The thing is incredible!" he exploded. "I sent Cassata down there to stop Barnes."

"He tried," Sneed pointed out.

"Tried!" Murphy snapped. "What good does that do me? I told him to stop Barnes. Where is Cassata now?"

"In Cartagena," Sneed said.

"Arrange air passage for me from Cristobal to Cartagena immediately," Mordecai Murphy said. "It is obvious that this is one of those things I'll have to do myself."

"Yes, sir," Sneed said. He started to go out of the saloon, stopped and spoke again. "Remember, sir, you warned that we must not underestimate Barnes."

"That," Murphy said airily, "was before I gave Cassata directions on how to handle the situation. He must have disobeyed them. This thing has had poor handling from the start. I'll take care of it myself. I'll find out whether this Barnes can really fly."

"You may regret it, sir," Sneed said.

"That will be all, Sneed."

VII—OVER THE CREST

NED BUNYON, a big man with a shock of unruly black hair and a heavy, serious face, sat in the living room of the suite of rooms he had engaged for Bill in a hotel on the plaza.

"You had a cable today that Buzz is better?" Bill asked. "I was afraid the other night he was a goner."



The Garland Lincoln LF-2 replica of the wartime Nieuport 28 used in the movies—engine a 200 h.p. Wright.

"He'd be a hard boy to kill," Ned Bunyon said. "Especially before this job is finished."

"He told me something about the layout down here. How much more stuff do you have to take to the mine?"

"About a hundred tons," Ned Bunyon said. "It's only an eighty-mile run. But you've got to get the load off in this rare air and get up twelve thousand feet more to get over the crest."

"That would be between ten and twenty loads," Bill said. "I can carry five tons of bombs in my carrier-transport. We have no bombs in her, of course, and I took out Sandy's Eaglet. She'll carry quite a load. What about the landing at the mine?"

"It's tricky," Bunyon said. "But you will be able to manage it easily enough. Outside interference is the thing that has us tied up. Buzz told you about—"

"Yes," Bill said. "But I didn't know which part was delirium and which was true. He told me someone who calls himself the Saver of Souls killed three of your men and has committed all kinds of sabotage."

"That's right," Bunyon said. "He warned us politely at first to lay off the job. Then he threatened us. When we paid no attention he went to work."

"Have you any idea who he is?"

"I wish I knew," Bunyon said vehemently. "I'd break his back. All we know about him is the dirty work he has done and the name he uses. He's trying to scare out the people who are opening the mine. There is controversy about the ownership—government politics. If our people get their machinery in there and start working it, no one can take it away from them. They've offered to double the amount of the original contract to us if we succeed on time."

"I hope that will be enough to pay for the Snorter I lost," Bill said.

"They'll pay for ten Snorters if you get the stuff in there, Bill," Bunyon said earnestly.

"You don't have any ideas about preventing this Saver of Souls from doing any more damage?" Bill asked.

"We'll just have to keep our eyes open and be ready for him. It's a peculiar situation, Bill. Do you know what this Saver of Souls did? It doesn't make sense. All three of the men he murdered were married—had their wives down here with them. He deposited twenty-five thousand dollars to the credit of each of the wives. It doesn't make sense."

"No," Bill said, slowly. "It doesn't make sense. But we'll take the stuff over the crest. I want to fly over in the morning and take a look at the landing field at the mine. But right now I'm going to bed. Five thousand



The Fleetwings Seabird, 285 h.p. Jacobs L-5, is constructed entirely of stainless steel.

miles in two days is too much for an old man. I'll see you at the airport at, say, eight o'clock in the morning?"

"Eight it is," Bunyon said. "I'm glad you're here, Bill. Good night."

"Good night," Bill said.

Bill had carefully checked the Lancer and was warming it up when Bunyon appeared on the Cuzco airport the next morning. Fifteen minutes later they were spiraling upward to get the necessary altitude to get over the Cordillera de Vilcanota that towered to eighteen thousand feet. The air became thin and cold as they climbed upward in spite of their proximity to the equator.

As they nosed upward, Salcantay to the northwest and Nudo Ausangate to the southeast poked their noses twenty-one thousand feet into the air. Their peaks were deep with snow. Behind them the reddish-gray mountains over which they had flown to get to Cuzco reared their heads.

At eleven thousand feet they entered a region of coarse grass studded with alpine flowers. Llamas and alpacas, herded by Indians, grazed on the slopes. Far below in a valley the Urubamba River wound through a deep channel cut through walls of black lava.

At fifteen thousand feet the line to the eastward rose over gentle slopes to a broad, bleak, wind-swept ridge where small rivulets, welling out of pools in the yellowish grass, were flowing west to the Pacific.

Bill switched on his oxygen after he had told Bunyon to fasten his overhead hatch securely. The cold was cutting into their vitals now like a keen rapier.

At twenty thousand feet they cleared the crest of the Cordillera de Vilcanota with two thousand feet to spare. It spread out below them like some cold nightmare that chased a man through his dreams. Then they began their glide down the other side through pockets and bumps that slapped them against their safety straps until their stomachs were sore.

Down and down they spiraled, with Bunyon giving directions until their altimeter read only a thousand feet above sea level. Bunyon pointed out a group of some twenty buildings nestling in the shelter of a mountain spur that rose two thousand feet above the floor of the valley.

"That long, flat strip to the left is the landing field," Bunyon said. "We cleared it with native labor."

Bill circled low above the field and buildings, studying the terrain. To the west lay a mountain wall eighteen thousand feet high, to the east another wall and then the impenetrable jungle of the Amazon Valley. The little mining camp was a strange and primitive place cut entirely off from the rest of the world. But there, deep within the bowels of the earth and jealously guarded by great watchdogs that were mountain peaks, was the thing that man wanted most—gold!

"There is no use in our landing," Bill said. "If you took your Tompkins in and out of there we can do the same thing with my carrier. We'll go back and go to work. But tell me this—are the packing cases that covered the machinery you have taken in there intact?"

"I think so," Bunyon said.

"Good. Now I'll tell you what we'll do. We'll confuse 'em a little. It's going to take us a week or ten days to get the rest of that stuff in there. When we get back to Cuzco, you inform the local newspaper that the machinery that has already been taken in will not do the work and has to be brought out again. Say it isn't suitable or isn't the right kind—anything you would say if it was true. Then, each time we take in a load we'll bring out a big load of empty packing cases. That will make the opposition think there is no hurry about their dirty work, or at least I hope it will. Then they'll leave us alone while we get the rest of it in. You said once they get

their machinery in and start working the mine no one can bother them. What about the government?"

"The Maroma people who are employing us are the real owners. This Saver of Souls and his gang have horned in with graft to take it away from them. Once the Maroma people are definitely in there the government won't bother them. The government gets a large slice of all the gold they mine," Bunyon said. "Your idea might work and we can finish our contract on time. If there is any more successful interference we won't make it."

"That's the way we'll try to work it," Bill said as he hung the Lancer on its props to take it back over the mountains. "We'll make quite a fanfare about bringing the stuff out and take the stuff in as quietly as possible and see what happens."

"It's a good idea," Bunyon said. "You're ready to start today?"

"Today!" Bill said grimly. "I've got things to do back home."

At twelve o'clock that day Bill took the big carrier-transport into the air with five tons of machinery stowed away in the hangar of the Eaglet. He took it over the crest of the Cordillera de Vilcanota and down into the Maroma Valley, fighting the controls every inch of the way. Beside him rode Shorty in the Lancer and Red Gleason in the surviving Snorter.

The carrier was unloaded and then her fuselage loaded with empty packing cases. The leading paper of Cuzco carried a picture of Bill and his men and the bomber on the front page that evening. It stated that Bill had come down to take the machinery out of the Maroma Valley that had been taken in by the mysteriously destroyed trimotored Tompkins.

"If they fall for that they're pretty dumb," Shorty Hassfurth said.

"All I ask is that it takes them seven days to get wise to it," Bill said. "Three trips a day, carrying five tons each trip, will finish the job in a week. Then we can go home."

At the end of four days they had flown fifty tons over the crest and landed it safely at the mine. There had been no sign of interference or sabotage. The whole thing was going smoothly.

That was why Bill was getting worried. Things were going too smoothly. Not a hitch had occurred. He had learned through a series of tempestuous years that there was always a lull before the storm. He was waiting with his nerves on edge for trouble to strike. He was certain that anyone who sent out six fighting planes to stop him wouldn't quit cold because the planes hadn't been successful. He was sure they were biding their time, waiting

for the opportune moment to strike one blow that would undo what he had accomplished. He knew that the kind of men who were engaged in mining projects in primitive countries were not the kind of men who let a little opposition stop them. He knew they were the kind who used any means to secure their ends.

But as the week went on, and there remained only five tons of machinery to go over the crest, his tension lessened. He was sure that they had either fooled the enemy into believing they were bringing machinery out of the Maroma mine, or they had quit cold.

Before he went to bed on that seventh night he plotted their course home two days later. He was glad that Buzz Harding was going to live and glad that he had been able to help him out of a jam. But he was more than glad that he would be back on Barnes Field within a few days with the loss of only one ship and a fee in his pocket that would more than take care of that.

"Tomorrow, kid," he said to Sandy, "will see the end of this job."

"Put up your hands, Barnes!" a voice behind him shrilled.

Bill jumped three feet as he whirled to find no one behind him. He glared at the laughing Sandy lying in bed.

"I'm going to break your neck if you don't stop that!" he roared.

"Good night, Bill," Sandy said as he turned off his light.

"Good night you—you—good night, kid," he spluttered.

VIII—HALF-BREED WARNING

NED BUNYON was directing the loading of that last five tons of machinery when Bill arrived on the scene the next morning. The crew of the carrier had just finished their breakfast in the little dining saloon aboard the carrier.

Old Charlie, the cook, was standing in the doorway of the galley, his round face wreathed in smiles. Shorty, Red, Sandy and Bev were lolling beside the Silver Lancer and the Snorter with side-arms strapped around their waists. They weren't taking any chances on that last precious load.

"This does the trick, eh?" Bill said to Ned Bunyon.

"It does," Bunyon said. "But I won't breathe easy until it's over the hill and unloaded. Who takes this load?"

"Shorty," Bill said. "It's his trick. I'll fly the Lancer for the last load."

He went outside to talk to Shorty, Red and Bev about their trip home. Sandy went inside to see if he could talk Charlie out of a little food. He was bored.

When they had left Long Island and after that fight over the Pacific, it had looked to Sandy as though this might

be an exciting trip. But now, in his estimation, it had simmered down to becoming an expressman's job. All they were doing was carting a lot of uninteresting machinery over a mountain.

He talked old Charlie out of a piece of toast smeared with orange marmalade and went forward to watch the stowing away of that last batch of cases. He was about to take his first bite out of the piece of toast when Ned Bunyon's irritated voice attracted his attention. He edged along the deck and saw Bunyon standing with his hand on the shoulder of one of the workmen. The man was straightening up after having bent down between the cases of machinery.

"How did you get in here?" Bunyon asked the man, suspiciously.

"I'm one of the regular crew," the man said in English. He was a dark-complexioned man with black hair and shifty eyes. He shook Bunyon's hand off his shoulder and stepped away from him.

"The hell you are!" Bunyon said. His serious face was a mask of rage as he advanced toward him.

The man crouched a little forward and his right hand shot inside the top of his overall and came out with an automatic. His face was twisted into a snarl and his beady eyes were mere slits.

"Don't open your mouth or I'll kill you," he said, jabbing the gun at Bunyon's stomach and including Sandy in the gesture with his eyes. "Both of you back against the wall with your hands up."

This was Sandy's chance, the chance for which he had been waiting for two weeks. He dropped the piece of toast and started to put his hands above his head. At the same instant a voice spoke in back of the man with the automatic.

"Put your hands up or I'll blow your backbone in half!" it said viciously.

The man half dropped the gun as he started to whirl. Sandy's arm dropped and his fist doubled as he took two quick steps in perfect balance and let it fly. It caught the man a little above the point of his jaw. The gun flew out of his hand as he landed on his back. Sandy kicked it out of his reach and darted his hand toward the holster slung on his hip.

But before he had his own automatic out of its holster, the half-breed had slithered across the deck and was out the port gangway and dropping to the ground.

Both Sandy and Bunyon were after him, but he dodged underneath the carrier and raced for a roadway that bordered the field. Bill and his men came running toward the carrier as Bunyon and Sandy started in pursuit.

Then the man was over a fence and

astride a motorcycle that stood there waiting for him. He jumped into the saddle and a second later the motor roared. Sandy stopped, took deliberate aim and fired. His first shot went wild. Before he could shoot again the half-breed was speeding down the road with Sandy's bullets whistling by his head.

"What's wrong?" Bill asked.

Bunyon told him.

"I don't like it," he finished. "I saw him before he did any damage, but he might have gummed things at the last minute."

"Well, he didn't," Bill said. "Let's get that ship loaded and get it over there before anything does happen."

"She'll be ready to go in half an hour," Bunyon said.

MORDECAI MURPHY landed the rugged green fighter on the airport at Arequipa and taxied it toward the hangars. He locked the wheel brakes, killed his power plant and slid over the

believed you when you reported they were bringing it out and that there would be plenty of time to get possession of the mine."

"I could only tell you the reports I got," Hernandez protested.

"Why didn't you make sure?" Murphy asked, his words coming from his lips like bits of metal dropping on metal. "You believed them when they reported that they had to bring the machinery out. It seems to me any fool would have seen through such a story."

"I believed it because—because—" Hernandez stopped.

"Because it was so simple," Mordecai Murphy said. "Because it was so simple to check and prove untrue. That's why you believed it. You knew it wouldn't be any effort at all to check it. You didn't think they would be so naïve as to tell such a story if it wasn't true. That's what they counted on."

"You can depend on that," Hernandez said.

"You still don't think the government would stand for it if we went in there with a pack of hoodlums and drove them out?" Mordecai asked.

"I'm positive they wouldn't," Hernandez said. "If we discourage them so much they abandon it, it is one thing. If we drive them out by force, it is another. You pride yourself on being deft at these things, Murphy. Perhaps this man, Barnes, they have up there is too clever for you?"

Hernandez watched Murphy's face go red and then white and for an instant he was frightened that he had gone too far. He knew Mordecai Murphy's supreme ego and pride only too well.

"He was too smart for you," Murphy said. "He thought of that simple little report that they were bringing out machinery. Bunyon's brain is too slow and thick for that one. And I must admit it was a stroke of genius. So simple you couldn't help believing it."

"But let's forget that. It worked. But I'm going to gum things for him tomorrow and make him sorry he ever came to the aid of his friend, Harding. Can we talk here without being overheard?"

"Speak in English," Hernandez said. His pig eyes were gleaming as he pulled his chair over closer to Murphy's.

IX—DUEL

BILL BARNES watched Shorty take the monster that was the carrier-transport into the air before he kicked the Lancer around into the wind and began his last trip from Cuzco, over the Cordillera, to the mine.

Up and up and up they climbed until it seemed they had reached the top of the world. Bill saw the carrier wallow with its heavy load as Shorty leveled it off at twenty thousand feet. He put another five thousand between himself and the carrier, sweeping around and around above it in widening circles. When it began its descent into the valley, he kept ever above it until it was almost ready to land.

He was thinking that this was the last trip and already beginning to plan the work he had to do when he got back to Barnes Field as the bomber settled down for a landing. He was so immersed in his thoughts that he didn't hear that first high-pitched scream of warning as the green monoplane came out of the sun above him.

The first warning he had was when he heard a machine gun bullet slap through his port wing and felt the Lancer lurch. Instinctively, he slapped the control stick to the right and kicked his rudder. For one brief instant the earth swung out from in under him in a dizzy circle, as bullets ripped



Focke-Wulf Kite Fw-58, two Argus 240 h.p. engines, is a German light, military trainer.

side. A big man who was talking to a uniformed chauffeur on the apron broke away and advanced to meet him. They shook hands and the big man gave orders to the manager of the field about the green monoplane.

The big man, José Hernandez, was known as the biggest rogue and scoundrel on the west coast of South America. He was also known to have his finger deep in any internal dirty work inside a half dozen governments. He was a fixer who could supply you with an army to overthrow a government or a single thug to cut a throat. He was Mordecai Murphy's personal representative on the west coast.

They climbed in the car and were driven to a large house surrounded by terraced gardens where Hernandez lived. When they each had a drink, Mordecai Murphy opened the conversation.

"You've made a hell of a mess of this thing, Hernandez," he said in Spanish. "I said a week ago that I should have taken personal charge of it. Now I learn that instead of bringing machinery out of the Maroma Valley they've been taking it in. I

"It was a smart trick," Hernandez growled.

"Well, what the hell are you going to do about it? Can you get the government to force them out of there?" Murphy wanted to know.

"We must destroy their machinery," Hernandez said, "and drive them out. The government won't drive them out as long as they are producing. After all, they own the mine; we don't."

"But you still think you can get a government sanction if we force them out and take it over?" Murphy asked.

"I'm sure of it," Hernandez said. "That part is all fixed. It was up to you to keep them from getting that machinery in there."

"Well," Mordecai Murphy said, "they aren't working it yet. There is still some to go in. Our job is to first get Barnes and his bomber out of there. I would have done that several days ago if I hadn't believed your reports. It is just a question of handling the thing in another way now. I just want you to be sure that after I drive them out and we go in, the government will uphold us."



One of Germany's 300 m.p.h. "mystery" fighters is the single-seat Heinkel He-112, fitted with a Junkers 650 h.p. engine.

through his port wing. Then he neutralized his controls for an instant and yanked the stick back into his stomach, as the green ship hurtled above him and began to turn tightly to the right.

His nose came up, and for one brief instant the green monoplane came under his sights. His mouth was grim as he clamped down on his gun trips and his powerful .50-caliber guns belched lead and flame. Feathery wisps that were the smoke from his tracers floated off the starboard wing of the speeding monoplane and he knew that he had overanticipated the speed of the green ship's turn.

A grin flashed across Bill's face as he realized that only a master pilot would have slowed up his turn as Bill zoomed up beneath him after his dive. The ordinary pilot would have tightened his turn, so that he would have run directly into Bill's bullets. But this man had slowed it so that Bill overshot his target. He grinned his tribute to the man's skill.

As he continued his climbing turn, Bill could see him looking back and down to see what he was going to do. He waited until the green ship was nearly around, then hung the Lancer on its two three-bladed props and came up beneath him. But the green ship skidded out of range of his bullets as though Bill had telegraphed his intentions.

When the two ships leveled off, they were at almost the same altitude and traveling in different directions. They both chandelled at the same instant and came roaring at one another with their guns chattering. They both had that knack of seeming to be flying on a true course. But, actually, they were slipping away from it all the time. They roared by one another so close that their wing tips almost touched.

Bill yanked back on his stick and zoomed the Lancer up and over on its back, as the green monoplane held its course. At the top of his loop he half rolled the Lancer to a level position and gazed over the side.

The green ship had come back and

was zooming up underneath him with its twin guns spewing. Lead chewed through the leading edge of his port wing again before he could get out of range.

The monoplane roared upward until it almost stalled, then flipped over and came down on Bill's tail as he started a sweeping turn to the left.

And again the pilot of the green ship did the unexpected. Instead of opening fire, he kept on down until he was under the Lancer's belly again, when he zoomed up and tripped his guns.

Bill cursed with rage as he half rolled out of that deadly hail of lead. The next moment they had leveled off again and were roaring at one another with terrific speed. Bill's fingers tightened on his gun trips this time and he could see his tracers driving alongside the green ship's fuselage before he slipped out of range.

"So you'll wait until the last day and sneak out of the sun to shoot a man's buttons off, will you?" Bill was saying to himself without being aware of it. He was concentrating on the job before him because he knew the pilot of that green ship was a master at his craft. He could fly and he could shoot.

"You're the yellow rat who ordered Buzz Harding stabbed in the back," Bill grated. "And you're the snake who led those other five ships against us. Well, I'm going to give you a lesson in the art of combat flying. I'm going to take you the way you tried to take me!"

The two ships streaked and tumbled all over the sky, filling the air with red-hot lead. They fired burst after burst without telling effect as they maneuvered for an advantage.

Bill's fingers clamped down on his trips time and again, only to have the pilot of the green ship slip away. His lips became a hard, set line of determination. He used every bit of knowledge he possessed as he studied the other pilot's tactics and strategy.

"You're a fighting fool," he said aloud. "But I wonder if you can take it when I put on the pressure? We've just started, so you'd better hold some-

thing back to offer when you'll need it." He sideslipped the Lancer out of range, as the green monoplane came at him, head-on, with its guns yammering.

He came up and around in a lightninglike chandelle and dived on the speeding green ship. But when he clamped down on his trips, the green ship crabbed out from under his sights as though some unseen hand had flicked it out of danger.

Bill shook his head with a gesture of disgust as he realized that he was bearing down too hard.

The next time the green ship flashed across his sights he held his fire until the pilot had made his correction to escape Bill's aim. Then he kicked his rudder ever so little and tripped his trigger. His bullets wove a pattern from the engine housing to the tail assembly of the green ship. But they were too low to be effective. It skidded off dangerously on one wing as Bill whipped around and came back to the attack.

Bill poured round after round at the monoplane, but the pilot managed to roll it out of danger.

For an instant Bill thought of switching to his 30mm. cannon. But he changed his mind as he saw his adversary come out of his roll laughing! Just for an instant he saw his lips drawn back from his white teeth and he was laughing! There wasn't any doubt about it. The man was either mad or he was getting a real kick out of a fight that might end in his death. Bill knew then that he couldn't use his cannon. He couldn't take that advantage.

He pushed the control column of the Lancer forward, as the monoplane nosed down in a vertical dive. Bill came up and over in a flashing Immelmann turn and the other pilot came up and turned with him. But Bill had a slight advantage in altitude and he dived again with his guns flaming. Only a thousand feet from the ground and diving at terrific speed, Bill pushed the stick all the way forward, until the Lancer went into an outside loop. He felt weak and a little faint as he hung head downward at the bottom of the loop. He gulped and shouted to relieve the terrific pressure.

His stomach felt as though it had been wadded up into a tiny ball as he probed the air for the green ship. Then its bullets came tearing up through the belly of the Lancer and he barrel-rolled to get out of range as the green ship zoomed past him. Then he was under its belly with his guns chattering. He could see his tracers tearing into it before it sideslipped out of range.

Together they raced upward, with the great mountains hemming them in on every side. They were both trying to get the advantage of altitude. Bill's

hand was trembling on the control column, he was so tired. His whole body seemed to ache.

He poured juice into the Lancer and chandelled back to the attack as the green ship began a wide sweep to the left. He followed him around and saw his tracer smoke curl above his head as he tripped his guns. He tried to correct his aim, but every movement was torture. He knew that he must put on the pressure now. He mustered all his reserve strength as he called on his muscles and mind to coordinate. He knew that the other pilot must be as tired as he. But he had not shown it yet. He was fighting like something that was not human. Bill felt a surge of something that was akin to affection for the pilot of the green ship because of his iron strength and nerve.

Then Bill put on the pressure. One moment the pilot of the green ship showed that he was confident of his own ability to outfight and outsmart Bill Barnes. The next instant something close to panic seized him.

He saw Bill do things with the Lancer he had never seen done before. He suddenly found himself being maneuvered into errors that brought Bill's deadly aim closer and closer to him.

The fight became a duel to the death such as Bill had never fought before. He knew that he should have the advantage with the superb performance of the Lancer at his command. But that superiority was offset by the experience and cunning of the pilot of the green ship. Time after time it seemed that one or the other of them had the other in a position from which he could not extricate himself. But each time the impossible happened. They were equally tired and their eyes were equally blurred from the terrific speed of their maneuvers as they raced through the heavens, trying desperately to get the other under his hair sights for that moment that would be enough.

As Bill flipped over in a half roll to throw the green ship off his tail and whipped up and back to get it under his sights, he clamped down on his gun trips again.

His heart froze as he heard only the metallic click of the hammers. He stared at his ammunition counters until he could feel bullets drumming through the metal skin of the Lancer. He could not believe his eyes. He worked his charging handle frantically, as he threw the Lancer out of the line of fire.

He realized only too well his deadly peril. His rage nearly burst its bounds when it came to him with startling suddenness that the pilot of the green ship had not used his guns a dozen times when he might have used them. He

had conserved his bullets waiting for this moment to arrive.

It was a situation that had never confronted him before. He knew that the pilot of the green ship must be nearly out of ammunition. Then he thought of his cannon again. He thought he would use it now. He clamped down on the electric trip fastened to the control column to test it. But no answering bark came back to his ears. He remembered only now that he had taken the ammunition out of its clips a week before and had not replaced it.

Bill's mouth twisted into a straight-lined grimace that he thought was a grin as he took the Lancer upstairs on its props until it almost stalled. The green ship was right on his tail with its guns blazing as he dropped the nose and kicked the Lancer into a sickening spin. He knew that a spinning ship presents one of the most difficult targets in the air.

He waited, with his heart in his mouth, as he saw the green ship circling down. For a moment the pilot seemed to believe that he had mortally wounded Bill, because he withheld his fire. Then, to be sure, he began to use his guns again. He didn't wait until that fatal moment when a spinning ship flattens out and presents a perfect target. Instead, he poured round after round at the Lancer that did not find its mark as it continued its mad plunge earthward.

A thousand feet from the ground Bill knew that the moment had come for him to pull out of his spin. He neutralized his controls, fed his engines all the juice they would take as he began to warp, kicked his rudder and threw the control column to the left.

For one sickening moment the Lancer refused to respond. Then the nose came up and Bill poured in power while he rolled it over and over to escape that last terrific burst of fire from the green ship.

He was a bare four hundred feet

above the ground when he saw the green monoplane zooming upward. He knew that his moment had come. He yanked the control column of the Lancer back into his stomach and hung it on its props. He knew the green ship had shot its bolt.

As he drew up beside the monoplane, he pulled a heavy automatic from a pocket at his side and pushed back his hatch. He saw the perspiring face of the pilot of the green ship clearly now. And Bill could have sworn again that the man was laughing as he emptied the clip in his automatic at him. The ship yawed for a moment and then recovered.

