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# AIR TRAILS

VINCENT BENDIX . . . . . Guest Editor

AUGUST, 1938



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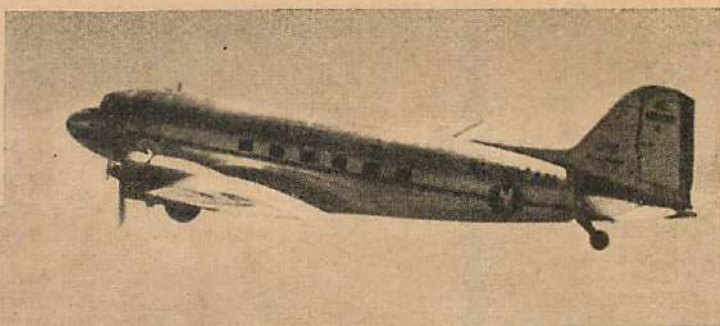
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# AIR PROGRESS

## A SUMMARY OF AVIATION NEWS

### TRANSPORT

**C**APTAIN EDDIE RICKENBACKER of the Eastern Air Lines announced recently that his company had broken all traffic records during the month of April, when 14,350 passengers were carried. On April 29th, all one-day records were shattered when 643 passengers were flown over the line's routes. And, according to the Federal Bureau of Air Commerce, seventeen scheduled air lines in this country transported 94,112 passengers in March, which exceeds by 18,140 the number for the same month last year.

American aeronautical firms have airplane and engine orders on hand totaling more than \$150,000,000, and tentative orders provided in pending Army and Navy bills, plus the increasing demands for American airplanes abroad, provide pleasing prospects for the industry in general. Employment of more than 27,000 additional aircraft workers will be required to complete most of the contracts already written. Forty cents an hour is the average pay for inexperienced beginners, while those out of private mechanical trade and technical public high schools are started at about fifty-five cents an hour. More than 10,000 workers in aircraft plants today entered the industry within the past three years.

T.W.A. now makes its coast-to-coast flight in 15 hours, 13 minutes, eastbound. The westbound trip takes 17 hours, 28 minutes.

The Federal government is beginning condemnation proceedings to obtain land adjacent to the United States Army air base at Mitchel Field, Long Island. It is understood that about \$1,500,000 will be spent in enlarging the field to accommodate big bombers.

Work is well under way on the New York World's Fair seaplane base at 23rd Street and the East River, New York City. Piles are being driven to support a platform 100 by 400 feet on which will be built the Administration Building, containing offices, rest rooms and a restaurant. The slip will be 500 feet in length and can provide room for most of the seaplanes in the East.

Operations during the first quarter of the Wright Aeronautical Corporation's fiscal year resulted in a net profit of \$586,288 after depreciation, interest and Federal income taxes were deducted. In the same period last year the firm profit amounted to \$286,353.

On the first day of the summer opening of the Wall Street skyport, recently, three private amphibians landed to bring their owners to work. The city plans to