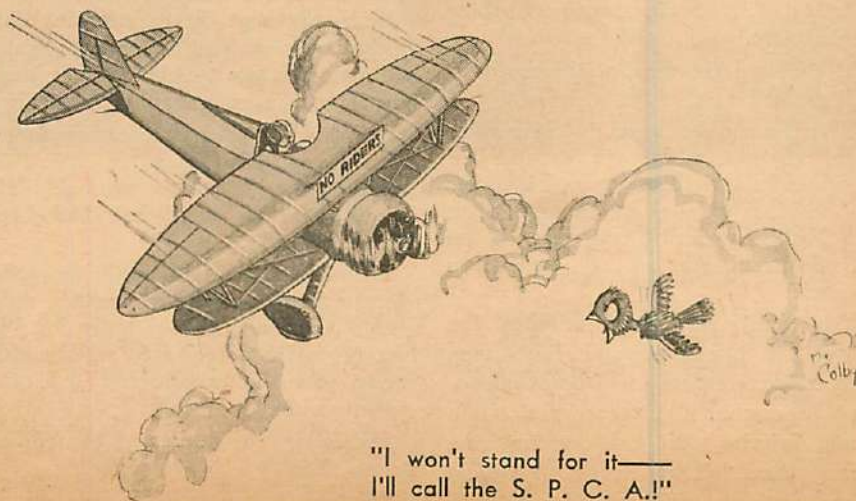
The pilot half stood up in the cockpit as he held his ship alongside the Lancer. His right hand came up and touched his helmet in salute. And then he was gone. He hung his ship on its prop and took it toward the crest of the Cordillera with the skill of a master pilot.

Bill watched him go and when the ship was five thousand feet above him, he lifted his right hand to his helmet and returned that salute. He knew that for once in his life he had met a man who was his equal in aerial combat. He sat back in the Lancer utterly exhausted.

It came to him that this was not the pilot who had led those six green ships against his men over the Pacific a week before. He was flying the same ship, but it was not the same man who had peeled off to escape. He knew then that this man would never have left the fight while he had ammunition. Through Bill's mind flashed the names of a hundred skillful pilots he had met in combat. But he had never met a man like this one before. He had that instinctive coordination with which a master must be born.

X—THE TURN IS CALLED

BILL cruised around in ever-widening circles while he rested. He didn't



"I won't stand for it—
I'll call the S. P. C. A.!"

want his men to see how completely exhausted and near death he had been. He looked over the side and saw that the unloading crew were taking the machinery out of the bomber. He saw Shorty and Sandy standing beside it gazing up at him.

A few minutes later he stuck the nose of the Lancer down and got the direction of the wind from a windmill pumping water at the mine.

"This," he thought, "is the end of this nightmare. We take the bomber over the Cordillera for the last time."

He fishtailed the Lancer to reduce its speed and took it in on the uneven, bumpy field. He found that he could hardly stand when he slid to the ground. His knees were weak and shaky. He drew a half dozen full breaths of air into his lungs as he decided that he was lucky to be alive. He started walking slowly toward the bomber as Shorty and Sandy came toward him.

And then it happened! Without any warning!

He froze in his footsteps as a terrific explosion made the ground tremble under his feet. He saw bits of wood and iron and steel and dirt flying in all directions from the spot where the carrier-transport had been standing. It had disappeared now in a great cloud of black smoke and dust and dirt. He saw Shorty and Sandy pitch forward on their faces as debris shot over their heads. A piece of metal that he recognized as a part of the carrier's instrument panel fell at his feet. He stared at it for a moment and then he began to run.

Shorty and Sandy were up on their knees and trying to struggle to their feet when he reached them. Their eyes were dazed and fearful—like the eyes of men who have been clipped on their chins with knockout punches. Blood trickled down the side of Shorty's face and into his collar. He tried to speak, but no words came from his lips. He pointed a finger and looked at Bill. Sandy began to babble incoherently.

"Where are the crew of the carrier?" Bill shouted at Shorty.

Then the smoke began to clear away from the spot where the carrier had been and he saw them grouped together on the other side of it. Among them was Ned Bunyon. They were all on their feet and none of them seemed to be hurt.

For twenty desperate minutes the officials of the mine and Bill's men checked the crew who had been unloading the carrier. There were a dozen minor injuries, but no serious ones among them. They had been behind a large packing case they had just taken

out of the carrier when the explosion occurred. It had been the last piece of cargo remaining in her.

"It's my fault, Bill," Ned Bunyon said to him. "I should have made a complete examination after I caught that man aboard her before we left Cuzco. He put a bomb in the cargo hatch. It was probably timed to explode while we were in the air."

"Well, it didn't," Bill said. That was all he could say. He was sick as he looked at what had been, next to the Silver Lancer, the pride of his fleet of ships. It was a worthless mass of twisted metal.

But the last piece of machinery had been brought safely over the Cordillera. Then he heard Ned Bunyon's voice again.

"The Maroma people will replace it, Bill," he said. "They'll replace both the carrier and your Snorter. One of the officials just told me that. They'll take millions out of here in no time at all with the machinery we brought in."

"That will help," Bill said, slowly. "But I want to get out of here. I never want to see the place again. I can feel death's breath on my cheek every minute. I'm going to take Sandy out in the Lancer with me. I'll send Red back with it, and Bev in the Snorter. They will bring all of you out. You can reach me at the hotel tonight, Ned. I'm shoving north tomorrow. Some of my men will have to get home by steamer."

AFTER Bill had taken a hot bath he felt physically better, but not mentally. He realized only too well that the trip had been a disastrous one. He had lost two ships. That a half dozen of his men had not been killed was only a miracle. That he had survived that aerial duel that morning was another miracle.

He couldn't keep still. He tried to sit down, but couldn't stay down. He kept pacing back and forth across the room—his blood burning in his body—while Sandy kept up an incessant flow of chatter to distract his mind. Sandy had seen him like this before and knew that he was worrying about something.

It was while they were eating dinner in their room that the letter came that brought him back to normal. He found out then just what had been worrying him.

The telephone bell rang and the operator told Sandy there was a messenger downstairs with a letter for Bill that he would not give to anyone else. Sandy told the operator to send the messenger up.

The letter was addressed to William Barnes, Esq.

Bill tore it open and his eyes darted

from the salutation to the signature at the bottom and widened.

DEAR BARNES: I wish to thank you for both a highly enlightening and pleasant adventure this morning. I had, of course, heard of your reputation as a combat pilot, but had discounted a large portion of the things I had heard about you. It did not seem possible that anyone could be as skillful as you were reported to be.

I herewith offer my apologies.

You are even better than you are reported to be. I know this to be true, because I would not now be writing you this note if it were not so. You would be dead.

You are the first man who has ever won an aerial fight from me. I say that you won, because I did not shoot you down. You are the first man I have ever met I did not shoot down and I have met a considerable number on various fronts since the World War.

You also succeeded in another thing against my opposition. You managed to take all of that machinery over the Cordillera safely. I do not understand myself how you managed to accomplish this against my wishes. That is another thing no one else has ever been able to do—win out against me.

The machinery is there now and you may safely tell Bunyon that the Maroma people will have no further trouble from me.

I owe you quite a debt, Barnes, and I am a man that is careful of his credit. I shall repay you, threescore and ten, at the first opportunity.

I will make that opportunity possible very soon, as there is not room in this world for you and

THE SAVER OF SOULS.

"Of all the colossal ego," Bill said, "that takes the brown derby. He—"

"Who, Bill?" Sandy asked.

"The man who attacked me today," Bill said. "The Saver of Souls."

Sandy laughed at the name as he reached for the letter.

"Throw up your hands, Barnes!" a voice said behind Bill.

Bill jumped. "Damn it, stop that!" he roared. But he was laughing.

He now admitted to himself what he had not been willing to admit before he had the letter. The letter had called the turn and he could look the thing squarely in the face.

He felt a soothing glow of elation at the prospect of an inevitable encounter with the Saver of Souls.

MODEL MAKING—

Air Trails Department of Practical Construction

Guest Editorial

By James Cahill

(Moffett International Trophy holder and veteran modeler)

Unquestionably, the gas model has done much to stimulate our hobby. The lure of the gas motor itself has brought back into the fold many of our former model builders. Unfortunately, the tremendous gas interest has not all been for the good of modeling. I believe gas models are overemphasized at the expense of other types. There is a practice prevalent among older model builders in Indianapolis, and probably in other cities as well, of ridiculing the non-gas builders. These "experts" build up the delusion that just because a model is larger, you can have more fun with it. And, too, that a larger model will lift you above the general run of model builders.

Newcomers to the hobby believe this "malarky." They waste their time and money on gas jobs—when they should be building up experience with rubber-powered models. The results are usually discouraging. Typical are the four fellows in our small Brookside Model Club who quit modeling after their first ill-advised gas jobs.

I'd like to dispute the claim of overenthusiastic gas modelers that skill and engineering ability are needed to build a gas model, whereas "anyone can build a rubber model." From considerable experience and observation, I've concluded that it takes more skill to get a good flight with a rubber-powered model than it does with a gas-powered one. The excess power of the gas motor is capable of flying practically any model regardless of how skillfully the construction has been carried out. The old saying that "you can fly a barn door if you use enough power" seems to apply to gas models. Design refinements that make rubber modeling interesting are not present in gas model construction.

Gas model contests are mighty entertaining spectacles. Unfortunately, they seem to prove far less than a rubber model contest. There is little stimulus for new designs. All the models are practically the same. Tie a wing and tail to a powerful motor and you're just as likely to win a gas model contest as anyone else. Until radio-control becomes commonplace, gas model contests will prove exactly nothing.

In conclusion, I hope to hear many comments—both pro and con—on this subject. But don't interpret my criticism of the gas model as stamping me as being opposed to this phase of the hobby. I'm heartily in favor of it—but not at the expense of the other phases of modeling. I'm asking gas modelers to cooperate in developing a well-rounded hobby—one in which EVERY phase of modeling will be encouraged.

12 Model Building Items

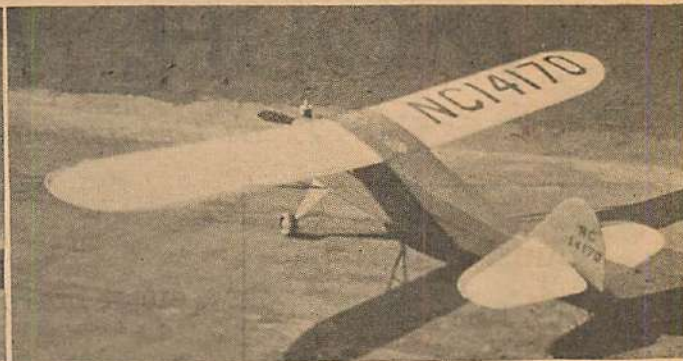
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95		
Gun Model Co.		
94		
Heathe Model Airplane Co.		
87		
Imperial Model Aero Supply		
91		



A scale model is always interesting to build. The Taylor Young is an ideal subject.



The design proportions of the large ship insure top-notch performance and fine stability.

Taylor Young Gas Model

A Cyclone-powered model of accurate design and simple construction. Performance and appearance are combined to please beginner and expert alike.

By Paul Plecan

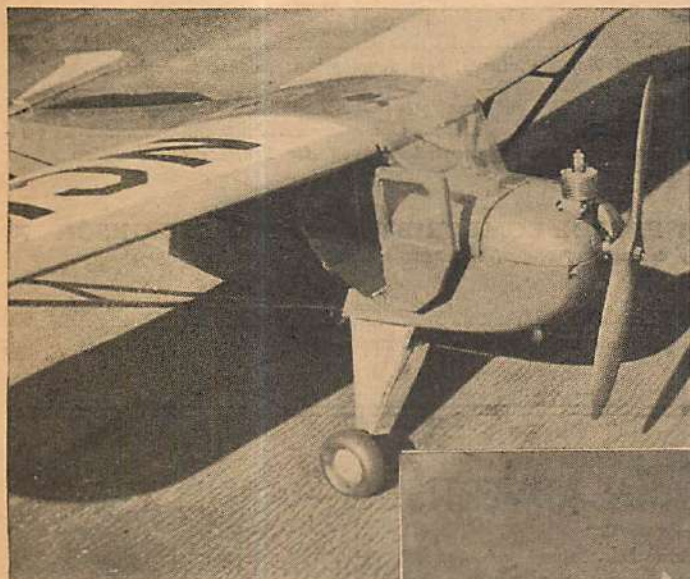
In collaboration with Gordon S. Light

THE trim lines and pleasing flight characteristics of the full-size Taylorcraft do not suffer by a reduction in size. The 72" model is an attractive, top-notch performer. The scale is $\frac{1}{6}$ full size and has been followed throughout with the exception of the elevator size and other minor changes necessary for successful flying. The NACA symmetrically shaped airfoil has been replaced by the Clark-Y, which has been found more suitable for models.

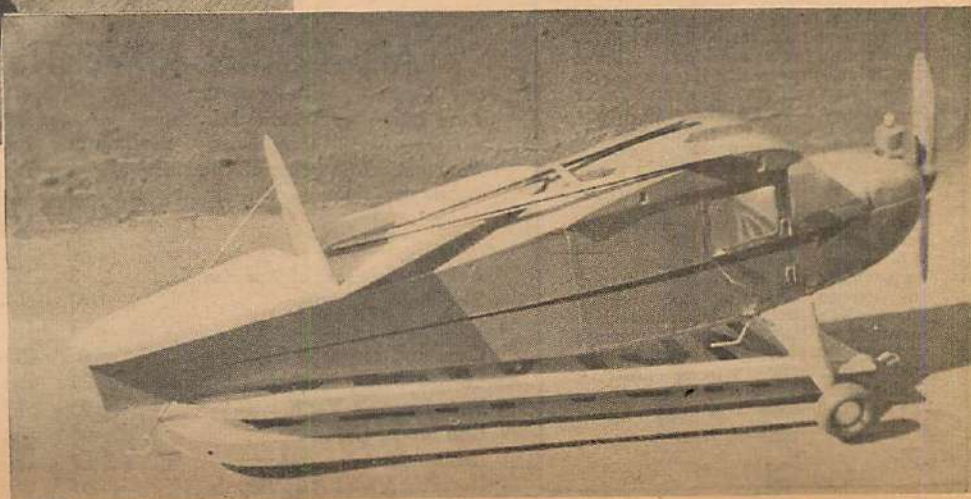
An interesting feature of the model is the method of attaching the two halves of the wing to the fuselage. The ends of the wing spars fit into hollow spars or "wells" in the center section. Each half of the wing is supported by V struts. The wing is readily detachable. The door in the right side of the fuselage not only makes the model realistic but serves the useful purpose of providing access to the inside of the fuselage for attaching the wing and servicing the ignition system.

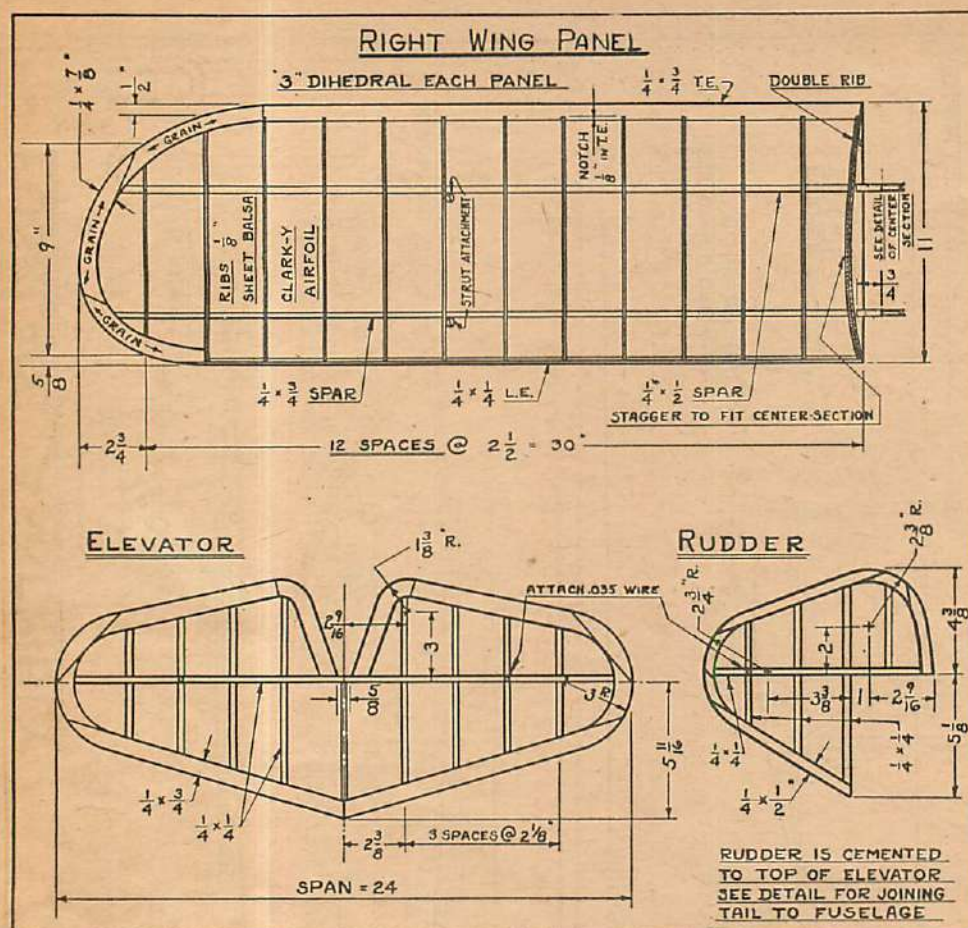
CONSTRUCTION

The fuselage assembly drawing has been fully dimensioned, and has been drawn to the scale indicated in the lower right-hand corner. Thus it is possible to find the size of any part of the model. When laying out the side panels of the fuselage remember that the door is on the right side of the fuselage. Consequently any upright or diagonal braces that interfere with the door are not included on the right-hand side-panel.



Above—A closeup of the nose shows the simple Cyclone mounting. The door is workable. Right—The component parts are quickly detachable for traveling. The structure throughout is rugged, but not too heavy.





The center section of the wing is built into the fuselage framework. The two center section ribs are cut from 1/4" flat. And early in the stages of construction check the angle of these center ribs. The flat undersurface of the rib should be parallel to the datum line.

The motor is carried on two hardwood mounts (5/16 x 5/8") built into the front of the fuselage. The front of the fuselage directly back of the motor should be filled in with 1/4" sheet as a prevention against oil spray. The motor mounts should be spaced to fit the mounting flanges of the particular motor which you intend to use. The motor cowl is cut in two pieces. The portion above the datum line is removable. Both parts are cut from blocks and the inside gouged out to 1/4" wall thickness. Note that the bottom portion has a small hole at the rear-bottom as an outlet for the oil which is sprayed out of the engine exhaust port. Material for the cowl is conveniently obtained by cementing several pieces of balsa together to form the block of necessary size. This is easier than trying to obtain a single block of balsa of this size.

The door is four thicknesses of 1/16" sheet balsa laminated cross-grain and cut to correct shape. A door frame of 1/4" sq. balsa is built in the side of the fuselage. The door should fit snugly inside this frame. Aluminum tube-piano wire hinges are shown in the detail drawing.

The "wells" in the center section must fit the ends of the spars tightly. And too, they must be set at the angle corresponding to the 3" dihedral which is put into each side of the wing. Use 3/16" sheet to build up the spar wells. Build them around balsa plugs corresponding to the size of the spars—to insure a good fit.

1/8" diameter piano wire is used to form the main landing gear struts. Bend the landing gear in two U-shaped pieces which extend across the bottom of the fuselage. A 1/16" diameter

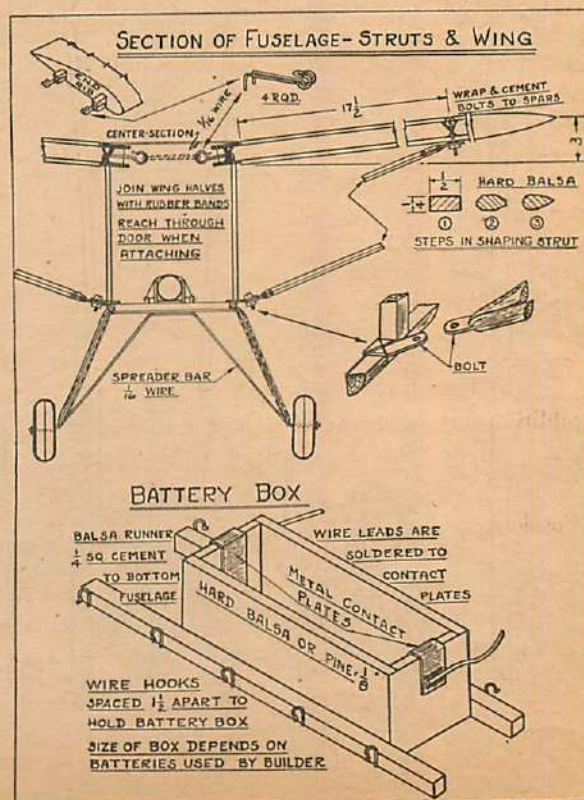
piano wire spreader bar connects the two V-struts and prevents the landing gear from spreading outward in a "hot" landing. The tail skid is also 1/16" diameter wire. All landing gear and tail skid joints are bound with strong sewing thread and cemented thoroughly with sufficient time between cementings to allow for setting and drying.

Sheet balsa (1/4") is filled in between the two 1/8" diameter struts which form the V on each side of the fuselage. Cut to a streamline shape and secure to the wire struts with silk or any type of fabric suitable for wrapping.

WING

The wing-half shown in the drawing is for the right side. Be sure you remember the simple but necessary changes when building up the left wing-half. The ends of the wing spars extend about 3/4" beyond the last rib and are inserted into the "wells" built into the center section.

1/16" diameter piano wire hooks are cemented and bound to the ends of the spars. The two wing panels are secured in the center section by rubber bands connecting the hooks on the corresponding



spars. These rubber bands can be readily put in place by reaching through the door-opening, and should be tight enough to hold the end-ribs firmly against the center section.

Each wing panel is braced by a V strut made up of two pieces of $\frac{1}{4} \times \frac{1}{2}$ " streamlined balsa. The attachment points for the struts have been indicated on the wing and the fuselage. Sheet metal lugs are attached to the three ends of the V strut. Ordinary "tin can" metal will do nicely for these fittings. $\frac{3}{32}$ " diameter machine screws are used for attaching the struts both to the wing and to the fuselage.

TAIL SURFACES

Both elevator and rudder are flat. That is, no airfoil shape is used as the rib pattern. Spars and ribs are $\frac{1}{4} \times \frac{1}{4}$ " balsa. Naturally the leading and trailing edges of both surfaces are cut away to a smooth sharp edge. The rudder is cemented to the top surface of the stabilizer and further strengthened with .035 diameter piano wire. Wire braces also run from the bottom surface of the elevator to the bottom-rear of the fuselage. These braces end about a half-inch from the fuselage, and hooks are bent in the ends of the wires. A rubber band connects these two wires, passing underneath the bottom of the fuselage and holding the wires under tension. This method provides an effective way of bracing the tail in addition to the help of keeping the stabilizer flat atop the fuselage.

In addition the tail is secured to the fuselage by rubber bands passing over the top of the elevator and attaching to hooks mounted in the upright braces at the top-rear of the fuselage.

ASSEMBLY

The model proved to be a trifle nose-heavy, necessitating carrying the batteries under the trailing edge of the wing to obtain balance. As shown in the detail, the batteries are carried in a box which can be moved backward or forward between two $\frac{1}{4} \times \frac{1}{4}$ " runners on the bottom of the fuselage. Wire hooks are spaced about every $1\frac{1}{2}$ " along these runners, making it possible to secure the battery box at any position necessary to trim the ship.

The elevator is set at neutral. The rudder is given a slight offset to the right. Be careful, not much offset is needed since the motor is set at one degree right-thrust. The wing is set at zero incidence—its position being fixed by the center section—and cannot be conveniently changed for any flight adjustments. But this isn't a handicap since the adjustable elevator and movable battery box allow ample leeway for trimming the model under all conditions.

The model is covered with bamboo paper. As for color scheme and decoration, we suggest visiting your local airport, which is practically certain to have one or more of these favorite light planes. And if you're a demon for detail, the Deluxe version of the Taylorcraft will tickle you. It has wheel pants and a tail wheel—plus other extras that will make interesting additions to your model.

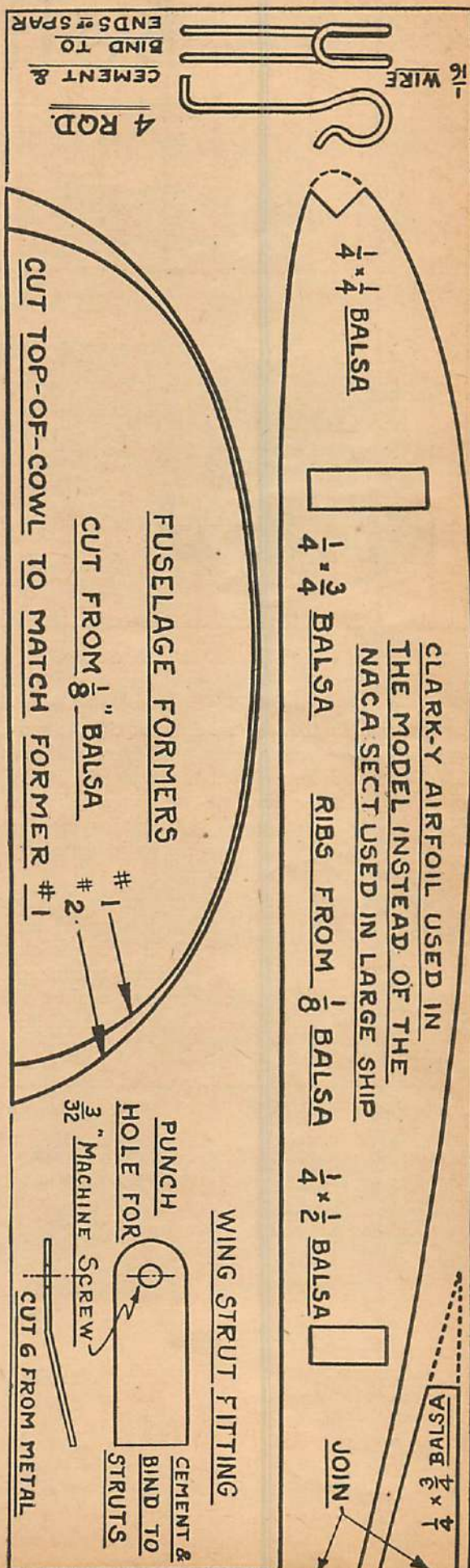
MATERIAL REQUIRED

(Balsa unless otherwise noted)

Fuselage

- 8 $\frac{1}{4} \times \frac{1}{4} \times 40$ " longerons and bracing
- 2 $\frac{5}{16} \times \frac{5}{8} \times 8$ " motor mounts, white pine or other hardwood
- 1 $1\frac{5}{8} \times 3\frac{3}{4} \times 5\frac{1}{2}$ " top part of cowl
- 1 $3\frac{1}{2} \times 3\frac{3}{4} \times 5\frac{1}{2}$ " bottom of cowl
- 1 $\frac{1}{8} \times 1\frac{3}{4} \times 12$ " formers #1 and #2
- 2 $\frac{1}{8} \times 1\frac{3}{4} \times 18$ " bottom longeron strengtheners
- 1 $\frac{1}{4} \times 3 \times 6$ " landing gear filler
- 5 $\frac{1}{16} \times 2 \times 12$ " center section, fuselage front, and door
- 2 $\frac{1}{4} \times 1\frac{1}{4} \times 11$ " center section ribs

(Turn to page 92)



The Balfour Trophy



Bernarr Anderson

ABOUT BERNARR ANDERSON

Akron is famous for rubber and model-airplane builders. Bernarr Anderson is doing his bit to keep Akron ahead in both these fields. He is employed in the instrument division of Firestone Tire and Rubber Company and in his spare time does considerable model airplane building. He got his first taste of national competition back in 1935 at St. Louis as a member of the Akron delegation—sent to the contest by the Akron NAA chapter.

Since that time Anderson's model-stock has been rising steadily. About a year ago he set a gas model record of 81 minutes. On this flight the model soared out of sight from Akron Airport. Luckily it was returned the following day—having made a perfect three-point in the middle of the highway. In 1937 at Detroit this same model—a veteran of a year and a half of steady flying—placed third in the open gas event with 52:10.

And this year he had the satisfaction of watching his model fly out of sight after 12:52 to win the Balfour Trophy for open-class stick models. The best compliment that could be given to Anderson is to describe him as a "typical Akron modeler"—a member of that famous group of modelers whose ability and good sportsmanship add much to our hobby.

Winner

Presenting the 21st consecutive Air Trails trophy-winning model. Detailed plans for duplicating another N. A. A. champion that flew out of sight at the 1937 Detroit National Contest.

THE BALFOUR TROPHY contest is for stick models and is open to modelers in the open class—over 21 years. This trophy was first put into competition in 1935 at St. Louis. Since then competition for it has been a feature of every national contest. The Balfour is intended to maintain the active interest of entrants after they are no longer eligible for the Mulvihill—the stick model trophy for modelers under 21 years. Success of this idea is indicated by the annually increasing list of entrants.

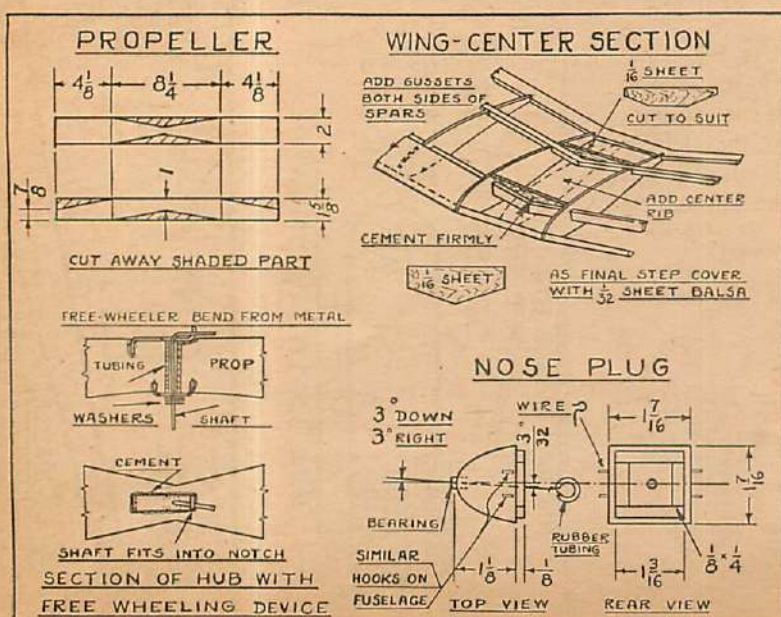
Bernarr Anderson of Akron was the 1937 winner at the national meet in Detroit. His model turned in a flight of 12:52. Unfortunately it was lost on the winning flight. Photos had not been taken, and it was impossible to check the drawings against the model itself. Luckily, however, Anderson had his original drawings, and a short time after the contest he revised

them to include some last-minute changes he had made in the model. The plans have been made as nearly identical as possible to Anderson's model as it was on its winning flight.

This model is classified as a stick model despite the built-up fuselage. However, the addition of a landing gear would qualify it as a fuselage model, making it eligible for both contests with relatively little change.

CONSTRUCTION

The fuselage is of square cross-section. Consequently both side and top views will be identical. The fuselage is used in the conventional manner—that is, the wing is mounted directly atop the flat surface. It is *not* set on edge in diamond fashion. Longerons and bracing are medium-hard balsa $\frac{1}{8} \times \frac{1}{8}$ ", except the outline of the front and rear openings, which are strengthened with $\frac{1}{8} \times \frac{1}{4}$ " balsa. The nosing is cut from a solid block of balsa ($1\frac{1}{8} \times 1\frac{7}{16} \times 1\frac{7}{16}$) to fit the front of the fuselage. The rear of the fuselage is detachable, fitting into the fuselage in plug-like fashion and secured with hooks and rubber bands. The hooks for attaching the nose plug and tail boom are bent from fine piano wire. All other wire fittings are made of #16 piano wire. Rubber hooks are covered with $\frac{1}{8}$ " spaghetti tubing to prevent cutting.



By

Bernarr
Anderson

In collaboration with

Gordon S. Light

similar to the methods used in the wing. The rudder is cemented atop the elevator. (The bottom rudder rib being carved to rest atop the curved surface of the elevator). The rudder is braced by two short balsa struts $\frac{1}{16} \times \frac{1}{8}$ (streamlined) $\times 3$ ".

The tips of the elevator are washed out, similar to the wing. However, looking from the rear, the right half of the elevator is washed out slightly more than the left. The rudder is set at neutral—the offset thrust of 3° being sufficient to offset the thrust.

PROPELLER

The propeller block is $1\frac{5}{8} \times 2 \times 16\frac{1}{2}$ ". The blank is marked off as shown and the blades are cut to rough shape. Use the full-size pattern when cutting the outline of the blades. A ball-bearing washer is used between the propeller and the nose block. 3° right and 3° downthrust are used. The propeller should be sanded and doped to a glossy finish. The free-wheeler is the type which is favorite among Ohio modelers, having been used on Lanzo's and Korda's winning models previously presented in this department. One edge of a small metal lug is bent down and pressed into the hub of the propeller. The other end is bent up and engages the shaft of the propeller. When free-wheeling, the shaft slips over the bent-up end.

The rubber motor is 18 strands of $\frac{1}{8}$ " flat brown rubber 40 inches long. Lubricate the rubber with a mixture of 50-50 tincture green soap and glycerin. Both of these are available at a drug store and make an effective and economical lubricant.

FLYING

The wing rests flat atop the fuselage. No incidence block is required. Attach with rubber bands passing over the center section and around the fuselage. Adjust the wing position so the model balances at a point about $2\frac{1}{2}$ " back from the leading edge of the center section.

The elevator is cemented directly to the top rear of the tail-boom. Because of the slope of the fuselage it will be necessary to block up the trailing edge. The block should be of sufficient height (about $\frac{5}{16}$ ") to raise the rear edge about $\frac{1}{8}$ " higher than the leading edge, as measured from the center line of the fuselage. After the elevator has been firmly cemented to the boom it will be possible to make minor changes in its setting by inserting small slivers of balsa between the tail-boom and the rear of the fuselage. Insert balsa at the bottom of the tail-boom plug to correct diving tendencies. And an insert at the top of the tail-boom will decrease the negative incidence of the elevator and correct tail-heavy tendencies.

The model has a steep, fast climb. Like most present-day championship jobs, it doesn't waste any time getting "upstairs." The circles are opposite torque—right circles with a right hand propeller. The offset thrust can be adjusted to circle the model in 100-foot diameter circles during the climb. The washout in the wing and elevator prove helpful in obtaining a smooth and efficient flight during the propeller run and during the glide.

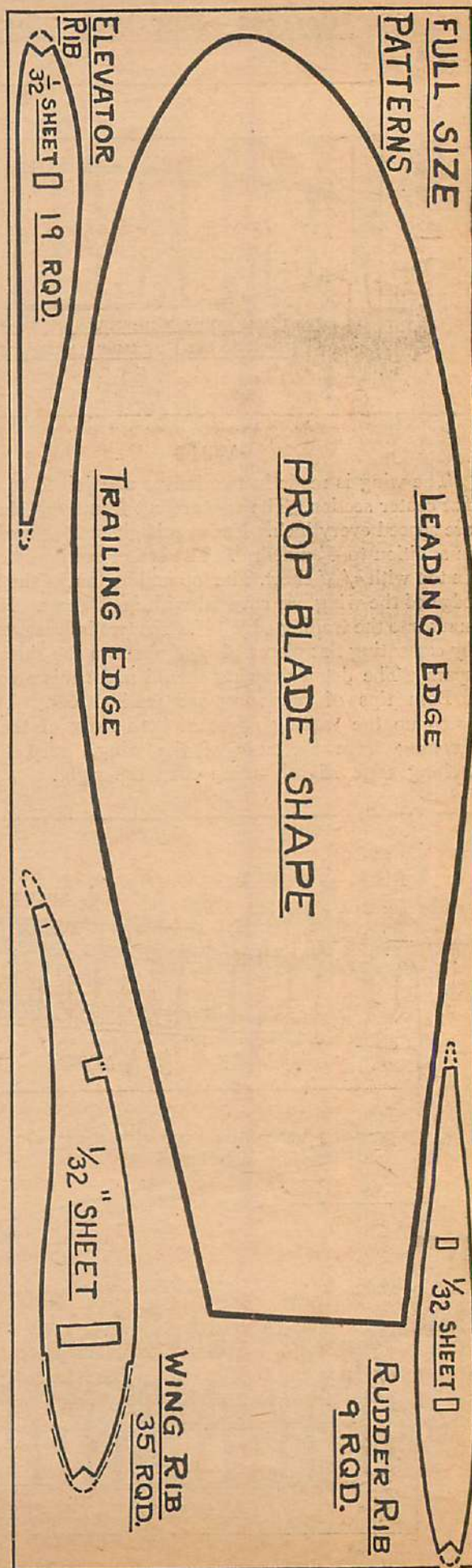
MATERIALS REQUIRED

(Balsa used throughout)

Fuselage

- 9 $\frac{1}{8} \times \frac{1}{8} \times 36$ " longerons and braces
- 3 $\frac{1}{8} \times \frac{1}{4} \times 12$ " fuselage openings, tail and nose plug insets
- 1 $\frac{1}{16} \times 1 \times 9$ " fuselage front
- 1 $1\frac{1}{8} \times 1\frac{7}{16} \times 1\frac{7}{16}$ " nose plug
- 1 sheet metal, free wheeler, nose plate, and bearing
- 1 12" fine piano wire, nose and tail attachment hooks
- 1 12" #16 piano wire, shaft, rear hook, and "S" hook
- 1 6" length $\frac{1}{8}$ " rubber tubing, rubber hook covering
- 1 $1\frac{5}{8} \times 2 \times 16\frac{1}{2}$ " medium grade, propeller block
- 1 ball bearing washer

(Turn to page 93)



The model art progresses through the exchange of ideas. The Discussion Corner is a monthly sounding board for your opinions. Think about them, then write your opinion in 150 words or less and send it to the Discussion Corner. One dollar is paid for each answer printed.

This month's topic: Does the diamond type fuselage model improve efficiency? What do you consider to be the best method of design for reducing the interference drag of wing and fuselage junction?

Next month's topic: One bladed propellers.

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

For July—Other factors of design being equal, do you believe that dihedral should be used in excess of what is actually required for stability? Is excessive dihedral beneficial, or is it a dangerous design feature? Answers must reach us by April 15th.

The Discussion Corner

PRO

At ten degrees angle of attack a square fuselage has seven times more drag than an elliptical fuselage of the same cross-section area. I believe the diamond does improve efficiency since it is a closer approach to the ellipse than is the square. By using this type fuselage and mounting the wing above the fuselage, drag can be reduced.—PAUL BURCHARD, Lenox, Massachusetts.

The diamond fuselage improves efficiency because it is the nearest approach to an ideal streamline, but without the difficulties that accompany oval fuselage construction. It reduces interference drag to a minimum because the wing can be mounted conveniently above the fuselage with clips and blocks. It can be mounted so that incidence can be changed quickly and easily.—T. JOEL, Watsonville, California.

A diamond fuselage greatly increases the efficiency of the model because the flow of air about the wing and the fuselage is much smoother. By parasoling the wing about $\frac{1}{2}$ ", the disturbing factor between the wing and fuselage is practically eliminated.—GERALD SAYERS, Saskatoon, Saskatchewan.

Diamond fuselage definitely! No resistance going or coming—thus better stability. Simplest to build. Looks swell.

Wriston uses neat tissue fillets that sort of "sag" into shape.—LAWRENCE PRANTER, Tulsa, Oklahoma.

Diamond type fuselage does improve efficiency. Having the wing attached to the fuselage with wire clips, so as to have the middle of the wing resting on the pointed top of the fuselage, decreases interference drag.—STANLEY CHOJNOWSKI, Canton, Massachusetts.

A diamond fuselage does improve model efficiency because it is the nearest approach to the oval cross section, which is supposedly the ideal fuselage shape. A mid-wing would reduce interference drag to a minimum.—MILTON BLAFKIN, Upper Darby, Pennsylvania.

CON

I doubt if the diamond type fuselage itself improves model efficiency. I have tested fuselages of square cross section for drag while passing at right angles to the wind stream. Results showed less drag with the flat side leading than with the fuselage set on an edge. However, the diamond fuselage does have an advantage in reducing interference drag much more effectively than fillets or fairings.—HENRY STIGLMEIER, Inglewood, California.

I don't believe that a diamond type fuselage improves the performance to any extent. I have found that the round fuselage is much more effective and easier to streamline where the wing joins the body. I believe that wing filleting is the best way to reduce the drag where the wing joins the fuselage.—DAVID ACKERMAN, Portland, Oregon.

A diamond fuselage does not improve efficiency because of the low speeds at which the model flies. The only possible advantage would be a slight decrease in turbulence at the wing-fuselage junction because of the parasol type of wing mounting. The best method of reducing wing and fuselage interference is to use a gull-wing with streamline root ribs. However, the increase in construction difficulties is not justified by the slight improvement in the flight.—JOHN GIBSON, Philadelphia, Pennsylvania.

An elliptical fuselage is most efficient aerodynamically, especially when used with a mid-wing. A simple square-box type fuselage has the greatest aerodynamic efficiency to work ratio because it is easy to construct. Contrary to popular belief, a square fuselage set on edge to the wing has a greater interference drag than one in its normal position. For any high-performance model I would favor the elliptical cross section. My second choice would be a square fuselage in its normal position.—H. K. WEISS, Lawrence, Massachusetts.

Ambulance of the Air



The parasol design is inherently stable.

ORIGINALLY designed as an ambulance plane, this Fokker monoplane became, in turn, a cargo carrier and a flying laboratory for the U. S. Army Air Corps' latest experiments in blind landing. (See AIR TRAILS, December, 1937.)

The tremendous inherent stability produced by the parasol wing and long fuselage made the C-14 a natural choice for such trying assignments.

Constructionally typical of methods pioneered by Tony Fokker, the fuselage and tail group are of welded steel tubing, while the full cantilever wing is entirely of plywood.

Powered by a 700 h.p. Pratt & Whitney Hornet, this

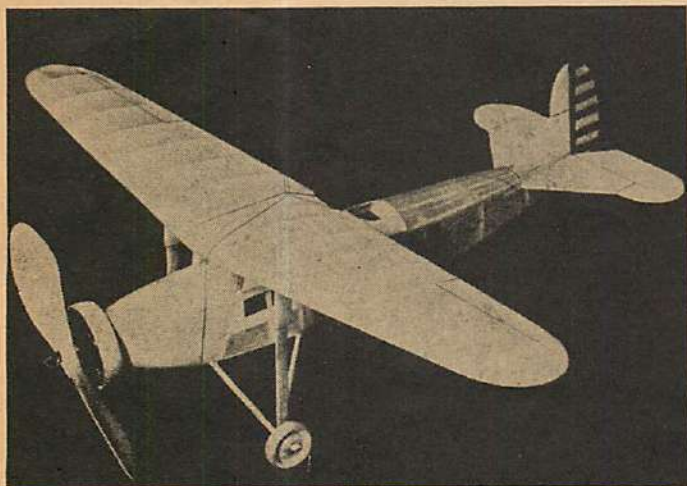
air hospital can rush the injured comfortably to proper medical attention at 160 m.p.h. Fourteen persons, including a doctor, can be accommodated in the spacious cabin. A single-place cockpit atop the fuselage affords the pilot excellent visibility and a complete set of instruments.

Retaining the stability, strength and efficiency of its prototype, the Fokker C-14 is an ideal entry for the increasingly popular flying-scale meets. Our model has easily made rafter-scraping indoor flights of 50 seconds, as well as indefinitely longer soaring flights outdoors.

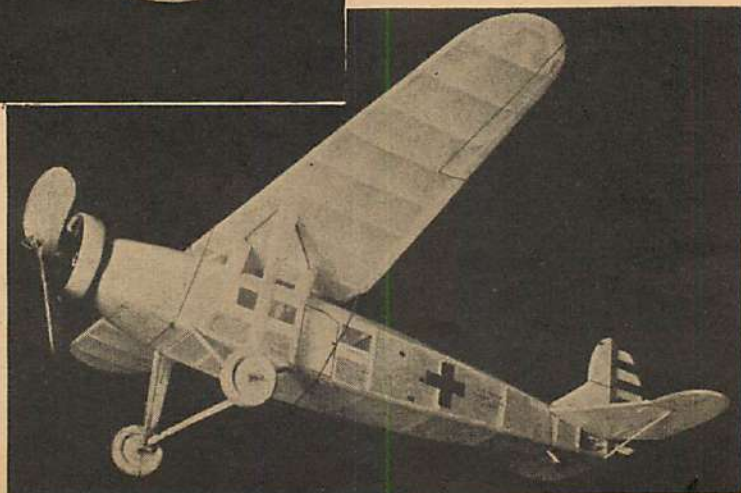
To duplicate the original, use only the best light, soft balsa, preferably of the quarter grained variety throughout. A table listing the weights of the individual parts is given at the end of the article with which to check as construction progresses.

THE FUSELAGE

Join plates I and II to obtain a full-size working plan of the fuselage. The longerons of medium hard, $\frac{1}{8}$ " sq. balsa are pinned to the drawings and the uprights of $\frac{1}{16} \times \frac{1}{8}$ " are fitted in position. Both sides are made at one time, one atop the other. When dry, they are carefully separated and joined by formers 1, 2, 3 and the corresponding bottom cross pieces. Pull the rear together and insert the (Turn to page 80)



Featured in the miniature Fokker C-14 are a free-wheeling propeller and a detachable wing, held in place by a rubber band. Despite such details as a dummy motor and an anti-drag ring, performance is comparable with that of a small contest model.



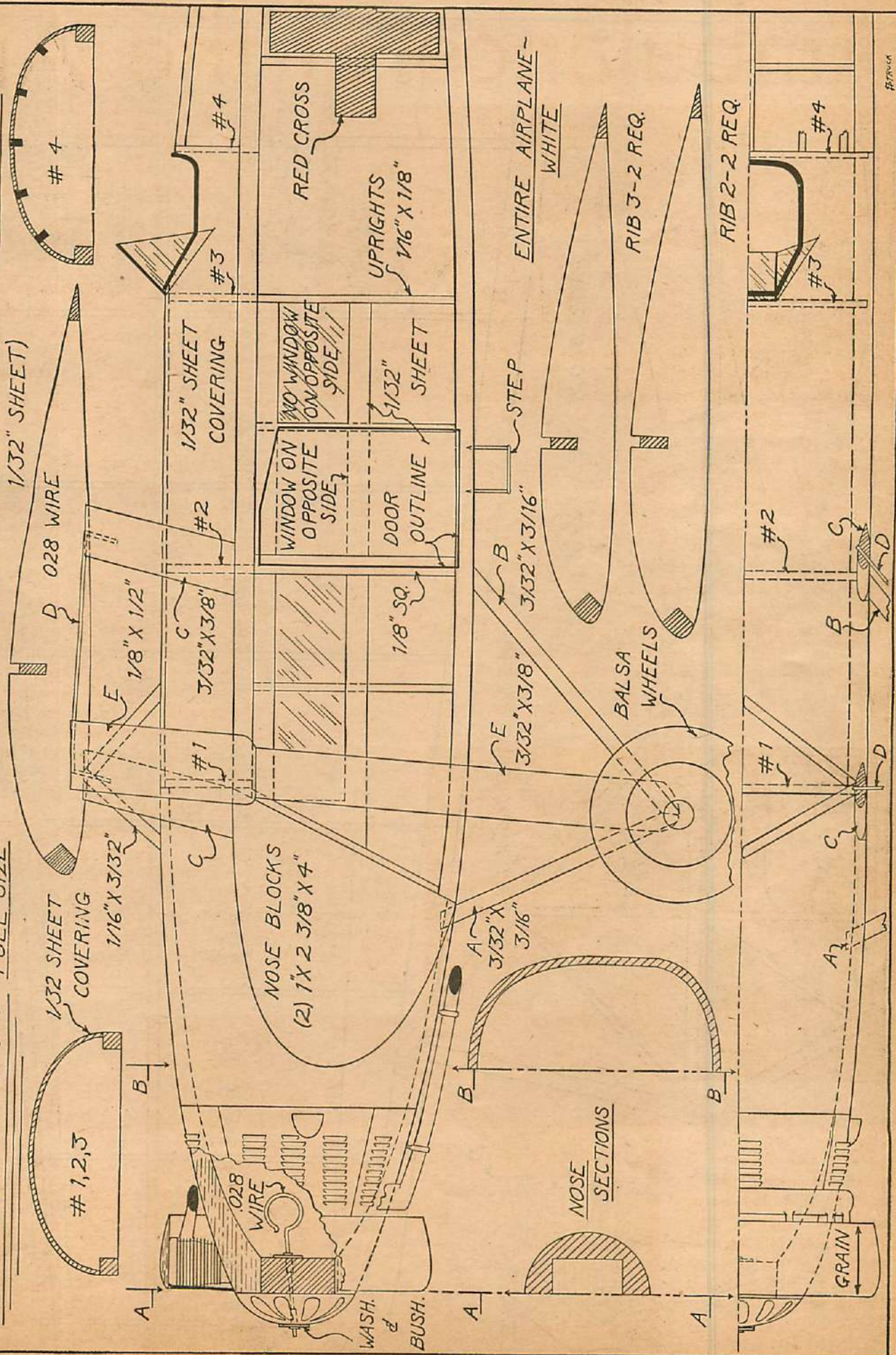
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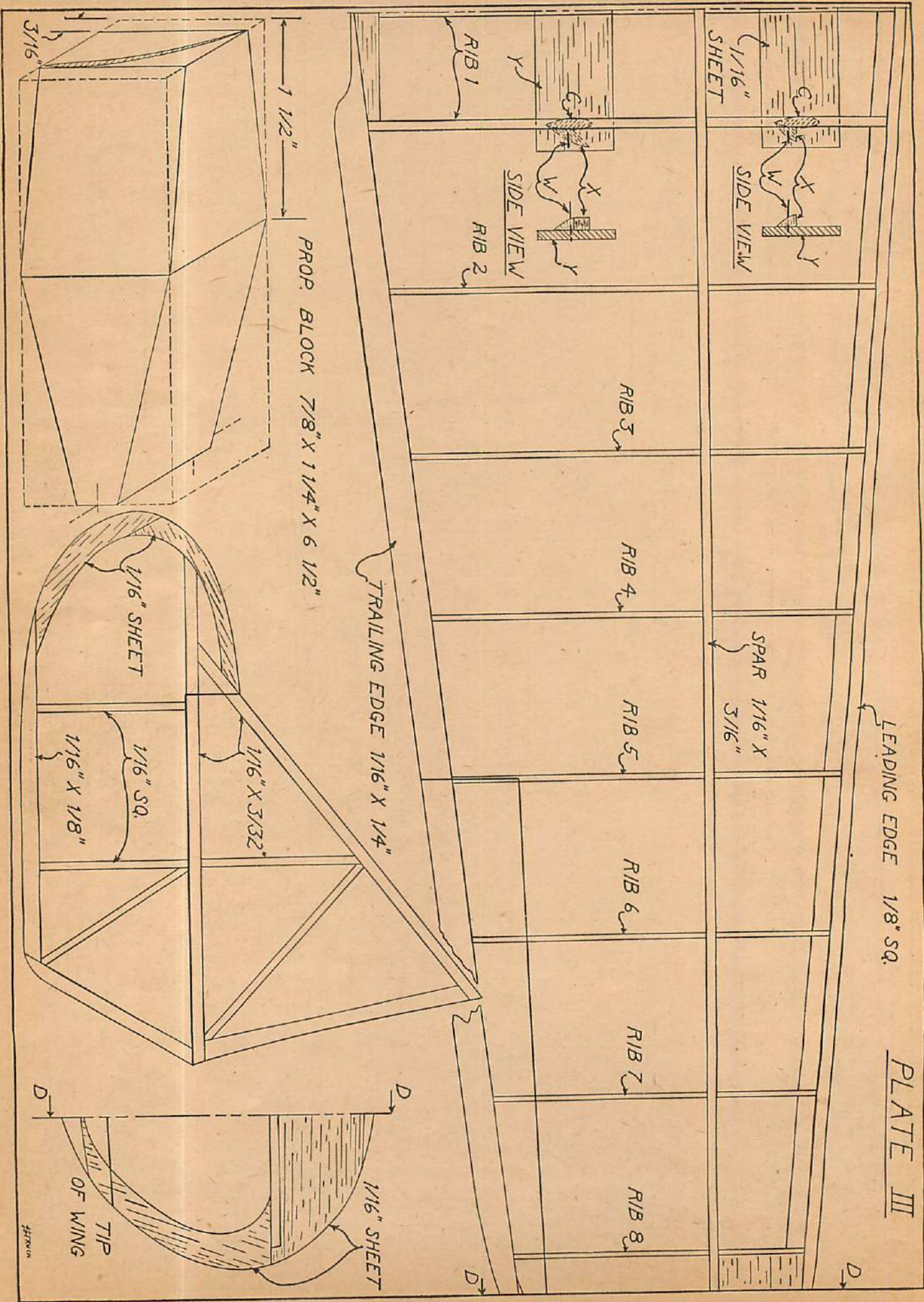
FOKKER C-14

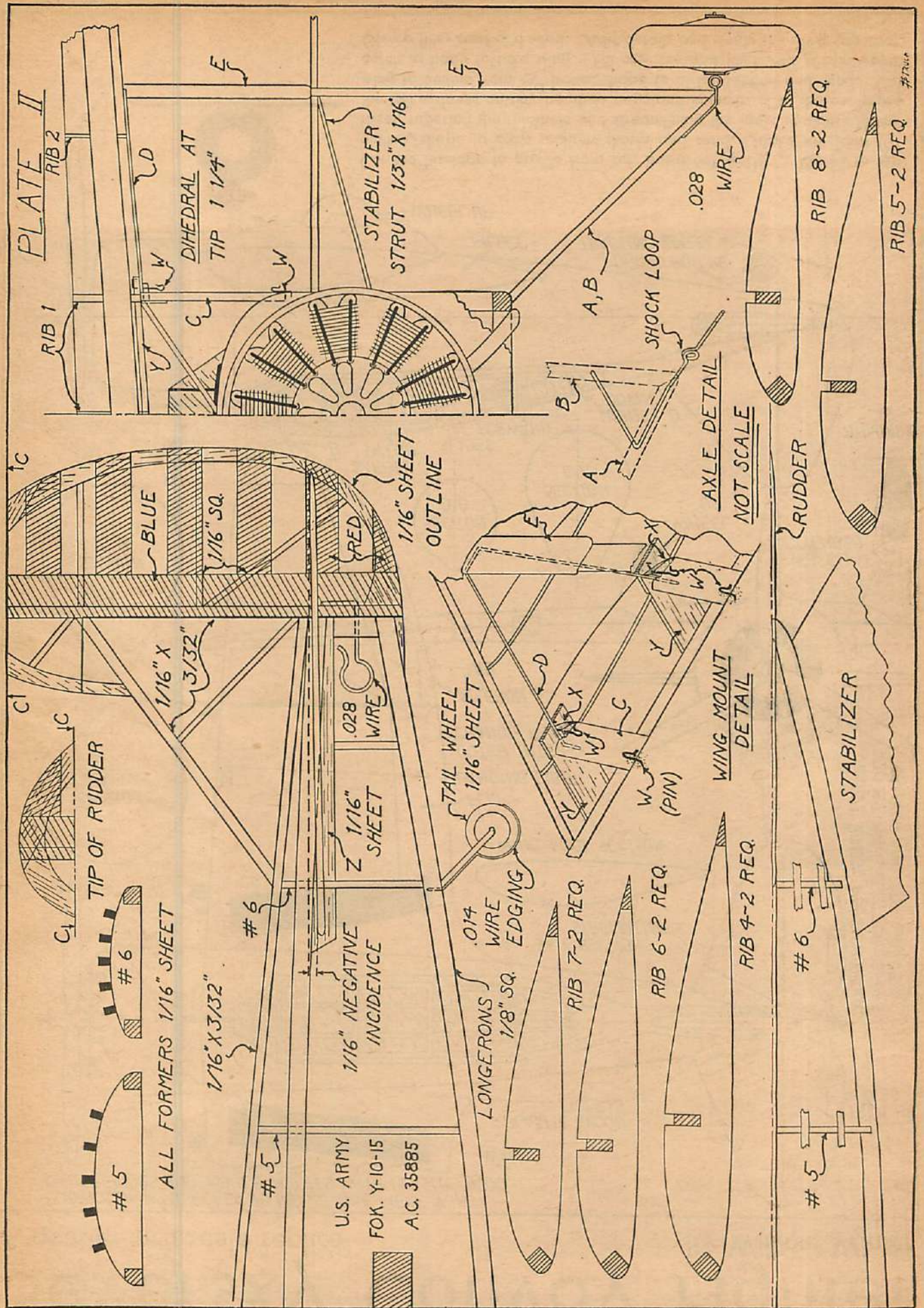
DRAWINGS
FULL SIZE

RIB 1-3 REQ (1/16" SHEET, ALL OTHERS
1/32" SHEET)

PLATE I



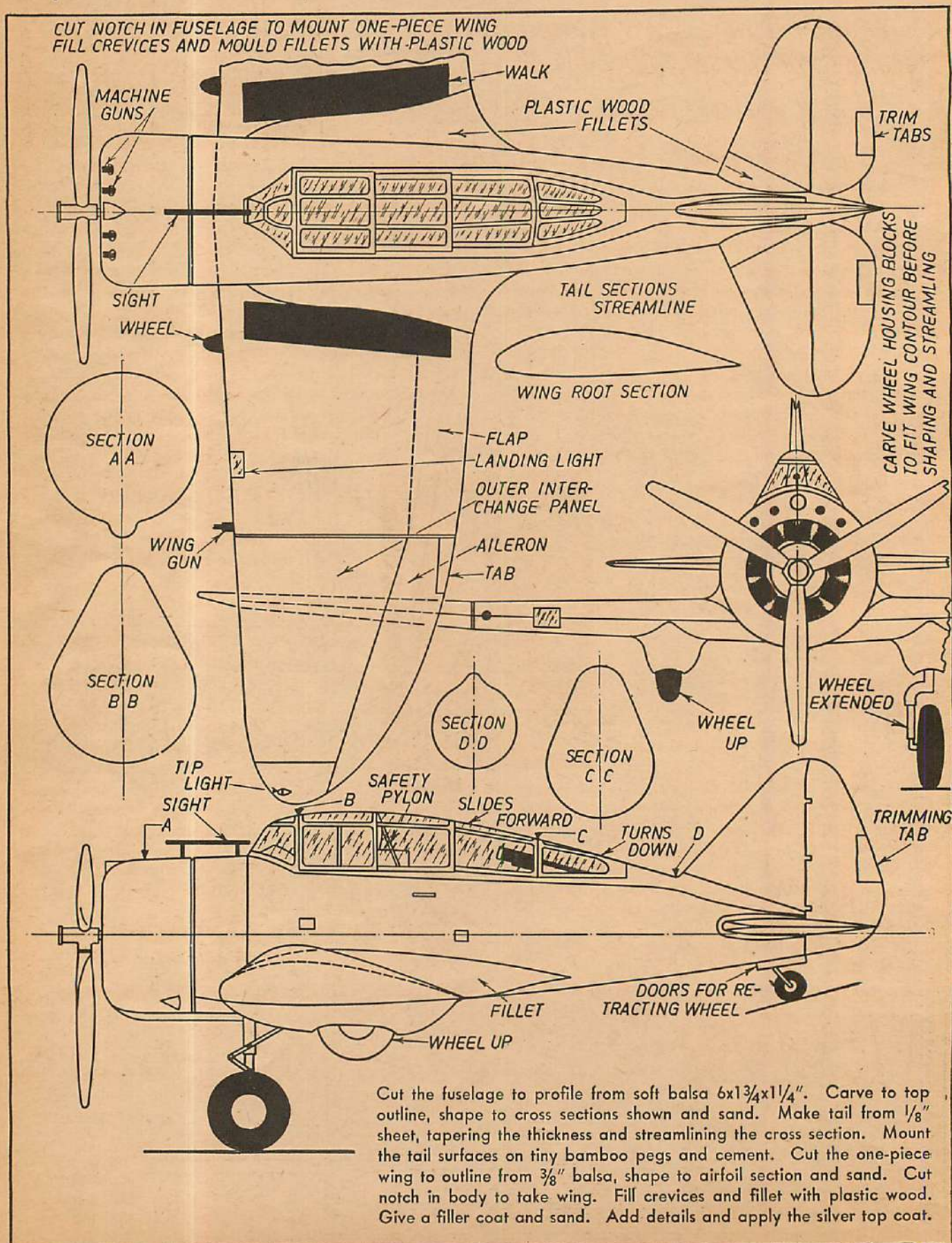




Seversky Convoy Fighter

A quarter-inch scale replica

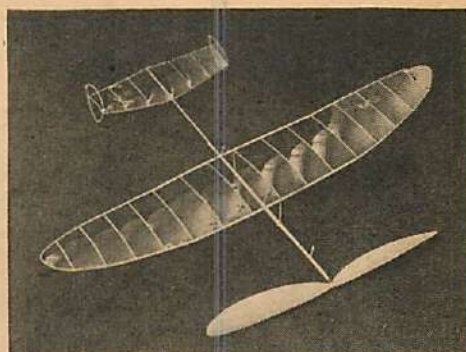
By William Winter



THE ZEPHYR

An interesting, Class B, twin-tailed indoor model designed by an expert to contest requirements.

By Lawrence N. Smithline



The Zephyr is a parasol design.

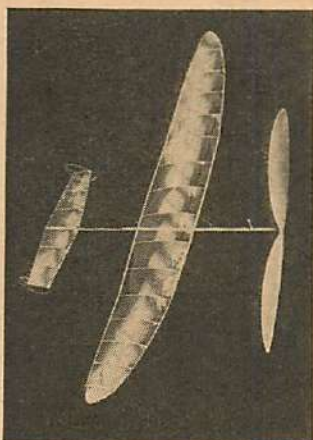
CONTESTS have made the "ship of the day" the class "B" model. A year ago the larger models were the most popular, as model builders apparently believed then—and they still do—that the class "C" job was the most consistent performer. Now, however, if model builders are to be contestants, not only must they build smaller models, but they have been forced to retrogress in building technique, as rules of the greater bulk of contests prohibit any built-up parts.

This model has been specifically designed for these rules. It has a solid, braced motorstick and a solid tail boom. This ship is set apart from the ordinary "run-of-the-mill" model because of the twin rudders. The purposes of using the twin rudders are: first, it enables us to use a smaller tail because it greatly increases its efficiency. Second, it cuts down the tendency to twist the boom. Both of these features will save us weight by allowing us to cut down the boom dimensions.

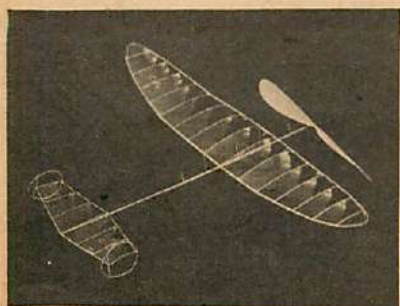
WING

The wing of this model is elliptical and of low-aspect ratio. Low-aspect ratio was used because it cuts down the weight of the wing.

Draw the wing out full size and make your spars from very light $1/16$ " sheet balsa $5/64$ " at the root and tapered to $1/16$ " at the dihedral. The tip section spars are made of $1/20$ " stock, $1/16$ " tapered to $1/32$ " square. Round all the edges, pin the spars to the drawing and moisten them with water. Make a template of the rib section from stiff cardboard and cut out the 15 necessary ribs in the following manner. Lay the template on a sheet of $1/32$ " "C" stock (quarter-grained balsa, which has a speckled appearance) and cut around it. Then slide the template down $1/32$ ", but parallel to the first cut,



Twin rudders permit a smaller stabilizer and lighter motorstick.



The model is rigid and a comparatively low flier.

and slice it again. This will form a rib. Repeat this process till all the required ribs are cut. Cement the ribs into place, cutting off $1/3$ the excess length from the front and $2/3$ the excess from the rear. Now make a template of the

curved tip from stiff cardboard and bend two strips of soft $1/32$ " sq. stock, soaked in water, around it. Let them dry, remove them from the template, and cement them to the tip spars. Tack the tip spars to the center section with a small dot of cement, remove the pins, and the wing may now be covered in one piece. After it has been covered, crack the cement joint at the dihedral and raise each tip one inch. Clip stilts are made of $1/20$ " by $3/32$ " stock, the front one 2" long and the rear $1 7/8$ ". Make the wire clips to fit the motorstick and cement them to the stilts. Then cement the assembly to the center of the wing making sure that they are perpendicular to the spars, and in exact alignment.

TAIL AND RUDDERS

Flight tests have justified this small tail. Because of the tip rudders this tail is as effective as one with almost half again as much area.

The tail spars are cut from medium balsa sheet $1/32$ ". Ribs are cut in the same way as the wing ribs, but the section used is a modified 23012 centerline. The 23012 is the most efficient section as determined by the NACA.

The rudders are made by bending two strips of $1/32$ " sq. soft balsa soaked in water around a lighted 50 watt electric bulb. After they have dried, they should be fitted on a drawing of the rudders and the spar should be inserted. Cover the tail first and cement the rudders in place.

Then cover the tip rudders. In covering the tip rudders DO NOT stick the microfilm to the end ribs of the tail.

MOTORSTICK AND BOOM

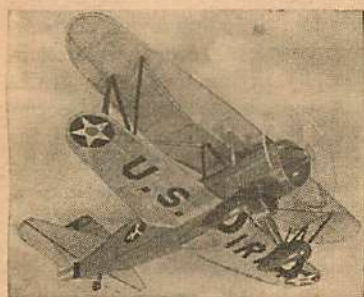
The motorstick is braced in order that it be reasonably light and still come within the rules which state that it must be solid. It has a round section as the round section gives the least angle of twist for a given cross-sectional area.

The motorstick is made of medium light $3/16$ " sq. balsa, 12" long. It is tapered to $1/8$ " square at both ends and the edges are completely rounded off to give a circular cross section. For added torsional rigidity, the stick is wound with #3 Tungsten wire at an angle of about 30° with the horizontal and in such a direction so that by twisting it in the same way as the fully wound motor, it would be in tension. Cement the posts for the wires, which counteract bending, in place, and string the #3 tungsten wire over it. Then cement on the thrust bearing and rear hook.

(Turn to page 92)

Let's Get Acquainted

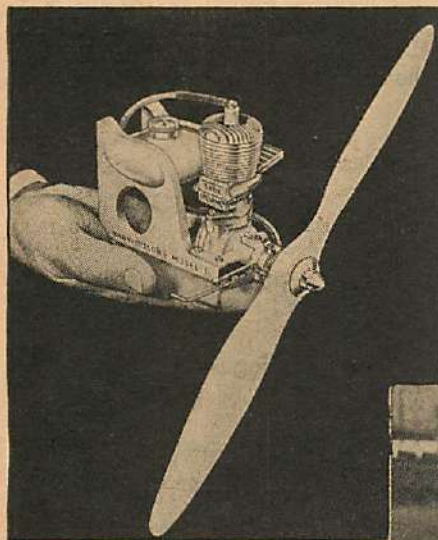
A page open to Air Trails advertisers of kits, engines and accessories. Reviewing outstanding products in response to popular request.



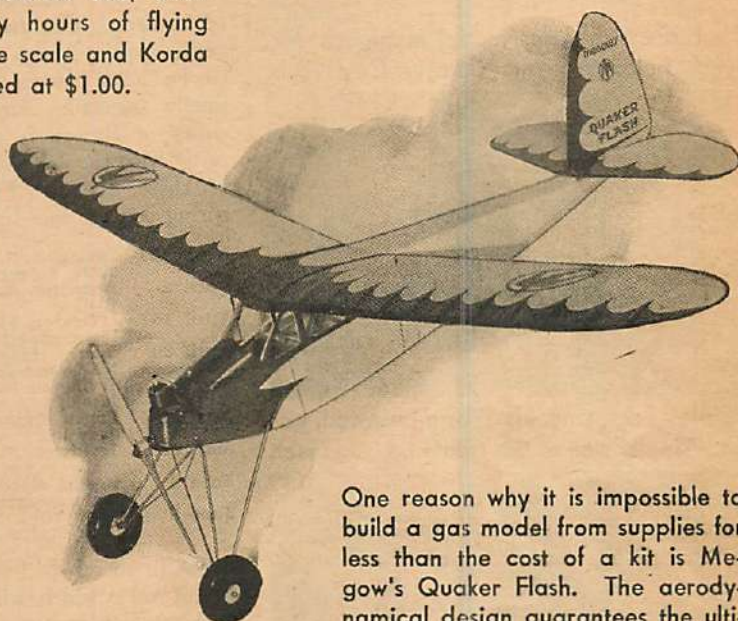
For those who prefer the flying scale model, the Burd Model Airplane Company offers a variety of sturdy, fine-flying designs. Moderately priced, these kits provide enjoyable evenings in construction and, when completed, many hours of flying pleasure. Both the scale and Korda kits are priced at \$1.00.

The Model Staff will supply on request any particular information on these products.

Below—Most famous of all gas engines is the Baby Cyclone. By its commendable service record both in the hands of beginners and champions alike the Cyclone has earned its popularity. Manufactured by Aircraft Industries, the Cyclone has proven its durability and is well worth the \$12.50 asked.



Right—Probably the most simple and practical gas model kit in America is the California Chief, priced at \$7.90 and produced by Aircraft Industries. The fuselage, sides, and tail surfaces are ready-cut from sheet balsa. The "Chief" combines proven performance and simple construction. A combination of the "Chief" and Baby Cyclone is priced at \$15.75.



One reason why it is impossible to build a gas model from supplies for less than the cost of a kit is Megow's Quaker Flash. The aerodynamical design guarantees the ultimate in flight performance. Supplied in kits such as this, are necessary fittings and parts that most modelers find difficult to duplicate. Using an equivalent amount of material the builder of an original design would soon find the \$4.95 cost of the "Flash" to be ridiculously low.



*Flight records
and contestants
in competitions.*

Model Matters

*Club notes and
news of model
organizations.*

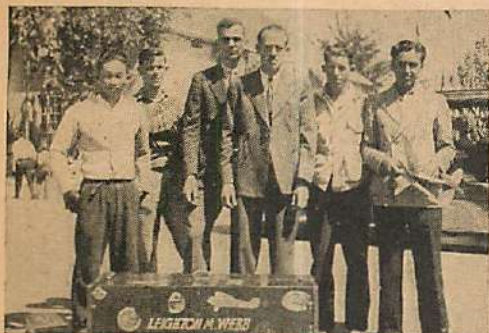
(In contest tabulations, results are to be read as minutes (to left of colon), seconds, and fractions.)



Charles Lynch's gas model in flight. Mr. Lynch belongs to the Quaker City Club.



Charles Bossi and his Brown-powered gas job. Trophy won at the Trenton, N. J., meet.



San Diego Aeroneers club members: left to right—Mitzi Hosaha, Dan Halacy, Jerry Sworts, Vedor Sworts, Bill Beckett and Joe Duarte.

Junior Aviation League, Boston

A rigorous contest program has been underway since the beginning of the year to determine the Boston model builders who will represent the J.A.L. at the National battle in Detroit in July. High-point winners will be awarded free trips with all expenses paid. Many contests are still to be held before the winners are finally selected. Anyone in the vicinity of Boston is cordially invited to fly with the J.A.L. members in any of these events. Following is the spring contest schedule:

March 19	Irrington St. Armory gliders, scale, experimental
April 2	Irrington St. Armory stick & ROG
April 16	Irrington St. Armory gliders, scale, experimental
April 30	Smith Playground, Allston. NAA outdoor list
May 7	Irrington St. Armory stick & fuselage
May 14	Smith Playground N.A.A. outdoor list
May 21	Irrington St. Armory gliders, scale, experimental
June 4	Boston Garden Indoor North-eastern States Meet
June 5	Harvard Practice Field Outdoor States Meet

J.A.L. members have drawn up a set of rules which will govern flying scale model contest of the league. Briefly the rules are: Models must weigh one ounce for every 50 square inches of wing area; have at least one rib for every inch of span; tail surfaces and landing gear are not to be enlarged; plans must accompany entries; models must ROG without propeller hitting floor when fuselage is in a horizontal position. Six official flights—no delayed flights—will be

permitted. Entries must not be less than 15" span and must have the same shape and outline as the full-size version, including airfoil shape.

Seven new local records were set in the last flying session of the J.A.L. held in the South Armory, December 18. Ralph Brown qualified for the rating of "ACE" by flying a glider for more than the required time of 30 seconds.

Contest results are:

Glider

1. Cain (Senior), C.I.A.	:40*
2. Talenti (Junior), C.I.A.	:38.1*
3. Stanwick	:36.1

Scale

1. R. Brown (Junior), Curtiss Robin	1:15.9
2. Hannon, Taylor Cub	1:08.2
3. Golden, Curtiss Robin	1:01.8

Ornithopters

1. W. Brown (Open)	:25.1
--------------------	-------

Helicopters

1. Cain	1:53.7
2. R. Brown	1:38.1*
3. W. Brown	1:05.1*

* denotes new Boston record.

Four Boston records were knocked sky high at the indoor contest held at the South Armory, Boston. Ralph Brown and Hewitt Phillips divided honors.

Stick Type H.L.

1. H. Phillips, Sr. C	9:42
2. Oringer B	6:36.2

Fuselage—ROG

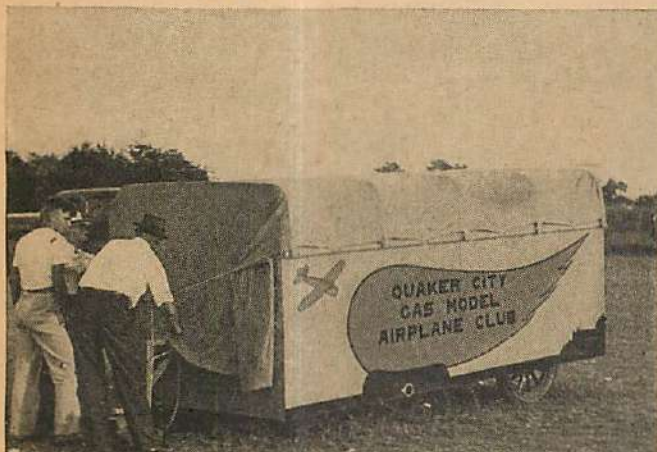
1. R. Brown B	6:12.5
2. Cain B	5:39.9

Stick—ROW

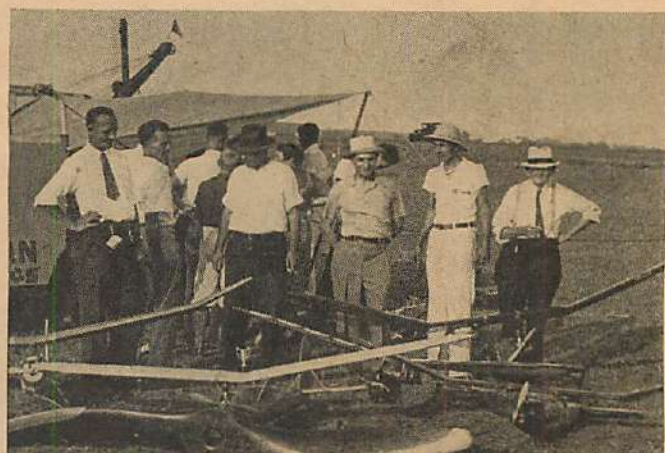
1. R. Brown B	3:15.7
2. Sebring B	2:26.7

Fuselage—ROW

1. R. Brown B	2:02.2
2. Wallerstein B	1:39.1



The Quaker City Gas Model Airplane Club trailer. Costing \$60, the trailer was made by club members and was a familiar sight at many 1937 contests.



A few members of the Quaker City Club: left to right—Walter Eggert, Mr. Gulekunst, Dick Kehrer, Walter Hurler, N. B. Spotts and W. S. Berry, Sr.

Helicopters

1. W. Brown
2. Saidel

1:29.2
1:39.3

Quaker City Club

Quaker City Gas Model Airplane Club. Here are the specifications on the club trailer:

Dimensions—12' long, 6' wide, 7' high
Capacity—16 planes on upper deck
Compartment for wings—8' 6" long
Tool compartment in rear.

Trailer was made by club members from the materials—cost \$60—furnished by the club directors. It has traveled 500 miles up to December, 1937, was put in service in July. Transportation charge is \$.25 per plane. The trailer has been taken to every contest up to 100 miles from Philadelphia.

A 40-second timer flight contest was held January 15th at Northeast Airport, Red Lion Road, near Philadelphia, Pennsylvania. Only twelve members entered the contest. Five were able to fly their models because of the freezing weather and the 20 m.p.h. wind that was sweeping the airport. Charles Bossi won first with 1:32. His model was exceptionally stable in the high wind. Charles Lynch was second with :30. His model clipped along at 50 m.p.h. with the wind and then power dived at the end of the flight. Kenneth Werner took third.

Chicago Aeronuts

The Chicago Aeronuts announce the names of their new officers for 1938—the result of a recent club election:

President—Wallace Simmers
Vice-president—Charles Belsky
Secretary—Dennis Turner
Treasurer—Milton Huguleit
Editor—Tom Cunningham

Members chosen for the council to assist the officers are Carl Goldberg and Karl Holzinger.

Election was held at the Aeronuts' second annual banquet. Another important bit of business carried out at the same time was an amendment to the club constitution which stated that members in good standing for a period of one year, who find it difficult to attend club meetings, shall automatically be given life memberships in recognition of the interest and service which they have shown in the club.

This is a splendid way of keeping older members interested in club activities, despite their inability to follow club activities as closely as they'd like to.

Contest Calendar

READERS AND CLUBS. Notices should be mailed to the Contest Calendar, Air Trails, 79 7th Ave., New York City, at least 5 weeks in advance; news of winners and results immediately after the events.

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

EASTERN STATES GAS MODEL CONTEST sponsored by the Philadelphia Gas Model Association and directed by Mr. Jesse Bieberman. Date tentatively set for May 28th or 29th; entrants welcome from all states east of the Mississippi. Further information from Mr. Jesse Bieberman, 3219 E. Brighton Street, Philadelphia, Pennsylvania.

NORTHEASTERN STATES MEET sponsored by the Junior Aviation League of Boston, Massachusetts. Open to modelers from all sections of the country. Indoor flying at the Boston Garden, June 4th; outdoor events at the Harvard practice field, June 5th. A full list of trophies, plaques, cups, gas engines and other awards. Information and entry blanks from Al Lewis, Junior Aviation League, Jordan Marsh Company, Boston, Massachusetts.

NATIONAL CONTEST, Detroit, Michigan. Date tentatively set July 6th to 9th, inc. Complete list of N. A. A. contests for the National trophies. Information and entry blanks, National Aeronautic Association, Dupont Circle, Washington, D. C.

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

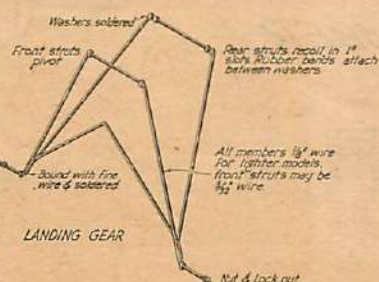
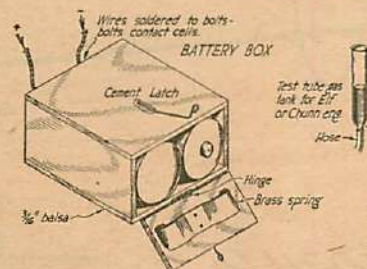
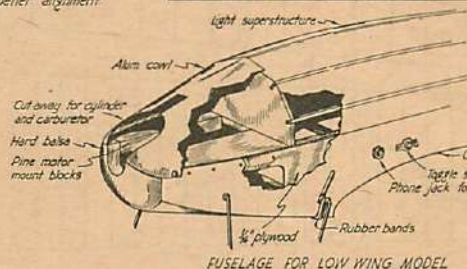
SECOND ANNUAL TRENTON EASTERN STATES GAS MODEL MEET sponsored by Trenton Chapter of the N.A.A. Permanent trophies and cash awards for first place winners; numerous awards for other place winners. Date: Sunday, August 21st; place: Mercer Airport. For further information address the Trenton Aero Society, 212 Centre Street, Trenton, New Jersey.

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

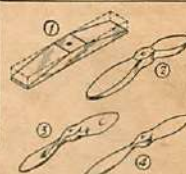
PROPELLER DATA
Mahogany, poplar, and walnut are most suitable materials. Finish by sanding between coats of dope—use clear lacquer for final coat. Back face of hub should be exactly at right angles to hole for best propeller alignment.

CURRENT GAS MODEL CONSTRUCTION

USED BY LITTLE ROCK, ARKANSAS BUILDERS



Drawn by: H. A. Thomas

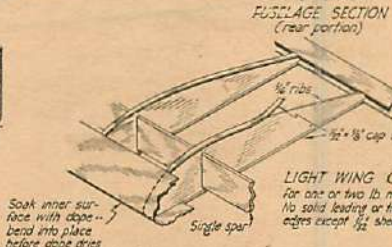


STEPS IN MAKING A PROPELLER

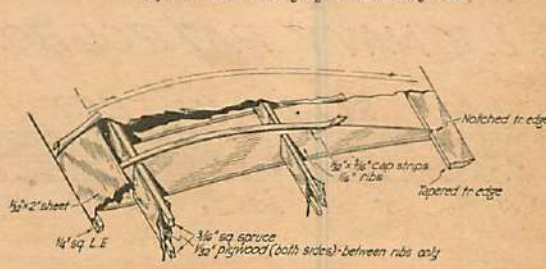
1. Drill and taper block
2. Dig saw blade pattern
3. Rough out with draw knife
4. Rasp, balance, sand & finish

PROP DIMENSION TABLE
Block tapered front only 1/8"

ENGINE	Dia	1"	1 1/2"	2"
Brown B.C.	14"	14"	14"	14"
Cyclone	15"	14"	14"	14"
Magel-Gann	12"	14"	14"	14"
Forster Bros.	16"	14"	14"	14"
E4	20"	14"	14"	14"
Churn	12"	14"	14"	14"
Morton	12 1/2"	14"	14"	14"



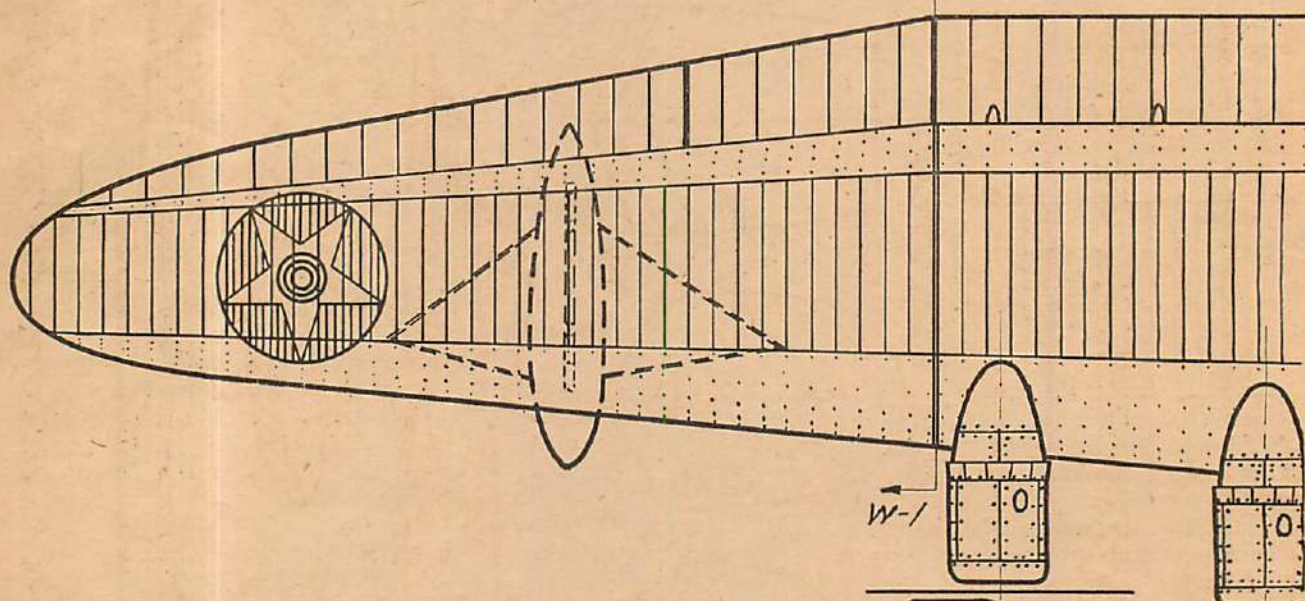
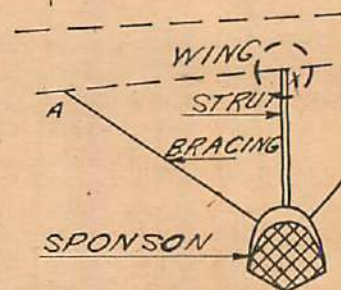
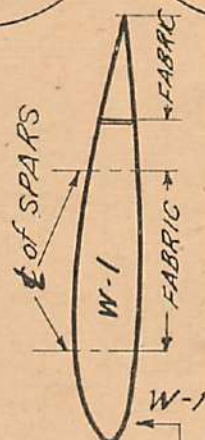
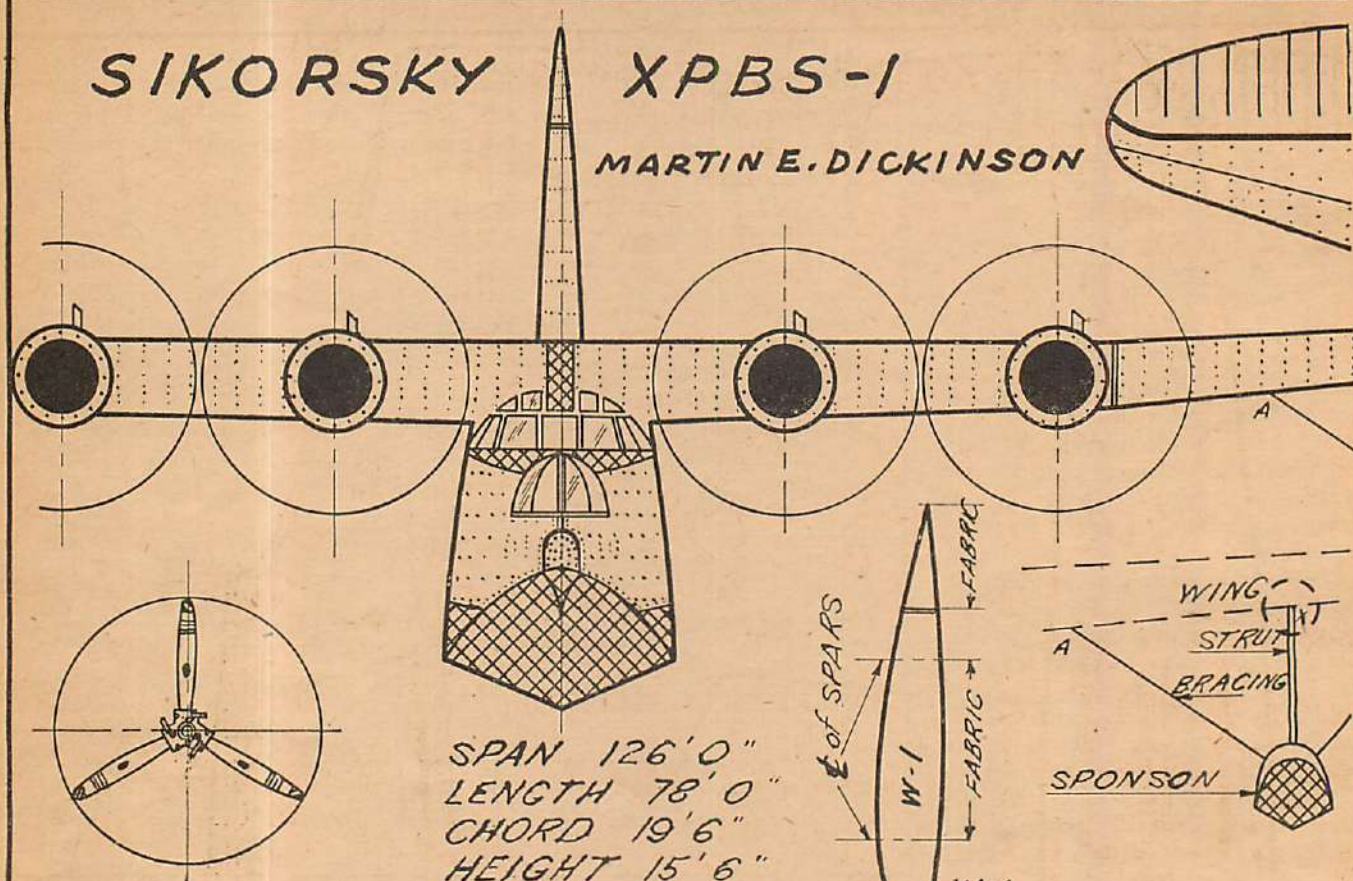
Note: 1/8" dia. alum. welding rod is excellent wing tip material. It may be filed flat at trailing edge and can be strengthened.



TYPICAL WING CONST. (8 TO 10 FT. SPAN)
Aerofils used: Clark Y, Gullwing 491, RAF 32, Eiffel 400, U.S.A. 21, and numerous original sections.

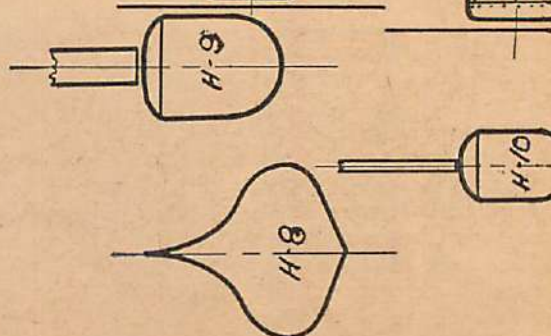
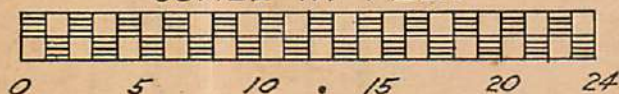
SIKORSKY XPBS-1

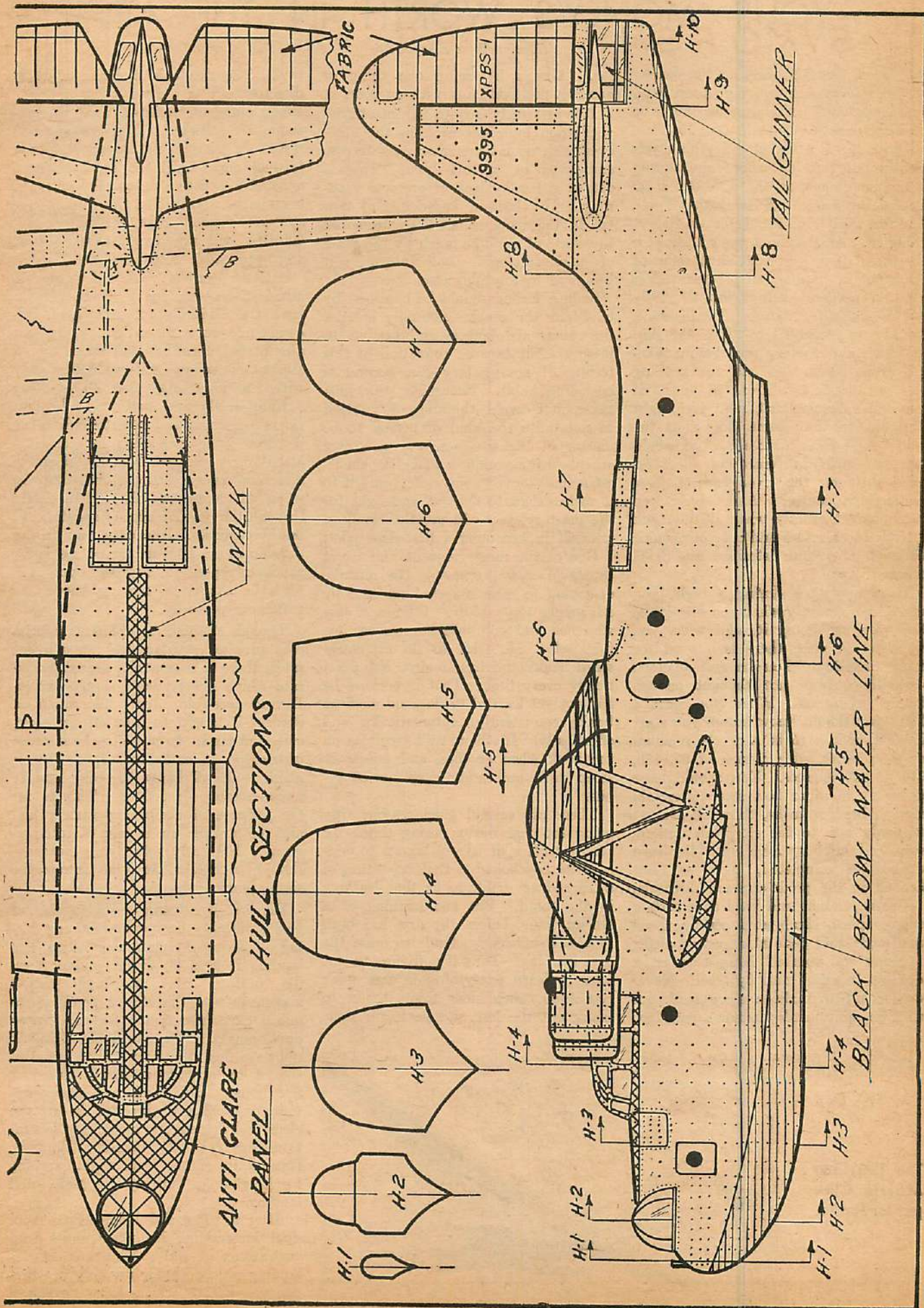
MARTIN E. DICKINSON



4 TWIN WASPS 1050 H.P.
U.S. NAVY PATROL-BOMBER

SCALE IN FEET





YOUR MONEY'S WORTH IN THE AIR

(Continued from page 12)

you know the differences in the correct methods of taxiing up wind, down wind and cross wind? Ask your instructor or read *Aeronautics Bulletin No. 19*.

Write down a list of everything you are supposed to do before and during a simple circuit of the field to a 90 degree approach and landing. You'll find it a fairly long list if you get everything in. And without your instructor to correct you, you will leave some of them out in your actual practice unless you do prepare such a list to study before and after flying. For instance, would you remember to "Ess" the ship and look ahead every time before take-off, even though you felt sure nothing was on the field in front of you? If you didn't develop that habit you might find out too late some time that the field wasn't clear after all. And would you remember to "crab" to allow for wind drift on the cross legs of your rectangular course? And would you remember at exactly what altitude you intended to level off and cut your engine back to a certain "straight and level cruising" r.p.m.?

If at any time during a flight you don't know exactly what you are doing, how you are doing it, and what you want to do next, there is a need for more precision. You haven't planned carefully enough nor thought enough before taking off. When you start a bank you should know before you start it whether it is to be a gentle, medium or steep bank, with a turn of 90, 180, 270 or 360 degrees. You should have definitely in mind how steep a certain kind of bank is to be, then roll over at a steady rate to the steepness desired, stop and hold it there until the turn desired is completed, then roll out headed in the predetermined direction.

Cruise straight and level at a certain engine speed, climb at a certain speed and angle, and glide at a certain angle.

Never let yourself hang between a decision to climb and fly level. Never decide just to make a steep bank out of a medium bank that has gone too

far. Always be doing one thing or another, positively and with purpose.

It is extremely easy to fall into trivial vacillation and indecision in the air—even with no instructor or passenger to embarrass or perturb you. This is caused either by lack of previous planning or by lack of knowledge of how to do the maneuvers. You recognize this state of mind as much by the sense of discomfort and vague insecurity it brings as by anything else.

Such a feeling should be banished by banishing the causes—not only because the causes are dangers and barriers to progress, but because toleration of this feeling of non-mastery can become a corroding habit. Recognize your mistakes, but avoid thinking of yourself as not quite the kind of person to be master of the situation. If you ever accept such a notion or make the slightest mental move to reconcile yourself to it rather than to deny it and fight for the mastery, you will greatly handicap yourself in becoming a first-class pilot.

One of the most frequent and worst causes of slow progress is the mistake of trying to save money and time by advancing too rapidly. I know a boy who has had only ten hours since his first solo. He tries to do extremely steep banks and has to dive out practically every time. That is because he has not yet learned to do good medium banks consistently, automatically and effortlessly. His hand still trembles on the stick when he flies, and failure in steep banks makes him even more nervous.

There are several good reasons why going too fast means losing time. In the first place, it is well known to educational psychologists that repetition of a learned act tends to fix that learning in the mind. But the learning of a second thing, before the first has been repeated sufficiently, tends to erase the first learning. Thus if a flying student tries to learn everything in too quick succession, each new thing tends to blank out the last and he learns none

well. The result is a chaos of badly directed efforts. Everything is done wrong and bad habits, difficult to overcome, are initiated. It is necessary to repeat a simple maneuver, correctly learned once, until the right performance of it becomes automatic, until the brainpaths controlling the process are so well defined that the subsequent learning will not blank them out to any appreciable extent.

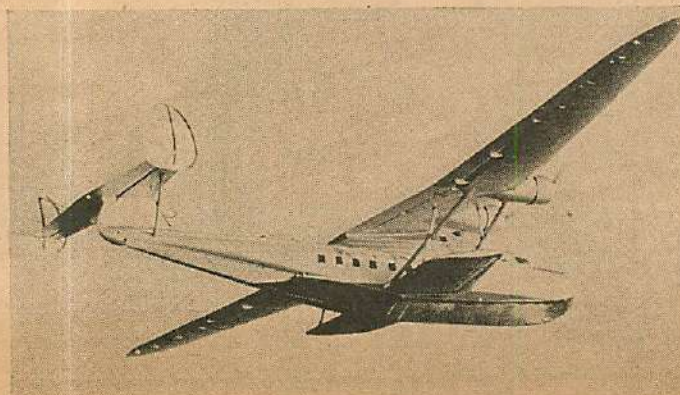
Another serious result of trying to advance too rapidly is that it holds back the all-important growth of self-confidence and relaxation, which are absolutely essential to success. A student develops self-confidence only with the knowledge that he is doing a thing easily and well. And he gets rid of tenseness and anxiety only when he does it so well that his conscious attention is released from the strain of directing every little move—that is, when he learns to fly automatically through the development of spontaneous reflex responses. The only way he can develop these habitual responses is by means of repetition, over and over, even after he thinks he already knows the maneuver perfectly.

Though students of different abilities can advance satisfactorily at different rates, there is a generally recommended rate which few students should exceed. During pre-solo dual instruction a student is taught to take off, fly a circuit, and land. In addition, he is given instruction in stalls and spins (if his plane is at all likely to spin) and in forced-landing procedure. This is for the purpose of decreasing anxiety and also for possible use in case of an emergency. His early solo flying, however, should be confined for some time to the simple maneuvers.

His first five hours of solo work can very profitably be spent practicing taking off, flying a rectangular course, and landing from a 90 degree gliding turn. To perform this seemingly simple maneuver with the utmost precision requires close attention to detail. Proper development of the habit of doing it right means that no other practice should be attempted during this first five hours. This maneuver alone provides a wealth of practice in all the elemental maneuvers, including preparation for take-off, take-off, climbing, turning in climb, level flight, turning level, gliding, turning in glide, and landing.

After the first five hours comes more dual instruction, including more demonstrations of stalls, spins and forced-landing procedure, for use only in emergency. Errors which have developed are corrected. If the student is good

The 150-foot
Martin Clip-
per for Russia.



enough at flying his circuit and making 90 degree approaches, he may be shown the 180 degree side approach. From here on he tries to make all landings as close as possible to a predetermined spot.

If his 90 degree gentle banks (which to avoid skidding should not be less than 20 degrees) are good, and if he is developing relaxation, he may be given instruction in gentle and medium banked precision turns. Medium banks should be about 40 degrees, and turns exactly 90, 180, 270 and 360 degrees. These careful turns are important because they are practice not only in precision, but in taking conscious attention away from the controls.

The next five hours of solo (fifth to tenth) are spent practicing maneuvers in which he has received instruction (except stalls, spins and forced landing). The student interested in getting his money's worth should avoid experimenting and playing with other maneuvers he has heard about. It may be helpful to pitch the plane carelessly around a bit and to be deliberately "sloppy" for short periods now and then to relieve tenseness. But except for this purposeful deviation, you should stick closely to your prearranged flight plan.

Solo time after the next instruction flight—ten to fifteen hours—should be devoted to repetition of the same elementary maneuvers over and over. You are not ready yet for the more advanced maneuvers. You need to grind the basic principles into your habits.

On the instruction flight after fifteen solo hours your instructor corrects errors and gives you more stalling and forced-landing practice. If you are calm and relaxed on your medium banks and landing work, he can now give you instruction in a steep bank, that is, some bank beyond 45 degrees.

This is a good time, too, for instruction in slips.

Even before this time you perhaps will have discovered how easy it is to correct a small overshooting error with an innocent little slip. Avoid the pitfall of slipping. When you slip your plane (unless you are deliberately practicing slips), you are slipping in your efforts to become a truly expert flier.

In the Air Corps students are not allowed to slip at all in ordinary landing practice. If they have overshot, they go around again. That makes them less likely to overshoot next time. Slipping constantly in landing is the mark of a poor pilot, though it is well to have a slip in your bag of tricks for use in a possible forced landing. Slipping destroys the habit of precision, and it can undermine the landing approach skill even of expert pilots.

Solo time from fifteen to twenty

hours is devoted to practicing all the non-emergency maneuvers in which instruction has been received, including steep banks in level flight and in gliding spirals. Very little time is needed for practicing slips. More is spent gaining precision in 90 degree and 180 degree side approaches.

After twenty hours of solo practice comes the major part of the training which serves truly to develop a high capacity for "reflex" flying. By this time you should have the fundamental maneuvers learned so well that you are able to do them fairly well while thinking about something else or watching the ground. To aid you in this transfer of control from the conscious to the subconscious portion of your mind you begin practicing various maneuvers which require concentration on the general pattern of the whole maneuver rather than on the various parts of it. These include four or five varieties of figure eights, chandelles, 180 and 360 degree overhead approaches, and a few others.

There are also precision spins in which you come out headed in a certain direction, and also the other acrobatic maneuvers. Students with different abilities will be ready for the various advanced maneuvers at different times. The advice of a good instructor throughout at least 50 hours of training is invaluable.

It is essential that the student not try new advanced maneuvers faster than he can master them within a reasonable time. If the student, however, has been faithful in his repetitions of the basic maneuvers during the first twenty hours, he can practice, afterward, a much greater variety of "pattern" maneuvers simultaneously without confusion.

Throughout your advanced work as well as during elementary practice, you must keep up a tireless fight with that old devil which constantly prompts you to grow slack and careless, to take the line of least resistance, to let yourself lose your precision. In fact, you must keep up that fight as long as you fly.

Always the high satisfaction you experience in doing a thing right, the expert's pride in excellence, will more than repay you in terms of sheer pleasure for the effort of maintaining your high standards. Not to mention the advantage of being a safe, rather than a dangerous pilot.

The habit of doing the thing right, and of not being comfortable if it is not done right, is a good pilot's greatest asset. And if you want to get the greatest possible good out of your flying time, and the greatest satisfaction out of all your flying, follow one simple rule. Find out exactly how everything should be done, and then never permit yourself to do it any other way.

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A BETTER ENGINE FOR LESS MONEY... HERE'S HOW WE SAVE YOU MONEY: The very finest materials, high precision skilled workmanship and rigid test inspection required in its manufacture make the Baby Cyclone very expensive to build. To add usual dealer's discount to cost of manufacture would cause this engine to sell for \$25.00. Instead Aircraft Industries now sells only direct from factory to user thus passing the dealer's discount on to you as a big saving. You thus can buy the best and most expensive engine at the cheapest price. It has proven that it can win for others and it can win for you. Win meets! Be a Champion! Order your Baby Cyclone today... right now.

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"CYCLONE SERVICE"—Your engine positively will be shipped some day order is received
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☐ **BABY CYCLONE ENGINE MODEL "E" . . . \$12.50**

☐ CALIFORNIA "Champion" Kit Complete \$10.00 ☐ CALIFORNIA "Champion" Kit Complete \$7.90 ☐ HARDWOOD PROPELLER \$1.50

☐ COMBINATION "Champion" Kit, propeller and engine \$17.85 ☐ COMBINATION "Champion" Kit, propeller and engine \$15.75

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AMBULANCE OF THE AIR

(Continued from page 66)

remaining formers and cross pieces. Cover the top of the fuselage with a 2" sheet of $\frac{1}{32}$ " balsa. It is easiest to use separate sections between formers 1 to 3, and 3 to 4. Run five stringers $\frac{1}{16} \times \frac{3}{32}$ " over the rear formers.

Secure two very light and soft pieces of balsa, $1 \times 2 \frac{3}{8} \times 4$ ", glueing them together lightly. Cut one end at the angle necessary to fit the front of the built-up portion of the fuselage. Tack lightly in position with cement. Trace the side view on the block and carve almost to the outline. The top view is similarly treated. Shape to the proper cross section with knife and sandpaper, trying to blend the lines of the fuselage smoothly into the nose block. When finished, remove from the body, pry the halves apart and hollow out the inside to the thickness shown by dotted lines. Recement to the body. The window outlines of $\frac{1}{32}$ " sheet are fitted between the uprights. Note that there is a window opposite the door, but none opposite the last window on that side. Cement the stabilizer support Z to the top longerons.

THE WINGS AND TAIL

The ribs, given full size, are cut out of sheet balsa as specified. From the right wing panel given, trace a left half and assemble the wing directly on the complete plan. Before inserting the center rib, the wing is cracked at the center and each tip raised $1 \frac{1}{4}$ " for dihedral. The remaining rib, as well as the spar and the wing mount supports Y, are then added.

The tail group is flat in section and very simple to build of the materials noted on the drawings.

Curved outlines of the wing and tail should be made of separate sections in which the grain of the wood runs as indicated.

COVERING

The completed framework is sanded to round off any sharp corners or remove bumps that may mar the covering job. Actual covering of the simple surfaces with white tissue presents no problems that fresh, smooth paper and average care cannot overcome. The left rear panel of the fuselage and the rudder are not covered for the present. Apply several coats of dope, sanding between each, to the exposed wood parts.

THE LANDING GEAR AND ASSEMBLY

The landing gear struts are of very hard balsa, streamlined in cross section. Struts A, projecting into the nose, are

cemented in place at the proper angle. Struts B are joined to the outside of the longerons and to the ends of A. The wing mount struts C are glued to the top longerons, recessing the cowl as necessary. From .028 piano wire form fittings D and cement to C, using the dihedral of the wing as a template to get the correct angle. The shock struts E are made of two sections and cemented at the top to D and at the bottom to the landing gear. The axles are bent of .028 wire, incorporating a small loop to cushion landings. (See axle detail.) Glue the rudder to the tail post. After the rear hook is installed, the rudder may be covered.

Throughout the assembly process described, use several coats of cement on all joints and check alignment of the structure frequently.

The stabilizer halves are attached to the foundations with a $\frac{1}{16}$ " negative incidence. Now pin the wing temporarily in position and glue the small blocks X to the wing mount supports Y. Do NOT glue to either struts C or wire D. The purpose of the blocks is to prevent the wing from shifting in flight, yet the wing can move if the plane strikes an obstacle. Hooks W, bent of pins, are connected by thin rubber bands permitting the wing to be quickly attached for flight or removed for transportation.

Spray the surfaces lightly with water and apply a coat of thin dope.

MOTOR AND PROPELLER

The dummy cylinders can be made in several ways. Most difficult, but also most realistic, is to make them of alternate disks of paper and $\frac{1}{32}$ " sheet balsa. A second method is to wrap cylinders of the proper diameter and shape with thread, while the easiest of all is to use a set cut from a purchased celluloid motor.

The nose plug, laminated of two sheets of $\frac{1}{4}$ " balsa, should fit snugly into the front of the nose. A shaft hole is drilled at a slight downward angle. Washers, with bushings inserted, are cemented to front and rear.

Sand a $\frac{9}{16} \times 6 \frac{1}{2}$ " length of $\frac{1}{16}$ " sheet to an airfoil section for the drag ring. As the grain must run in the shorter direction, several widths of balsa will have to be cemented together. Soak the strip in hot water and bend around a bottle or can $1 \frac{7}{8}$ " in diameter. When completely dry, the ring is removed and cemented to the cylinders.

The propeller is carved of a $\frac{7}{8} \times 1 \frac{1}{4} \times 6 \frac{1}{2}$ " block, blanked out as shown on the plans. The back of the blades should be undercambered about $\frac{3}{32}$ "

at the widest point. Round off the outline, balance, and finish with several coats of dope. To take full advantage of the gliding ability of the model, the prop should be equipped with one of the many popular free wheeling devices.

FLYING AND DETAIL

Six strands of $\frac{3}{32}$ " flat lubricated brown rubber are enough power to fly a one ounce model perfectly. Eight strands of $\frac{3}{32}$ " (six strands of $\frac{1}{8}$ ") will give a terrific climb for outdoor flying even with a heavier job.

The first step in flying is to check the incidence and balance. The center of gravity should be located $\frac{1}{3}$ the chord from the leading edge, where the wing spar is found. Correct any variation with a small amount of clay ballast for the first tests, later replaced by added details of equal weight.

When a smooth glide has been obtained, making the small adjustments that may be needed by warping the stabilizer slightly, give the motor about 100 turns and hand launch. Adjust the rudder to circle the model against the torque. If under increased winds the circles become too tight, washout the right wing slightly. (Looking from the front.) Stretched and wound with a winder, the 800 turns possible will easily hook your ambulance plane to one of those spring thermals.

Details such as colored tissue insignia and black India ink lettering and trim add greatly to the appearance. Other items can be easily taken from the plans and reproduced with a little ingenuity from scraps of balsa or wire.

TABLE OF WEIGHTS

PART	WEIGHT
Fuselage frame.....	.12
Nose1
Dummy motor.....	.1
Prop and plug.....	.1
Tail05
Wing13
Covering1
Rubber (6 strands $\frac{3}{32}$ " flat) ..	.14
Landing gear and miscellaneous detail20
Finished model.....	1.04

MATERIAL

Blocks	Sheet
2 $1 \times 2 \frac{3}{8} \times 4$ "	1 $\frac{1}{32} \times 2 \times 18$ "
1 $\frac{7}{8} \times 1 \frac{1}{4} \times 6 \frac{1}{2}$ "	1 $\frac{1}{16} \times 2 \times 18$ "
	1 $\frac{1}{4} \times 2 \times 2$ "
Miscellaneous	Strips
1 sheet white tissue	1 $\frac{1}{16}$ " sq. x 18"
1 1×4 " sheet thin celluloid	1 $\frac{3}{32} \times \frac{3}{16} \times 18$ "
2 $1 \frac{1}{4}$ " balsa wheels	1 $\frac{3}{32} \times \frac{3}{8} \times 18$ "
1 $2 \frac{1}{4}$ " length .028 piano wire	4 $\frac{1}{8}$ " sq. x 36"
2 oz. cement	2 $\frac{1}{16} \times \frac{3}{32} \times 36$ "
2 oz. clear dope	1 $\frac{1}{16} \times \frac{1}{8} \times 36$ "
6' $\frac{3}{32}$ " flat rubber	1 $\frac{1}{16} \times \frac{1}{4} \times 36$ "

AIR PROGRESS

(Continued from page 4)

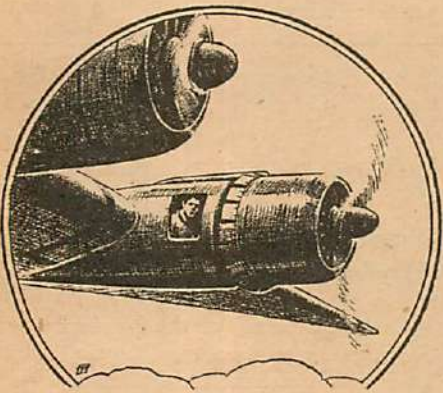
and 175 m.p.h. Its top speed is close to 200 m.p.h. and it has a range of 3,500 miles under actual transport conditions.

The Lycoming company has developed a new seven-cylinder engine which is rated at 210-220 h.p. for take-offs and 190-200 for normal maximum horsepower. It will be known as the R-530-D and carries many of the features of the R-860 motor.

Seversky has designed a new "Executive" model from Frank Fuller's Seversky racer, which will have space for a pilot and two passengers. It will have a top speed of 340 m.p.h. and cruise at 310. In structure and aerodynamic form, the "Executive" follows previous models of all-metal construction with skin-stressed wing, monocoque fuselage, retractable landing gear and split type trailing edge flaps.

AIR FORCES

The new Curtiss P-37 pursuit fighter is the first American single-seater to



An artist's drawing of one of the great motor nacelles of the new Boeing Clipper.

use a liquid-cooled engine in years. With the new 1,000 h.p. Allison engine beautifully faired into a bullet nose, there is every reason to believe that the United States will soon have service planes capable of speeds equal to that shown by the Supermarine Spitfire and other foreign fighters equipped with Vee-type motors.

Germany's new Messerschmitt fighter, the Bf 109 which recently set a new world's land plane speed record of 379 m.p.h., is an all-metal job using a Mercedes-Benz 1,000 h.p. engine. The service type is said to do 335 m.p.h. But with slots and flaps, they can be brought in at 58 m.p.h. In the record-breaking flight, the Mercedes-Benz was probably souped up to about 1,500 h.p.

Nothing quite like the new Consolidated XPB2Y-1 has been seen in any naval service. This new four-engined flying patrol boat carries its own beach-

ing gear, which is stowed in racks mounted in the hull. In addition, there are sleeping, living and workshop quarters aboard. The crew has its own locker room, a complete telephone system and a galley. The first of this series has just been completed and is now undergoing test flights.

The North American NA-16 general-purpose planes, sold to the Australian government, are the same types as those used by the U. S. Army Air Corps for advanced training. But they will incorporate a number of improvements over the original models. They will be powered with a 640 h.p. Wasp instead of a 550 h.p. engine, which will give the plane a top speed of about 220 m.p.h.

No navy war games conducted in the Pacific have been cloaked with such secrecy as has been noticed in the present maneuvers, generally known as Fleet problem nineteen. No newspapermen or accredited foreign observers will be allowed aboard any of the vessels taking part. But all nations will be watching with interest the results of the Naval Air Service activity which will play a big part in the defense problem.

More than 400 new airplanes were purchased in 1937 by the Army Air Corps in an effort to comply with the army's program to build by June, 1940 to the authorized strength of 2,320 modern effective planes.

Inside information has it that the new Bell *Airacuda*, the twin-engined pusher fighter now under test at Wright Field, has displayed a top speed of 350 m.p.h. A second model is now under way at the Buffalo factory, which will be cleaned up to show an additional 25 m.p.h. over the No. 1 model.

Lieutenant-Colonel Robert Olds of the Langley Field Air Station, who has been doing such splendid work with the Boeing B-17, set a new record for military aircraft in January when he made a non-stop flight from March Field to Langley Field in 11 hours, 1 minute. Lieutenant-Colonel Olds said the flight was uneventful and carried out at an average height of 11,000 feet. Five other airmen were in the plane during the trip.

The U. S. Navy has planned to send forty-two patrol and bombing planes from San Diego to Hawaii during the next few months. Eighteen ships of VP-10 and VP-9 left on January 19th. Twelve more will follow in the summer and twelve more will leave in November. The planes will strengthen the Pacific outpost.

Three American aviators flying for the Chinese have been killed in action against the Japanese. The most recent casualty was Frederick Kreuzberg, a former German War pilot who was naturalized an American in 1922. He

was shot down while flying a single-seater during a raid on Hankow.

Harold "Whitey" Dahl, the American aviator shot down and captured by the Spanish rebels, has been saved from a firing squad, but has been imprisoned "for life" according to an announcement from Spanish Rebel headquarters recently.

The new German Dornier Do. 17 medium bomber, powered with two Mercedes inverted engines, is said to be faster than the British Bristol Blenheim.

The Italian Cabinet has passed a decree providing for the selection and conscription of pilots and mechanics from among those normally due for compulsory military service.

MISCELLANEOUS

According to pilots who have flown the craft, the new Waco N cabin plane, the ship using the tricycle landing gear, is one of the easiest planes in the world to fly. It offers relaxed ease in the air and takes off and lands so easily that one masters the art of flight with no more trouble than is experienced in learning to drive a motor car in modern traffic.

Major General Frank M. Andrews, speaking before the National Aeronautical Association, declares that there is a woeful shortage of trained personnel in the nation's air forces and that in the event of war the country would be in grave danger. He also pointed out that it takes years of training to develop skill necessary to operate the modern airplane.

Of the 2,229 landing fields in the United States, 720 have lights for night operations. California has 181 fields and Texas has 125.

Two engines mounted side-by-side and both geared to the same propeller is the latest idea of the Lockheed Corp. The idea is being tried out in cooperation with the Menasco Manufacturing Co., and it is hoped that it will give a new margin of safety to the modern airplane. The two engines may be used in unison or separately and will be geared to a variable-pitch propeller through a system which will eliminate all need for special synchronization of the twin engines.

A number of newly commissioned pilots in the Royal Air Force will be required to take a preliminary course with the London Gliding Club before being passed on to power machines.

An ingenious type of pilotless sounding balloon is now being used in Germany. In the balloon basket will be found scientific instruments for recording temperatures, wind speed and altitude which are, in turn, linked up to a specially designed self-operating radio transmitting device.



Arthur Schultz

The tenth American to win the coveted Silver "C" button was Arthur B.

Schultz, president of the Detroit Glider Council.

Mr. Schultz first became active in gliding in 1930 when the A.B.C. Glider Club was first organized, and has been active in motorless flight ever since.

His first leg on the Silver "C" button was won during the Second National Contest at Elmira with a flight of five hours and five minutes over South Mountain. During the First Annual Midwest Soaring Contest on September 6, 1936, he repeated the requirement with a duration flight of seven hours and seven minutes.

The Silver "C" was two thirds won on July 8, 1937, when he soared to an altitude of 4042 feet, to be bettered the following day when he reached 4210 feet on his distance flight of fifty-one miles to Binghamton—winning the last and final leg on the gull button with the silver wreath.

It is an achievement in itself to be a Silver "C" pilot, but when the distance and altitude flights are, moreover, made in a plane of the pilot's own designing and building, that is a tremendous testimonial not only to the pilot's skill as a

pilot, but to his skill as a designer and aeronautical engineer.

Mr. Schultz and Mr. Ross are the only two pilots in this country who have built and piloted their own ships to Silver "C" honors. The interesting part of it is that both achieved this distinction but a few days apart.

Mr. Schultz's qualifications as an aeronautical designer are of the best, being a graduate aeronautical engineer from the University of Michigan.

The A.B.C. Sailplane designed by Mr. Schultz won the \$700 first prize and trophy in the Warren E. Eaton Memorial Sailplane Design Competition at the Eighth Annual National Soaring Contest at Elmira in 1937.

As a director of the Soaring Society of America for two years and president of the Detroit Glider Council for four years, "Art" has become a well-known figure in connection with motorless flight both in this country and abroad.

The activities of this famous Silver "C" pilot in the past are merely an indication of what we may expect from him in the future in motorless flight—both from the engineering angle and the active piloting of his craft.

GLIDING

(Continued from page 27)

and the publication of the "Glider Operation Manual" written by the technical committee of the SSA seem to indicate the realization by government officials of the tremendous future value of such aid.

Now, let's see what can be done in the meantime. Taking England as an example, we find that glider clubs on the "tight little isle" have formulated a plan that seems to be working to perfection. With minor changes and ramifications, this same plan may be applied to our own motorless flight set-up.

The English clubs have formed glider camps during the summer months for the training of non-members. These camps last for from one to two weeks and not only serve to train beginners, but also offer an opportunity to those who have become a bit rusty to brush up on their flying.

These glider camps serve a twofold purpose in that they not only train pilots, but have materially helped the clubs that run them from a financial standpoint. Let's see just how this is possible. For example, the Midland Glider Club of Long Mynd, England, holds an instruction camp from September 6th to 12th. The fee for the course is approximately \$25 in our money. This includes instruction, food and accommodations. The London Gliding Club offers nine days for approximately \$42, and the Yorkshire Gliding Club charges \$63 for a whole two weeks.

These prices compare very favorably with the amounts paid for non-flying vacations—with the added advantage of worthwhile instruction in flying, plus the good fun and health of camping with others whose interests and enthusiasms are similar.

Is there any real reason why we cannot do the same thing?

To prevent the dangers of inexperienced groups from forming such camps, we suggest any club or organization do so with the sanction and cooperation of the SSA and the Bureau of Air Commerce.

CLUB NEWS

The Airhoppers Gliding and Soaring Club of Astoria, N. Y., has ordered a two-place sailplane from the Schweizer Brothers in Peekskill, N. Y., so that club members may receive instructions in

high-performance soaring under the tutelage of Emil Lehecka. The sailplane will be delivered by the end of May or the beginning of June. In the meantime, flying activities are conducted at Wurtsboro Airport in the club's Prueffing. Walter Dusenberry, a new member, has successfully accomplished his 360° turns and is out for a "C" license.

Carlton Schaub, of the North Jersey Soaring Association, is helping Chet Decker to overhaul the Minimoa which Chet bought from Lew Barringer. And Felix Chardon is designing and building a two-place sailplane with the help of the rest of the North Jersey boys.

The County of Chemung and the WPA have appropriated \$48,313 for further improvement of the soaring site on Harris Hill, Elmira, N. Y. Fifteen additional sleeping cabins will be erected



A scene at Elmira during the annual meet.

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QUESTIONS

(Continued from page 24)

Question: I live in New Zealand and have read much about you. What do you think of my chances of working my way up to an aviation job with a good salary? J. L. I., Auckland, New Zealand.

Answer: Knowing what I do of New Zealand and her future as a part of the British Empire's air strength in the East, I have every reason to believe that you stand an excellent chance, noting by your stationery that you are attending a splendid school. But be sure to take the required science courses.

Question: Where was Igor Sikorsky, the famous designer, born? Can you tell me the name of his father and mother? E. S., Camden, New Jersey.

Answer: I am sorry, but I only know that Sikorsky was born in Russia.

Question: Where are the 1938 Air Races to be held? F. R. H., Shreveport, Louisiana.

Answer: So far as I know, no date has been set. I do not know definitely where they will be held in 1938, as a matter of fact.

Question: Can you tell me what is meant by "the Azores"? T. D., Portland, Oregon.

Answer: The Azores are a group of small islands situated in the Atlantic about 900 miles off the coast of Portugal. They have served as a stopover on many a transatlantic hop.

Question: Where can I find full information on gaining admission to the Naval Aviation Air Base at Pensacola? R. U. F., DeLand, Florida.

Answer: We have carried much of this information in previous issues. To save you a lot of time, I suggest that you write to the Bureau of Air Commerce, Washington, D. C., and ask for their Bulletin No. 19 on "Aviation Training." You can get the complete details on all the services.

Question: I haven't the financial means to pay for a master airplane mechanic's course. Can you tell me where I can obtain an apprentice's position? W. R., Hagerstown, Maryland.

Answer: The only hope I can hold out for you is to communicate with the Luscombe Airplane Corporation, and inquire about their apprentice plan, which was in operation some time ago. They will send you full particulars. (See page 93 of the February AIR TRAILS.)

Question: Where can I get full information on the universities and col-

leges that offer degrees in aeronautical engineering? M. T., Franklin, New Jersey.

Answer: The Department of Commerce, Bureau of Air Commerce, has bulletins on this subject and you should be able to get full information there. To my knowledge, New York University and M. I. T. here in the East award these degrees. There are several others in the country, also. You might check up with the Curtiss-Wright school and the Aero Industries school which advertise in AIR TRAILS.

Question: Where can I secure the plans and the cost estimate on the plane "Snuffy" shown in the November issue of AIR TRAILS? J. V., St. Cloud, Minnesota.

Answer: The plane was built to private specifications, and I do not believe you could get the plans or any other information. We know no more than we published.

Question: I am interested in plane designing and would like to know the address of Glenn Martin. Z. H., Elizabethtown, Pennsylvania.

Answer: Mr. Martin can be reached at his office, the Glenn L. Martin Co., Baltimore, Maryland.

Question: Can you tell me where I can get full information on the new M.M. cannon? L. W., New York City.

Answer: I presume you mean the new A.A.C. 37mm. cannon made by the American Armament Corporation. All I can say is that it is a light weapon designed for use aboard aircraft. It may be mounted as a fixed or movable gun and has a rate of fire of 100 rounds per minute. Several types of shells may be used and the gun and its mounting weigh about 350 lbs. That's all I can tell you, but you can write for more details to the American Armament Corporation, 6 East 45th Street, New York City.

Question: Who was the first person to complete a flight across the Atlantic Ocean and what type ship did he use? D. W. S., New Bedford, Massachusetts.

Answer: The first complete flight across the Atlantic was started on May 8, 1919, and finished on May 31, by a U. S. Navy N.C.4 Curtiss flying boat. The craft was in the command of Lieutenant-Commander Read of the U. S. Navy, and his crew consisted of Lieutenant E. F. Stone, Lieutenant Walter Hinton, the pilot; Ensign H. C. Rodd and Chief Machinist's Mate E. F. Rhoades.

Question: Will you please tell me the license number of the China Clipper? R. L., Thiells, New York.

Answer: There are several ships in the China Clipper class, but I presume you wish to place one on a model. The license number of the China Clipper flown by Captain Musick is NC-14714, I believe.

Question: Where can I obtain the Aircraft Year Book for 1937? L. D., Island Pond, Vermont.

Answer: Most aviation publishers advertise in AIR TRAILS. The Aeronautical Chamber of Commerce, publishers of the Aircraft Year Book, will be found at 30 Rockefeller Plaza, New York City. The price of the book is usually \$3.00.

Question: Do you know of any plane, transport or bomber, that has a cruising range of more than 4,500 miles? J. A. C., Toronto, Canada.

Answer: I do not. There are several planes now under consideration, the Boeing 314 for instance, a flying boat which will have a range of 5,000 miles, but I do not believe work has started on it as yet. Some reports say that the 314 has been started, while others deny it. Then there is the new Martin built for Russia which is supposed to have a range of well over 4,000 miles and a German airliner of amazing range, but I do not believe there are any ships actually in service with a range of 4,500 miles.

Question: Would it be possible to gear a radial engine to drive two propellers turning in opposite directions? E. H., Swan River, Manitoba, Canada.

Answer: You must realize that such an arrangement would not be worth the expense. Few such radials produce much over 1,000 h.p. and up to that output we do not find much trouble with propeller torque, which was the reason for devising the idea in the Fiat engine, which was rated at 3,100 h.p.

Question: Do you think stewards are preferable to stewardesses on airlines? Please give reasons for your answer. R. W., Verona, New Jersey.

Answer: This is a touchy question and may be personal. I believe that under modern air-transport conditions, the trained stewardess is more valuable than the man steward. In the first place, as a registered nurse, she is most suitable for caring for elderly people and young children. She can care for people who may be suddenly taken ill. Beyond this point, which is very important, she appears to have nothing on the man steward. Both may be equally skilled in serving meals and offering service, but over the full program, the girl seems to have more to justify her position. But as I say, it is most likely a personal proposition. Some prefer to be waited on by men, others by women.

Question: Has any step been taken to take aviation away from the army and make a separate Air Service? R. L., Milwaukee, Wisconsin.

Answer: Nothing official is under way at present. The point has been brought up on several occasions since the War, but it never seems to get much backing. I do not believe we shall ever have what is termed a unified air service. There are many points in its favor, of course, and probably just as many that detract from a separate air service.

Question: Is a person who wears glasses barred from becoming a pilot? A. R., Morristown, New Jersey.

Answer: No, providing you can satisfy the examining Department of Commerce physician that you can pass a reasonable eye test wearing corrective lenses in your goggles. You stand little chance of becoming a transport or service pilot, of course. See your nearest Department of Commerce physician, say at Newark Airport, before you spend any money for tuition.

Question: Do you need a college education to enter the Army or Navy Air Service? How many aircraft carriers are there in the United States Navy? J. K., Middletown, Ohio.

Answer: You do not require a college education to enlist in either the army or navy, but you require the equivalent of at least two years of college to get an appointment for Flight Cadet training in either service. I believe we went through all this in our "Getting into Aviation" feature some months ago. The U. S. navy aircraft carriers are: Lexington, Saratoga, Ranger, Yorktown, Enterprise, Langley and Wright. The Langley is a light experimental ship and the Wright is listed as a heavier-than-air tender.

Question: What happened to the steam-powered airplane which was so highly publicized some time ago? J. B. B., Los Angeles, California.

Answer: Frankly, I do not know. But I believe it was not found suitable in its present form for commercial use and the last I heard of it was that the designers were working on a more efficient motor.

Question: Do planes using a cannon-motor have a controllable-pitch propeller? If not does this lower its performance?

Answer: According to the booklets on the Hispano-Suiza 12Xers motor-cannon engine, provision can be made for the use of a variable-pitch propeller, or a controllable-pitch propeller. The controllable-pitch propeller offers a wider range of efficiency, not necessarily better performance. Some types are faster at

normal altitudes with fixed blade propellers, because of weight, but the controllable-pitch prop offers better all-around performance.

Question: Is there a scheduled air mail route from Salt Lake City to Denver? Does it pass over Lake County? L. G. G., Leadville, Colorado.

Answer: There is no such scheduled line listed and any line running from Salt Lake City would most certainly not go so far south, so as to cross Lake County to get to Denver.

Question: What is meant by balanced controls? R. M., Englewood, New Jersey.

Answer: A balanced control, or control surface, is one that carries a portion of its surface beyond the hinge line, thus providing itself with a balancing section which makes it easier to move. A more modern idea is to place a streamlined mass-balance, or weight, on the control surface. This will be noticed on many up-to-date planes, if you inspect them carefully. The Northrop XFT-1 uses them on the elevators.

Question: How many magazines (air) are there in England and Australia? Do aeronautical firms sell booklets of photographs of their planes? E. S., New Rochelle, New York.

Answer: There are ten aeronautical magazines published regularly in England and one in Australia. I know of no aeronautical firms that put up booklets of photographs of their planes which are intended for sale. Most of them put out catalogues, but they are only intended for those interested in purchasing.

Question: Can you tell me whether the British Fairey Battle Bomber is a two or three-place ship? Is the Caudron racer a one or two-place job?

Answer: The Fairey Battle is designed to take a crew of three. The Caudron C-460, which won the Thompson Trophy here last year, is a racing single-seater version of the Caudron line of low-wing monoplanes. Some of the Caudrons have been turned out as two-seater sport planes but with lighter engines. The C-460 was a single-seater.

Question: Will you advise J. H. of Caton, Illinois, that I have a copy of the 1917 edition of "All the World's Aircraft" which I will sell on the first reasonable offer? Larry Otis, 615 1/2 Front Street, Norwalk, California.

Answer: Many thanks, but I believe that most readers are most interested in the 1919 edition, which carried the pictures and data on most of the planes used during the last two years of the Great War. However, we hope that some reader will be interested.

(Turn to page 91)

BOYS!

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Here's a smashing buy—just look at this bargain price. MODEL AIRPLANE NEWS—the magazine for all Model Airplane Enthusiasts—every month for a whole year—and OPEN ROAD FOR BOYS—every month for 2 whole years—36 magazines for only \$2.00. An amazing BARGAIN offer for you.

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Air Adventurers

(Continued from page 37)

Now then, Air Adventurers, let us not forget those men who have given their lives that we all may fly in safety in the future: Musick, Nick Mamer, and the rest. Let us pledge ourselves to carry on their torch through the air trails of the future as our organization grows and contributes other great pilots and engineers to aviation.

Let us strive to make aviation the greatest industry and the Air Adventurers the greatest industry club. It will take time and many new Air Adventurers, so grab your helmets and flying gear and take off on a new membership flight!

All along the way show your pals the coupon given, help them earn their dimes and may your only crash be the one when you crash the Air Adventurers' headquarters with a full payload of new members.

Ready—pull the chocks and take it away!

Your Flight Commander,
ALBERT J. CARLSON.

AIR ADVENTURERS' NEWS

Marcel Marier of Montreal, Canada, has won his Observer's ticket with a particularly interesting article on air-line operations in his area. He has given us full details of the Dominion Skyways, Ltd., which is the only transport outfit in Canada using seaplanes only. They use Waco custom seaplanes and D.H. Dragon-Rapides. The report offers full details on the planes and the many routes taken. Marcel has also sent in his application for a Flight Lieutenant's examination and is now organizing a

new club in Montreal which will be known as the Canadian Eagles Club.

Bob Eggersman wins his Photographer's Award with a print of an autogiro, the only one, according to him, in the state of Indiana. Bob lives in Seymour, Indiana, and the picture was taken at Cities Airport. He uses an Eastman 620 Brownie with Agfa 620 film. In this instance he set his exposure at 1/25th of a second.

Charles J. Thiessen of New York City passes his Topographer's test with a swell scale map of North Beach Airport. He has done the job neatly. It shows every building, hangar and the details of the airport landing ground. North Beach, you know, is situated on the northwest portion of Long Island. Anyone attempting to land at North Beach would find Thiessen's map a very handy diagram.

A new member is Billy Ellis of Vivian, Louisiana, who has been reading Air Trails for three years. In that time he has built forty models. He also sends us in a new plane for Sandy which is a low-wing monoplane amphibian. He has labeled it the BE-5-C-7. It is powered with a new rocket motor, the details of which are a deep secret. But from the drawing, it appears that Billy will use a rocket chamber into which will be ejected a mixture of gasoline and oxygen, fired by a spark plug connected to a 6-volt battery.

You may have something there, Billy.

William Kipp of Manitou Springs has been scanning Air Trails very closely of late and has come to the conclusion that we should add a page of War-time planes, a humor page and a special section devoted to photos of models made by club members. These ideas are all good, but we are very limited as to space. However, if there is any real demand for War-time ships or anything new in the humor line, we'll be very glad to give it serious consideration.

Ronald Telling of Drummondville,

Quebec, is one of those fortunate lads who is able to travel. He recently visited England and got some very good pictures of the planes in use there. The list of pictures, he sends us includes a British Short airliner, a Douglas belonging to K.L.M., an Airspeed Envoy belonging to the Commercial Air Hire Co., and a D.H. 86-B. Ronald has applied for membership and his Flight Lieutenant's examination.

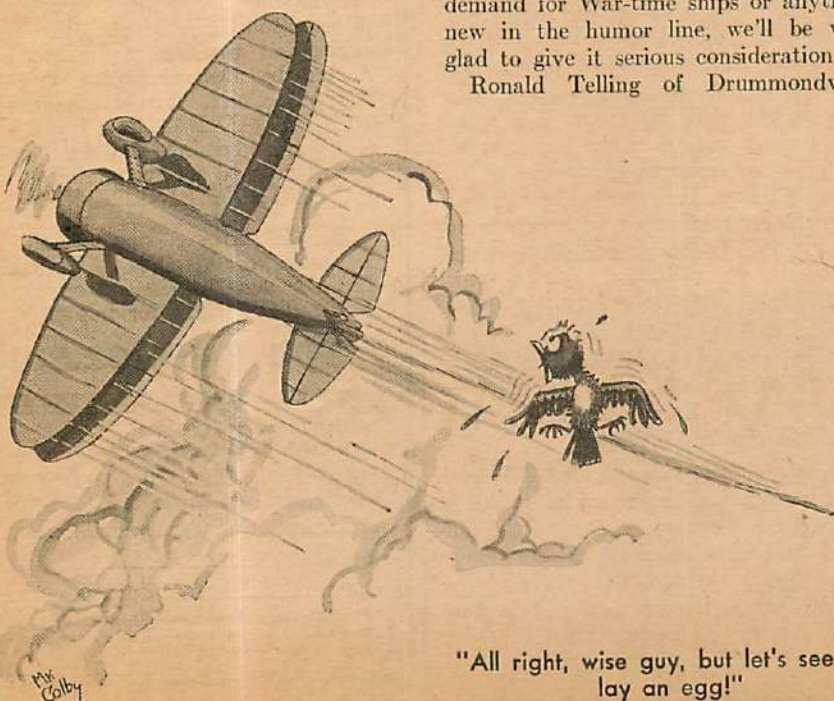
We have one member who is getting to the point where he is wondering whether the United States is as far ahead in aviation as most of us believe. Irving Robinson of Morrisville, New York, is of the opinion that foreign nations are pressing us hard and that we shall have to look out for our laurels. He offers many constructive bits of criticism, and they are worth anyone's consideration. He feels that we are too smug and satisfied with what success we may have had and fears that Great Britain's flying boats and Germany's dirigibles will soon wrest the commercial lead in aviation from us. Well, at least that is a new slant for a member, and we must give Robinson some credit for his interest and having the courage of his convictions. But we should also point out that keen competition is just what we want. It's the best thing that can happen to aviation, and we welcome a good clean splash of rivalry.

These Canadians are the boys for keeping us posted. This week we got a swell batch of pictures from James Vandeventer of Sioux Lookout, Ontario, showing the many types of planes that drop in on the Sioux Lookout field. Among them are to be found a Fox Moth on skis, a Junkers "Flying Boxcar" belonging to Canadian Airways, a Fairchild 82-B and a Junkers on regular land gear. Jimmy also gives us some interesting details on the new Canadian Airways base. This outfit is certainly working to open up Canada.

All the way from Australia comes a grand letter from Max Couche of Torrensfield, Adelaide, who is a hard-working Air Adventurer. Max is now sending for his Flight Captain's papers and includes a fine report on Adelaide's Parafield Airport from which operates the Australian National Airways, using D.C.2s, and the Airlines of Australia which also uses American Douglas ships.

Richard Meyers of Allentown, who is quite a camera fan, sends in a few neat shots and suggests that we run an airplane photo contest this summer and give prizes for the best pictures.

Well, that's all for this month. We want to hear from more of you members who are going in for new Craftsman Awards. We want more drawings and photographs. We want the details of your activity in aviation. What's new? What have you heard? Shoot the works!



"All right, wise guy, but let's see you lay an egg!"

LIGHT PLANES

(Continued from page 20)

of their popular models. It takes a little time, but eventually we click. Now we have the new Taylorcraft seaplane which should make a swell job for a summer vacation. I have just been reading about the junket Harold F. Allen and George Gregg went on last summer in a Fleet seaplane. Harold and George are just ordinary birds with a natural yen for the best. They have a limited pocketbook and a limited time for a vacation. But they managed to do a show in that pontooned Fleet that would make you go at least a pale green with envy. From Syracuse they headed for Westbrook, Conn. Then they followed the Mohawk River up to Albany. From there they followed the Hudson, circled Manhattan and tried to get into the Wall Street ramp, but were flagged off and had to accept North Beach.

From there they went up the coast and made for Bridgeport, ducking light storms, and a few that were not so light. They continued on and hit Roger's Lake, where they landed and were entertained. Then the trip took in Hartford and followed the Connecticut River to the White Mountains. They camped overnight along the river near Hanover. They went to 7,000, crossed Franconia Notch and headed for the Rangeley Lakes. To go into the rest of the trip, which covered most of Maine and southeastern Canada, would only be rubbing it in on you birds who also have these yens. But there it is—a real flying vacation by one who had about one hundred hours and the other, just a student.

And speaking of seaplane jobs, they are becoming so popular among the few who do fly for fun that we shall soon see the sport bitterly divided on the relative merits of the wheeled and pontoon outfits. Lloyd Lafin who has an Aeronca K job with water gear, wouldn't be caught even looking at a landplane. He has overcome the big problem that confronts all seaplane owners—that of beaching the thing—by devising a two-wheeled platform which is moved up and down a concrete ramp by a small automobile. If you're interested, I'll send you a few of the details of Lloyd's device.



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3/4x1/4 3 for 5c
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And while we're on the topic of preferences, we can't help noticing the rivalry that is being built up by the respective followers of the Cub and Taylor Young outfits. And it's good healthy rivalry, too. Have you noticed how the Cub people are now promising a side-by-side de luxe job which will be known as the Cub Coupe, and which, we presume, will be put out to satisfy those who want a side-by-side cockpit? Another new Cub model will be the new "Sport," which we understand will replace the present model and find favor with flying clubs for primary training.

I have had some interesting comments on the merits of the two types of cockpits which I hope to offer in this department next month. You can get into a fight any day at any airport by bringing that one up, so if I get through the next couple of weeks, starting the argument, I'll give you the low-down on the battle between Kid Side-by-Side and K. O. Tandem.

PLANES ABROAD

(Continued from page 20)

not be disastrous, as a natural gliding angle will be assumed by the plane.

The Wicko is economical to operate and appears to be a fine plane for the light plane owner. None have, as yet, been seen in this country, however. Specifications and performance figures on the two different models of the Wicko are as follows:

	85 h.p. FORD	90 h.p. CIRRUS MINOR
Wing Span	31'-6"	31'-6"
Length	22'-3"	23'-3"
Height	6'-7"	6'-7"
Wing Area	135 sq. ft.	135 sq. ft.
Power Loading	20 lbs. h.p.	16.6 lbs. h.p.
Wing Loading	12.5 lbs. sq. ft.	10 lbs. sq. ft.
Weight Empty	1,170 lbs.	938 lbs.
Useful Load	530 lbs.	562 lbs.
Gross Weight	1,700 lbs.	1,500 lbs.
Baggage	45 lbs.	50 lbs.
Gasoline	13 gallons	20 gallons
Oil	1 gallon	2 gallons
Top Speed	115 m.p.h.	120 m.p.h.
Cruising Speed	100 m.p.h.	103 m.p.h.
Landing Speed	50 m.p.h.	40 m.p.h.
Service Ceiling	10,000 ft.	11,000 ft.
Price	425 (about \$2,065)	650 (about \$2,760)

NEXT MONTH

MAKE MINE LIGHT

An absorbing article on light planes

by

ARCH WHITEHOUSE

LINK TRAINER

(Continued from page 23)

Aviation needed absolute certainty, precision pilots, pilots who could fly in all kinds of weather with sure knowledge to guide them. They needed more than facts supplied by air and vertical speeds, beacon indicators and gyro compasses. They had to know exactly how to use instruments in conjunction with each other and under various conditions. They had to know *before those conditions arose!* The Kiwi could teach them.

Dick Merrill, checking with a Kiwi the first time, said it did everything but crash. Big-heartedly, he put up a five dollar prize for the first man to crash a Kiwi—and promptly won his own prize when a misplaced steel locker took his rudder off while banking!

Hubert Huntington, navigation man of EAL, made a safer offer for the first Caterpillar member of the Kiwi birds. He very nearly lost his offer when a crack pilot became so intent over his problem that he tried to "bail out" from a spin when the altimeter showed 300 feet.

This effect of actual flying so grips the imagination of pilots in the Kiwi that the above incident is not exceptional. After twenty or thirty minutes of blind flying a problem course, the best birdmen are liable to forget they are only a few feet off the floor.

The Kiwi has the general appearance of a hooded, single-cockpit plane without motor, prop or landing gear. It has fuselage, wings, ailerons and tail section. It may be "flown" with the hood up or down. But when down, the pilot is entirely inclosed and blinder than in dirtiest pea-soup weather. This is to overcome a natural psychological dependence upon visual sight. A window would make the pilot conscious of his ground position and reduce the simulation of actual flight.

The dimensions of the Kiwi are roughly eight feet in length, seven feet in wingspread and seven feet four inches from bottom of base to top of closed

hood. The fuselage sits atop a series of strong bellows which rotate through the full 360° on a square fixed base—housing the mechanism—and having a longitudinal and lateral movement angle of 50° each way. These bellows are the Kiwi's "sky". While it is impossible to fly the Kiwi upside-down—such as some amusement park apparatus which operates on steel frames—a 50° power dive or 360° spin is possible. When at rest, the Kiwi is held on a lateral and longitudinal level by rigid metal shackles to its underside. It has insufficient stability to sit level by itself.

A small 110 volt A.C. motor supplies power, operating a vacuum turbine which actuates the bellows. Air for the bellows is controlled by stick and rudder movement through a system of valves in such manner that the Trainer banks, turns, climbs, dives and spins in response to the controls. Note that the air is controlled directly, and *not by the bellows*. This supersensitive control, not possible by direct mechanical reaction, has done much to overcome the major fault of instrument flying—over-controlling.

A slight rudder or stick movement in a modern high-speed plane, traveling under ordinary conditions, may only nudge or bump the plane which levels, by its inherent stability and inertia. But the Kiwi, having no inherent stability, may slough off in a slip or spin, requiring the pilot's acute concentration and manipulation to keep it on course. Most important feature of the Kiwi's spin is the fact that it has never been possible to explain or illustrate to pilots precisely what happens when a plane goes into a spin. By spinning the Kiwi, the same vertigo sensation is experienced. The pilot can make a careful study of just what his instruments are doing and thereby visualize the plane's action. These facts have been important factors in developing smooth handling and sensitivity of control.

Both "rough air" and "cross winds" may be given the Kiwi during flight at the wish of the instructor. The force of the cross winds may be varied so that the student beneath the hood is entirely dependent upon radio and instruments to guide his line of flight or to reckon his position. Where this is exceedingly important is to improve a bearings' maneuver over a beacon. Say that the pilot is triangling to get position. Theoretically, this is a simple maneuver. But actually, with clouds below and stars invisible, it is quite a job to get position in a stiff wind because the legs of the triangle and angles of turn are thrown out by the cross wind. The Kiwi's one missing sensation of actual flight is the violent letdowns of rough weather in the air.

The Kiwi's cockpit houses ten instruments: magnetic compass, air speed,

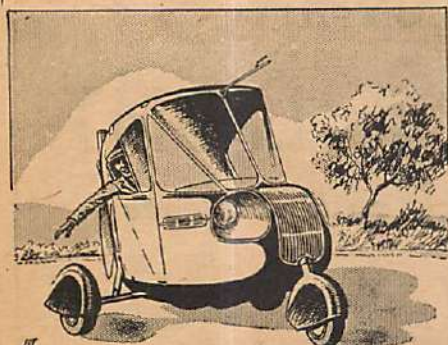
bank-and-turn, vertical speed, directional gyro, artificial horizon, sensitive altimeter, tachometer, visual marker beacon and radio compass. Beam volume, two-way radio controls, wheel, rudder and throttle complete the picture. The gyro compass is the only stock instrument, the other nine being highly sensitive mechanisms correlated with one another—the throttle, stick, rudder and actions of the trainer. These delicate instruments must have the utmost sensitivity and synchronization, so as to operate precisely as they would if the Kiwi were actually in flight.

One of the early instrument problems was how to make the magnetic compass behave as it would in the air where it bounces around after any change of course. The realistic eccentricity was supplied by a magnetic "kicker" so that when the Kiwi's course is changed, this magnet, operated by the rudder pedal, knocks the compass, which moves backward and forward until it slows to a true position again.

The altimeter operates—under pressure—an automatic vacuum control, reducing the barometric pressure accordingly as the Kiwi climbs, or increasing it as it dives. This control is so sensitive that the instrument records rough air. The instrument makes possible problem landings and climbs by instrument and courses to be flown at predetermined altitudes. The altimeter—in conjunction with the radio compass, marker-beacon indicator, gyro compass and horizon—is used for instrument landings and approach practice, utilizing the army system. The throttle functions in a normal manner, actuating air speed, vertical speed and tachometer. As the throttle is opened, the air speed increases, the vertical speed reads in accordance with the Trainer's attitude, and the tachometer indicates the proper r.p.m. Present type Trainers have a constant cruising speed of 120 m.p.h., but this is being changed to give any variable speed between 120 and 180 m.p.h.

At the outset of the Trainer course, students are given 30 to 60 minutes' instruction with raised hood to familiarize themselves with the Kiwi's actions. Periods of instruction are usually fifteen or twenty minutes, seldom over thirty, due to the intensity of concentration necessary. Problems are intentionally difficult, such as would be experienced in actual flight—but only for a few minutes.

When the student is thoroughly used to the Trainer, the real instruction with lowered hood begins. At a near-by desk the instructor sits with earphones and microphone. In a drawer at his side is the radio equipment to simulate any radio conditions met with in regular flight with the exception of a static simulator.



An artist's conception of the Waterman Arrowbile.

On the desk is a chart of the territory being flown, radio beams and marker beacons clearly outlined. Upon this chart will be recorded the pilot's flight precisely as he controls his ship, except that altitude is not recorded. This chart is always aligned with true bearings. A three-legged crab is electrically synchronized and correlated to the slightest movement of the Trainer. One of its legs lays down an ink trail of the Kiwi's progress, as the other two legs motivate the crab by means of cogged wheels.

When the pilot is in the Trainer, this crab is aligned with the Kiwi's position before the take-off, and thereafter operates automatically. A constant flow of electrical impulses moves the crab forward, in turns, spins, banks, climbs, although the Trainer is progressively stationary. On the chart the concentric circles represent five-mile distances from one another, or two and a half minutes' flight at 120 m.p.h. This spacing is simply for convenience. With a slight adjustment of the crab, the circles would represent ten- or fifty-mile distances if properly related to radio beams and guides.

With the Kiwi warmed up and the hood down over the student, the instructor places the crab at any position on the chart—the position unknown to the student. All that is necessary is that the crab and Kiwi be accurately aligned. The instructor then transmits the same radio signals to the pilot which would actually be received if the pilot were flying in the same relative position to the real ground station. Signals must be simulated artificially because the Trainer is covering distance in a stationary position. But the signals must vary in volume and modulation—just as in actual flight positions.

The student's job is to properly interpret the signals, find his location, fly to the radio beam and follow it into the cone of silence—just as in flight. Blind flying calls for rigid adherence to maneuvers and tactics. If the student tries to cut a correct turn, or flies the wrong side of the beam, his error is shown in damning ink right on the chart. As all these problems use actual airport, radio station distances and conditions, the student becomes oriented to various real courses as he trains. Problems such as split, bent or multiple beams, or storms requiring changes of course, etc., can all be introduced at the desire of the instructor.

However, the instructor and pilot have carefully gone over meteorological data and agreed on a general flight plan prior to the flight. If the instructor takes a whack at playing Thor and throws sudden gales or snow or hurricanes into the flight route, he has to be careful that such conditions would be possible with the data shown by

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preliminary reports!

Radio range signals and voice broadcasts are transmitted into the cockpit by headphones. The radio transmitter sends out the same signals as are sent out by radio range stations, the A. N. or A. I., "On Course" signals and station call letters. Various signals and their volume are controlled by the instructor according to flight position. Five sets of call letters are provided and a radio compass and visual and oral marker beacons—also controlled from the radio desk. At proper interludes, the instructor breaks radio range signals to broadcast appropriate weather data.

During rough weather or meeting unexpected problems, the student may query by key or voice just as he would query a ground station. The instructor may not answer on one band due to "local weather conditions," and the student has to try and establish contact on another. If the distance is great and all messages weak, the pilot may not receive an "OK. . . go ahead" to his call until he calls the station which, under real conditions, would most likely pick him up clearly. It stands against him if he does not try this station first unless he has reason, or unless special conditions have been introduced by the instructor which justify the pilot's actions.

Once the pilot's call is received, it is possible that the receiving station "will not be able" to get through to him. The pilot may have to pick up his answer from another station where it was relayed. To make sure that all ingenuity is used by the pilot, directional antennas are mounted atop the hoods of most commercial air line

Kiwis, and the pilot is given instruction in the use of this.

In Japan, the Link Trainer is used for primary pilot training. But in this country and England, the Trainer is used chiefly to put finishing touches on pilots who already have over 1,000 flying hours to their credit. It was found that it takes the average competent licensed pilot between 20 and 30 hours *air time* to become proficient in the use of instruments and radio beam flying. After 10 to 15 hours in a Trainer, supervised pilots reach the same proficiency with about five hours *air time*. (Army and navy figures.) There is the additional factor that they have not only learned how to use instruments in the Trainer, but also how to use them under more varied conditions than would ordinarily be possible without several hundred hours of *air time*. Without doubt the Trainer represents a big step forward in flight training.

When Casey Jones took over the world distribution of the Link Trainers, he considered the future of the machine so important that he hooked up with George Vaughn, second ranking ace in the world, and Dick Whatham, one of the foremost meteorologists. They call themselves the JVW and their combined experience represents pretty near all that is known about flying. Whenever you see a Trainer you may see one of them, as they are constantly studying new problems and possibilities along with engineers from Sperry, Kolsman and Pioneer. Their latest problem was working out a remote-control altimeter, rate of climb and air-speed indicator, synchronized with the Kiwi's and to be placed upon the instructor's desk. That is, working it out without running costs

up to a million, for the Trainer already costs \$6,000.

The cost factor is exceedingly important in training and checking pilots. The average operating cost for standard commercial planes runs between \$8 and \$20 per hour. The Kiwi's operating cost is about five cents per hour, and an average annual replacement cost of about \$25 for a 2000 hour year! Even with ace pilots, there is the risk of accident while learning to fly by instruments in a plane. Finally, there is the matter of geography and suitable weather conditions to give well-rounded experience.

The Kiwi disregards such matters. In 32 minutes flat, a pilot in Newark can make a 64-mile simulated approach to Grand Central Airport in California and fly in through those early morning fog banks without leaving the Trainer! Or if an old hand at instrument flying is going out on a new air route, he can go over that route foot by foot and practice his pickups and approaches before he ever shifts. All weather, radio and wind conditions on the new route can be simulated. If there is a mountain in the way and the pilot wants to be certain of just what radio conditions are like ten miles each side of that

mountain, he climbs into the Kiwi and finds out.

The latest use for Kiwis is being developed by a foreign army which is constructing "night rooms" to orient pilots to night flying. These night Trainers will have windows in the hoods. The ceiling and walls of the surrounding room will be equipped with systems of stars duplicating the heavens. Fogs, clouds, snow, ice, squalls, electrical storms and other conditions will all be accurately simulated. A Trainer and room of this order will be on exhibition at the New York World's Fair next year.

A.B.C. SAILPLANE

(Continued from page 28)

spiralled very steeply to take advantage of the smaller thermals. It is handled on the ground with the ease of a utility.

Adaptability to home construction is one of the foremost features of the design. It is easy to build. The fuselage, controls, tail surfaces and struts are all steel tubing, fabric covered. The wing is a two spar design constructed of wood, plywood and wire and is fabric covered.

The ship has several new and, unusual design features—such as a folding tail, an adjustable seat, adjustable stabilizer, etc.—all of which tend to make it really a utility type of ship. It can be removed from the trailer and assembled, ready to fly, in ten minutes.

The ship has been stressed for airplane towing, aerobatics and thermic soaring. It has also been built particularly rugged to withstand the wear and tear of routine airport operation. The ship does not yet have an A.T.C., but the designer is going ahead to obtain one. Preliminary load data has

been submitted and has been approved by the Bureau of Air Commerce.

The cost of the materials to build the A.B.C. Sailplane is not more than one and one half times that of an ordinary utility. This cost should be between \$200 and \$300, depending on local prices and upon how much material can be picked up at no charge.

The labor on the wings is, naturally, on account of the elliptical taper, considerably more than for a utility. The labor required on the fuselage will run about a half more, due to the careful streamlining. The labor on the struts, controls and tail surfaces will be about the same as a utility.

The practicability of the design was demonstrated very well at the 1937 Mid-West Soaring Contest. On the way to the contest, as a stop was made for gas, the tail surfaces and rear end of the fuselage suffered severe damage, due to ramming into a low obstruction. After a few hours' work at opening up fabric, straightening tubes, and closing up again, the ship was up soaring on the same day the damage occurred. Had this happened to an all-plywood ship, it would have taken days to make the repairs. In a case like this, ruggedness of design is appreciated.

Still, its performance is not far behind that of finer designs. During the National Contest at Elmira, a flight was made from Harris Hill to Beaverdams, a distance of 15 miles, late in the afternoon on weak thermals after everyone else was down. On another day an altitude hop for a Silver "C" was made, the ship landed back at the starting point, the barograph changed, and another flight of 27 miles made late in the afternoon in a few hours. The designer's Silver "C" distance flight of 51 miles from Harris Hill to Binghamton was the longest flight of the day. All the contest flights were made from winch tow because of the Eaton Contest limitations. But flights comparable to the best could have been made had airplane tow been used to secure earlier starts.

The drawings are very complete. Full-scale detail drawings of all ribs are supplied on "Black and White" prints from which rib jigs can be directly laid out. These prints avoid the distortion attendant with the usual blueprints. Full details covering the construction of the folding tail, the wheel control, pulley brackets, wing fittings, etc., are supplied, as well as assembly drawings of all units.

SOARING PILOT

(Continued from page 35)

was trying to decide on a field in which to land. Not wishing to destroy any crops and thus incur financial obligations made the choice of a suitable spot even more difficult. Down to 250 feet and still there was no definite place to alight. Over the top of a knoll a huge wheat field, sloping uphill and up wind, was spread before me. Necessity hastened my choice, so flying a few hundred yards farther on I turned back into the wind. A shallow dive and into the wheat we went. The ship stopped suddenly as the stalks bent over. It was covered with red dust from the ripe grain, but fortunately was undamaged. The friendly farmers helped me carry the craft out into the clear and instead

of mentioning the damage I had done, wine and dined me most hospitably.

Gaining confidence and courage, I made many flights—attempting to exceed the national altitude and distance records. This meant going to clouds and flying on instruments entirely.

The start of many successful soaring flights are discouraging. For example, on a day in July after the take-off I sank down to within 150 feet of the valley floor, my take-off being the top of a 1000-foot mountain. For an hour I fought to remain in the air and slowly, very slowly, worked my way back to the take-off level. Several good thermals got me up to 5,000 feet and down wind I went, racing the sun for 4 hours to land 146.6 miles from Elmira.

Some one is shaking my shoulder. I open my eyes reluctantly. Where am

I? Oh, yes! The airplane is at Allentown. Quickly we gather up my instruments and parachute and jump into a car. A short ride and we are at the airport. A Waco C is silhouetted against the twilight sky. The pilot and two of my friends seem very happy to see me. We climb aboard and take off just as the lights of the city start to blink on. An hour later my two friends, talked out, are asleep from the drone of the motor. I am relaxed in my comfortable chair alongside of the pilot. We pass over Scranton a mile high and the lights from the city flash off and on. The moon is full and dimly illuminates the cabin. The phosphorous numbers on the instruments stand out in the semidarkness. I steal a glance at the pilot. He is checking the beacons as they stretch toward home. No reason to say anything, so I doze again.

QUESTIONS

(Continued from page 85)

Question: Can you tell me why a single-blade prop is more efficient than a two or three-bladed prop, and if such a prop could be used on a model plane? E. L., Stratford, New Zealand.

Answer: You must get this single-blade propeller idea straight. It has been designed for a certain type of motor and light-plane work. The general idea is that the single-blade travelling at high speed does not run into broken air or eddies left by the preceding blade, and therefore under that particular circumstance, performs better. This would not always work out in ships using more power, and where prop speed is much less. Model props of this type have been used successfully.

Question: Would a junior matriculation certificate help one in commercial aviation? Is there an air school near London, Ontario? V. A., London, Ontario, Canada.

Answer: You do not state your case very clearly. A junior matriculation certificate, as I understand it in Canada, would help you if you took a commercial flying course, but it would be of little use in the Royal Canadian Air Service, or any other air service. I suggest that you write to your local Minister of Air Transport, 2498 Yonge Street, Toronto, Ontario, for full information on licensed flying schools in your area.

Question: Could I use a Menasco Buccaneer or a Super-Buccaneer in a Jones S-125? E. H. K., New Church, Virginia.

Answer: If you are really interested in such a change, don't you think you would be doing better to consult the manufacturers who know the complete data on their product? Personally, I do not believe it would be wise to make that change, but I would not make a definite statement until I knew the full stress details on the ship.

Question: What is the average height for a transport plane in flying? B. R., St. Vital, Manitoba.

Answer: The flying altitude of transport planes varies so considerably that there is no regular average. A flight plan prepared for the pilot immediately before each trip takes into account weather conditions prevailing over the route and specifies the most favorable altitude, especially as regards taking advantage of tail winds or avoiding head winds at different levels in order to conserve fuel. Then there's the question of ground contour such as mountains, varying in different sections. In general, transports operate at between 5,000 and 10,000 feet, probably most often nearer the latter figure.

Question: Do you think that by heating the inside of the wing, ice would be prevented from forming on the wing? Would this have any serious effects on the wing structure? O. F., Rossland, British Columbia.

Answer: Heating the wings is regarded by engineers as the most logical and natural way to prevent ice formation, but it's a method that hasn't yet been worked out practically.

There are two possible sources of heat: electricity, or the plane's engine. Electric wiring sufficient to heat the large wing surface would require a tremendous weight of storage batteries or a very heavy engine-driven generator to supply the necessary current, besides the weight of wire, so the electric method is apparently out.

Engine heat could be used in three ways. Air could be heated in "muffs" around the hot exhaust pipe, but they would have to be very large to supply enough hot air to fill the wings, involving much piping, weight and structural difficulty. Vapor formed around the jacketed cylinders in some modern "steam-cooled" engines such as the Rolls-Royce Merlin could be brought to wing-surface radiators, but such a large radiator structure would be complicated and easily damaged.

Finally the hot exhaust gases themselves could be used. This seems the likeliest scheme, but there are serious drawbacks. If introduced directly into the wing, the hot gases would endanger the fuel tanks usually built inside the wing nowadays. An alternative that has been considered is a straight exhaust pipe to form the leading edge of the wing. This pipe would have holes along the front and the hot gases emerging would be blown back above and below. The expansion of this heated pipe as part of the wing structure, however, would present a difficult problem. And in either case, circulating inside the wing or flowing through a pipe, the exhaust gases would be dangerous for their nearness to the fuel tanks, their tendency to corrode the wing metal, and the possibility of a disastrous "backfire" due to an unexploded fuel charge coming through from the engine.

A safe, efficient wing-heating method still lies in the future. In the meantime, American transports will continue to wear pulsating rubber "overshoes" on wing leading edges to break up the ice as it forms.

Question: Where are the Noorduyn "Norseman" planes built? Is it an all-Canadian firm, and what other type of planes do they make? G. W., Canada.

Answer: The Noorduyn Aircraft, Ltd., is located at the Curtiss-Reid Airport, St. Laurent, Quebec. I believe it is an all-Canadian outfit but so far they

(Turn to page 94)

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1/4x1/4 10 for 5c	30c; 1 pt. 45c	12x16 18c	
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1/2x1/2 2 for 5c	bottle, 10c; 1/2 pt.	CAMEL'S HAIR	15c
1/2x1/2 4 for 10c	35c; 1 pt. 60c	BRUSHES	15c
1/32x2 8 for 10c	CLEARCUT	Small 3c; Lge. 5c	
1/32x2 8 for 10c	5c per oz.; large	Extra large 10c	
1/32x2 7 for 10c	bottle, 8c; 1/2 pt.	NOSE PLUGS	15c
3/32x2 7 for 10c	35c; 1 pt. 55c	1/2" 12 for 8c	
1/4x2 6 for 10c	PROPELLERS	DUMMY RAD.	15c
3/16x2 3 for 9c	Balsa Paul-O-	ENGINE (Cellu.)	15c
1/2x2 3 for 10c	Mach. Cut Wina	1 1/2" d. 15c; 2" d.	
3" sheets or 30"	5" 4c	2" d. 25c	
lengths, double	6" 5c	ENGINE AND	
above prices; add	7" 5c	COWL (Cellu.)	
10c for pkg. chge.	8" 7c	1 1/2" dia. 15c	
for 36" lengths.	9" 8c	2" dia. 20c	
SHEETS 12"x2"	10" 8c	3" dia. 25c	
1/16 or 1/32	12" 10c	PANTS, per pair	
10 for 10c	14" 13c	1 1/2" to 1" 18c	
10 for 10c	15" 15c	1 1/2" to 1 1/4" 33c	
3 for 7c	16" 16c	ALUM. TUBING	
18" PLANKS	24 and stripes 5c	1/16, 3/32, 1/4	
1x1 5c; 1 1/2x2 6c	DOWELS	3/16, 1/4, 1/2, 3/4, 1	
1x1 1/2 5c; 1 1/2x2 6c	1/16x5 . . . doz. 5c	7c	
1x3 15c; 2x2 18c	1/4x18 . . . 2 for 5c	MODEL PINS	
3x3 20c; 2x3 35c	3/16x18 . . . 2 for 5c	1/2" or 1" pkg. 5c	
3x3 40c; 2x3 75c	WIRE	WASHERS	
BAMBOO	6-8-10-12-14	1 doz. 1/4 or 1/2 1c	
PAPER	2 for 15c	BEARINGS, dz.	
For cowling, re-	WOOD VENEER	Sm. 10c; lge. 15c	
pairing, etc.	PAPER	SANDPAPER	
Large can 25c	20x30 1 for 10c	Dz. sheets. . . 5c	
TISSUE, AA	.045 . . . 25 ft. 5c	MODEL	
1 lb. col. doz. 19c	1/16 sq. 15 ft. 5c	STANDS	
Silver, ea. 5c	1/4 flat . . 15 ft. 5c	Sm. 10c; lge. 25c	
Superfine, wh. 5c	Skein . . . 50c	METAL	
WHEELS per pr.	3/16 flat 12 ft. 5c	PROPELLERS	
Breh Balsa Cellu.	Skein . . . 75c	2 blades 3 blades	
1/2 .01 .03	RUBBER	1 1/2" . . . 5c	
3/4 .02 .04 .05	LUBRICANT	1 1/2" . . . 10c	
1 1/4 .03 .05 .07	Large bottle 10c	1 1/2" . . . 15c	
1 3/4 .04 .08 .10	PROP. BLOCKS	1 1/2" . . . 20c	
1 7/8 .07 .10 .18	1/2 x 1/2 x 6-5c	1 1/2" . . . 25c	
2 .15 .15 .30	1/2 x 1/2 x 6-5c	Specify whether	
NOSE BLOCKS	1/2 x 1/2 x 7-5c	anti-drag or closed	
1x2x1 2c	1/2 x 1/2 x 8-5c	BOMBS	
2x2x1 2c	1/2 x 1/2 x 10-5c	1 1/2" . . . 7c	
3x3x1 5c	1/2 x 1/2 x 12-5c	1 1/2" . . . 10c	
3x3x2 8c	1/2 x 1/2 x 15-5c	GUNS WITH	
3x3x3 10c	1/2 x 1/2 x 18-5c	RING MOUNT	
3x3x3 10c	1/2 x 1/2 x 21-5c	1 1/2" 10c 1 1/2 15c	
SHEET ALUM.	1/16 . . . 4 for 1c	BAMBOO	
.00045x11 1/2	1/32-1/16 2 for 1c	1/16 sq. x 12, 36, 5c	
2 sheets 3c	3/32-1/4 1 ft. 1c	1/16x1/16x15, dz. 10c	

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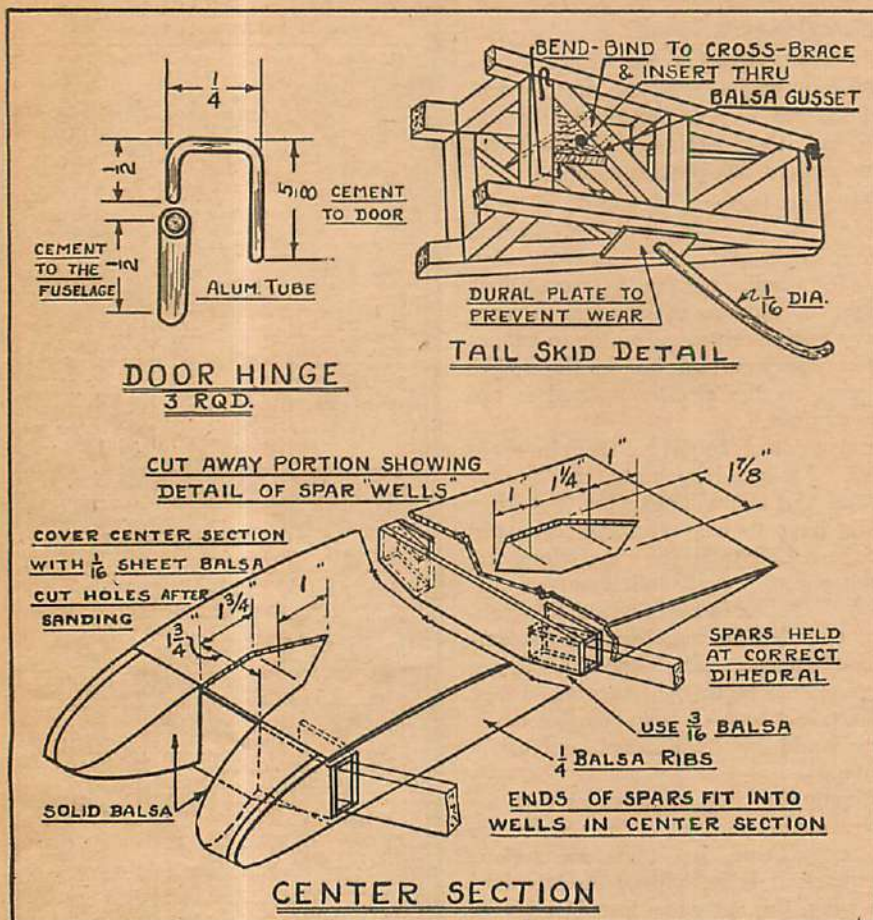
Mechanix Universal Aviation Service Co.

Strathmore Station Dept. T Detroit, Mich.

TAYLOR YOUNG

(Continued from page 61)

- 1 12x12" celluloid windshield, door, and top of center section
2 1 1/4x2x2" front of center section



- 2 3/16x1 1/4x12" spar "wells" in center section
1 2" long, 1/8" O. D. aluminum tubing door hinge fittings
1 1/32" diam. x 6" piano wire door hinges
1 1/16" diam. x 2 ft. piano wire tail skid and landing gear
2 1/8" diam. x 2 ft. piano wire landing gear
2 3/4" diam. airwheels
Wing
2 1/4x3/4x33" wing spars
2 1/4x1/2x33" wing spars
2 1/4x1/4x27 1/2" leading edge
2 1/4x3/4x25" trailing edge
8 1/8x1 1/4x36" ribs
6 1/4x1 1/2x8" tips
4 1/8" diam. x 6" piano wire spar-end fittings
4 1/4x1/2x24" wing struts
1 1x5" flat sheet metal strut attachment fittings
6 3/32" diam. x 1 1/2" long machine screws, strut attachment

Tail Surfaces

- 6 1/4x1 1/4x24" spars and ribs
6 1/4x1 1/4x12" outline
1 .035" diam. x 3 ft. piano wire, tail braces and hooks

Additional Material

- 10 sheets bamboo paper
1 pint dope
1 pint cement
Strong sewing thread, fine wrapping wire, and solder
Small patch of silk or linen for binding balsa fairing to wire struts
Small piece of dural or aluminum for tail skid bearing-pad.

THE ZEPHYR

(Continued from page 71)

The boom is made oval in cross-section. It is rounded out from a strip of medium balsa 1/8" by 5/64" tapered to 3/64" square and 8" long. After it is rounded out and smoothened, cement the tail and rudder unit (which has already been covered) in place. Then cement the boom to the rear of the motorstick with the thin end raised 1/8" for negative incidence.

PROPELLER

The propeller may be made from either a solid block, or from a semi-carved blank. If you decide to carve a block, one of the following dimensions is recommended—7/8x1 1/2x14". It should be carved in the following manner. First lay out the diagonals on the broad faces, carve down to these diagonals with a sharp knife (leaving about 3/16" at the center for the hub) and sand the edges smooth. You may now carve the concave sides which should be done first. Completely finish them even down to polishing with #10-0 sandpaper before starting the other side. Use a knife on the convex

sides till the blades are 1/4" thick, then you may use a razor and finally, varying degrees of sandpaper till you are using #10-0. When sanding never rest the blades on anything else but your fingers as otherwise you may change the pitch of the blade, or worse yet, you may break it. Make a template of the blade shape on paper and trim the blades to fit. Smoothen the edges with #10-0 sandpaper and insert and cement the propeller shaft in place.

Should you have decided to use a semi-carved propeller, use one that has a pitch diameter ratio of 1.6 and a diameter of 14". You will find that it will save you a great deal of time in carving and will also probably be more efficient. Of course, carving it will be similar to the carving of the block, but you will first have to cement the blades together.

ADJUSTING AND FLYING

Clip the wing over the motorstick about 3 1/2" from the thrust bearing and bind the clip with silk thread to prevent the wing from sliding around the stick. Insert the propeller in the thrust bearing, hang a loop of 5/64" brown rubber 16" long from the propeller shaft and rear hook and glide the model. If it dives, move the wing forward. If it

stalls, move it rearwards. After you obtain a good glide, wind the motor about 400 turns and release the model in flying position. It should hold its altitude for at least one complete circle of about 40' in diameter. If it does not turn enough, bend both rudder tabs over an equal amount till the proper circle is obtained. If it does not hold its altitude, try moving the wing forward. (Your model is probably a bit too heavy if this treatment causes it to stall and it may be remedied by decreasing the blade angle). If, however, the model has stalled, bend a little negative in the thrust bearing. Next, wind the model more fully and observe its flight. If necessary, make the same kind of adjustments.

WEIGHTS

Wing014
Tail rudders and boom.....	.005
Motorstick015
Propeller014

SPECIFICATIONS

Wing area.....	96.8 Sq. Ins.
Tail area.....	24.7 " "
Rudder area.....	19 " "
Wing incidence....	1/8"
Tail incidence.....	-1/8"

Balfour Trophy

(Continued from page 64)

Wing

- 4 $\frac{1}{8} \times \frac{1}{8} \times 18''$ leading edge and rear spars
- 2 $\frac{1}{8} \times \frac{3}{8} \times 18''$ spars
- 2 $\frac{1}{8} \times \frac{3}{8} \times 18''$ trailing edge
- 4 $\frac{1}{2} \times 1 \times 18''$ leading edge covering
- 9 $\frac{3}{32} \times \frac{3}{4} \times 12''$ ribs
- 2 $\frac{1}{8} \times \frac{1}{4} \times 12''$ tips

Elevator and Rudder

- 1 $\frac{1}{8} \times \frac{1}{8} \times 24''$ leading edge
- 3 $\frac{1}{16} \times \frac{1}{8} \times 20''$ spars, trailing edges, and rudder braces
- 6 $\frac{1}{32} \times \frac{1}{2} \times 12''$ ribs
- 2 $\frac{1}{16} \times \frac{1}{4} \times 12''$ tips

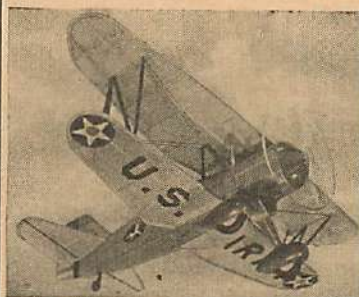
Additional Items

- 3 large sheets tissue
- 60 feet $\frac{1}{8}''$ flat brown rubber
- 2 ounces cement
- 3 ounces thick dope
- rubber lubricant
- 1 ounce thinner

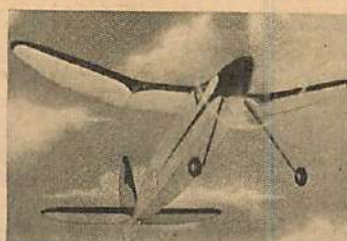
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CROSS WINDS

	1	2	3	4	5		6	7	8	9	10	
11							12					13
14			15			16						17
18		19			20				21	22		
23				24				25		26		
27			28				29		30			
		31					32					
33	34				35		36				37	38
39				40		41				42		
43			44		45				46			
47			48	49				50			51	
52		53						54			55	
	56							57				

ACROSS

- 1—Angle of attack of propeller blade
- 6—Movable portions of wing surface for increasing lift
- 11—Model-covering material
- 12—Pertaining to the air
- 14—Unit of area ten meters square
- 15—Stunt flier
- 17—Chinese unit of length
- 18—Two of a kind
- 20—Organ of hearing
- 21—To daze
- 23—And so forth, abbreviated
- 24—Bombproof underground shelters
- 26—Consumed
- 27—Actually
- 29—Curve of wing surface
- 31—Fabulous bird that carried off elephants
- 32—Large snake

- 33—Breguet 19-passenger flying boat used on Air France routes
- 36—Four-footed animals
- 39—Air line operating across country through Kansas City, initials
- 40—Set of revolving vanes that support an autogiro
- 42—Greek letter

- 43—Inns
- 45—Perish
- 46—One of cloth segments sewed together to form a balloon
- 47—Roman numeral for 101
- 48—Pertaining to the wind
- 51—Forward
- 52—Small protuberances on knob or wheel to provide firm grip
- 54—Air sickness
- 56—First name of famous make of French radial engines
- 57—Sudden blasts of wind

DOWN

- 1—Private-flier amphibian made by Argonaut
- 2—Exists
- 3—Former Russian ruler
- 4—Hint
- 5—By this means
- 6—Common air-plane wing-covering material
- 7—Grassland
- 8—Branches of learning
- 9—Ratio of circle circumference to diameter
- 10—Military greeting
- 11—Wing shape in which chord narrows from root section to tip

Answers for March

D	E	C	A	L	A	G	E		B	Y	R	D
I	K	E			B	I	R	D	Y	E	A	R
E	E	L	S		D	O						I
S		L	I	N	E	A	L		H	A	L	F
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	G	A	S						A	P	T	
A	N	G	L	E		S	M	E	L	T	E	R
B	E		I	T		P	A	R	D		D	H
A	T		P	A	R	A	K	E	E	T		Y
T						R	I		D	E	E	M
E	G		C	E	S	S	N	A		R	Y	E
S	O		P	E	R	E	G	R	I	N	E	S

- 13—Vessel or air-plane of a fleet covering regular route
- 16—Implement for propelling boat
- 19—Flying too high for safety, like the mythical Greek whose artificial wings were melted by the sun
- 22—A peppery sauce
- 24—Experimental American bi-motored mono-plane having two props in nose
- 25—Cavalry sword
- 28—Book in which use of airplane or engine is recorded
- 30—Giant, extinct, flightless bird
- 33—Air slang for lever operating control surfaces
- 34—Canvas shade
- 35—Knobby
- 36—Maker of the new Atlantic Clipper
- 37—Pains
- 38—Italian city, known as source of brownish pigment
- 41—Sesame
- 44—Make of British navy London flying boat
- 46—African antelopes
- 49—Kind of tree
- 50—Governing body of U.S. amateur sports, abbreviated
- 53—Prefix signifying "not."
- 55—City thoroughfares, abbreviated

109 MILES WITHOUT A MOTOR—? See the MAY issue of AIR TRAILS!

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Courtesy of

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QUESTIONS

(Continued from page 91)

have only turned out a few models of the "Norseman" monoplane as a land-plane, seaplane and on skis.

Question: Why has no one thought about using rear armament on single-seater ships? Couldn't such a gun be synchronized with a rear-view mirror?
E. S., St. Bernard, Ohio.

Answer: There is no particular reason why such a gun has not been tried out in this country, except that so far no one seems to be able to make one work on the retrospect-mirror idea. I believe the idea has been tried out elsewhere on several occasions, but unfortunately, until we get something to actually try it on, that is, an enemy plane, there seems little hope of putting it over. The idea is not new. It was brought up during the latter part of the World War, and actually tried out in France late in 1921, but the results did not justify carrying the experiment any further.

Question: What are the names of the air lines in Canada? Where can I get information on Canadian aviation?
R. McG., New York City.

Answer: The most important Canadian airways systems are the Canadian Airways, Ltd., of Montreal; Canadian Colonial Airways, of Montreal; National Air Transport of Toronto; General Airways, Ltd., of Amos, Quebec, and Northern Airways, Ltd., of Telegraph Creek. In addition there are about 23 minor concerns in charter and exploration-mining work. The Superintendent of Air Regulations at 2498 Yonge Street, Toronto, Ontario, should be able to give you all the information you desire on Canadian aviation.

Question: If a pursuit ship is attached to a bombardment squadron would it use its own pursuit insignia or the insignia of the bombardment squadron? How many different kinds of planes are there in the new German air service, and what are they?
J. G. G., Overlea, Maryland.

Answer: I am sure I have never heard of a pursuit ship being attached to a bombardment squadron. I am at a loss to know why one would be. I know of no army regulations that would cover such a situation, so I can't answer your first question. As far as the German air service is concerned, I can only tell you what has been released. Their single-seater fighters are Feiselers, Focke-Wulf, Hamburg, Heinkel and Henschel single-seaters. Observation is carried out in Henschel Hs 122s, Focke-Wulf "Weihe" and Dornier Do. 23s. Bombing is done by Heinkel He70s, and Junkers and dive-bombing by the new Henschel dive-

bomber. Beyond this, we know very little.

Question: I want to get into aviation. Would you tell me which school you would attend if you had your choice between the Casey Jones School of Aeronautics in Newark, or the Walter Hinton School in Washington?
F. B., Union City, New Jersey.

Answer: The choice in this case seems to be whether you can take time, either by night or by day, to attend the Casey Jones School, or must you limit yourself to a correspondence course, which is what the Hinton school offers. The Hinton school course, I believe, is one of the best if you cannot spare time by day or night for the usual course. Both are very good schools, but one demands a certain amount of actual school time and the other you may take at home in your own time. The practical experience in the shops of course will cost you more money, too.

Question: Do you know of any technical school near Detroit that teaches a course in designing of airplane motors?
J. A., Pontiac, Michigan.

Answer: Motor designing is a job for an engineer, which means that you've got to look for this training in college, rather than in a technical school. Near Detroit are Albion College, Albion; University of Michigan, Ann Arbor; Wayne University, in Detroit; and the University of Detroit, College of Engineering, located at Six-mile Road and Livernois, Detroit. If you will write to these, they will be glad to tell you in detail what aeronautical engine designing courses they offer, requirements for admission, etc.

Question: How are chances of my getting into the navy air corps? I have over 2,000 hours of engine and airplane mechanic training. I go to the New York State Aviation School in my home town. I belong to the New York State Aviation Association.
C. C., Utica, N. Y.

Answer: With that list of qualifications, you seem pretty well prepared. There are still plenty of stumbling blocks, however, along either of the two possible paths by which you might become a navy pilot. The first way is to get appointed as a naval reserve cadet, but for that you need a good college education or be able to pass a stiff examination that's equal to one. The second way is to join the navy as a sailor, for which you must be unmarried, between 17 and 25 years old, at least 5 feet 4 inches, and preferably have a complete high-school education. Then you ask for assignment to an aviation unit. That's where your mechanic training should be a strong recommendation for granting your request. Then you work up to an aviation rating as a machinist's mate,

metalsmith, or similar job, which may take a year or two, and finally, if you can pass the very rigid flight physical examination requiring almost perfect physical condition and eyesight, you are eligible for a year's training at Pensacola and subsequent flying duty with the fleet as a "naval aviation pilot"—a real navy flyer in everything except officer's ranking or pay. But it's a long, roundabout path, and as for your chances—well, you decide.

Question: I am a Canadian and am greatly interested in aviation. What training, education, and qualifications are needed to become a member of the British air force as a pilot, and where would one apply? What qualifications are required to become a civil pilot in Canada? I. G., Acton, Ontario.

Answer: Arrangements have been made in most of the British dominions, I understand, for recruiting men for the expansion of England's Royal Air Force. Details can be had from the headquarters of the dominion air services—in your case, the Royal Canadian Air Force. Write to the Air Force Branch, Department of National Defense, Ottawa, for any information you want about the R. A. F. or the R. C. A. F.

For information about the requirements for civil pilot licenses in Canada, and about flying schools, write to the Civil Aviation Branch, Department of Transport, Ottawa.

Question: Could I join the army and get training as a master mechanic right away and without cost, or would I have to pay a fee and wait my turn? B. S., Peoria, Illinois.

Answer: You can't count on getting courses in aviation mechanic training in the army air corps technical school right away unless the waiting list of those who want to enlist as students happens to be short. If it is, and if you have a high-school education or equivalent training—which means one year of training or actual experience, in the kind of work you want to study, as a substitute for each year of a high-school education—then your chances are good. If the list is long, you might save time by enlisting for regular service at an air field and getting sent to the school in the field's training quota.

In either case, you will be enlisted in the air corps for three years. You must be from 18 to 35, a citizen or applicant, and must pass a physical examination. If you haven't a high-school education or "equivalent," which are necessary for admission to the school, you can build up the "equivalent" by service in the air corps, possibly within three years.

There is no fee of any sort to pay. The only cost would be your fare to Rantoul if you wished to enlist in the school directly. You can get further information, entry blanks, etc., by writing to The Commandant, Air Corps Technical School, Rantoul, Illinois.

Question: I have built a model of the Corben Super Ace. I have heard of it only as a model. Can you tell me about the real plane? B. R., Ravenna, Ohio.

Answer: The Corben Super Ace is one of the many attempts that have been made to create lightplanes for amateur flyers which are cheap and simple enough to build at home. It was designed by O. G. Corben, of the Corben Sport Plane Co., Madison, Wisconsin, who had previously designed the Baby Ace and the Junior Ace, and was made available in the form of plans, semi-manufactured material kits, or complete. To meet the engine-cost problem, it used a converted water-cooled Ford A auto engine. It was a single-place parasol-wing monoplane, with fabric-covered spruce wing and welded steel tube fuselage and tail. Span was 27 feet, height 6 feet 7 inches, length 18 feet 4 inches; weight empty 596 pounds, loaded 856; top speed 100 m.p.h., cruising 85, landing 32.

Question: What kind of airplane did Paul Redfern use on his attempt to fly to South America? How many victories did Frank Luke have during the World War? W. E. G., Stanley, New York.

Answer: Paul Redfern, for whom expeditions have been hunting since he presumably cracked up in the jungle while en route to Rio de Janeiro in 1927, flew a Stinson Detroiter. It was a high-wing cabin monoplane with a Wright radial engine.

Frank Luke is credited on the official army list with four enemy airplanes and fourteen balloons.

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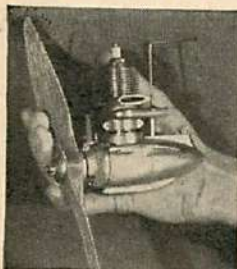
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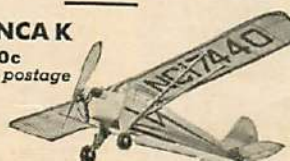


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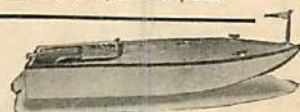
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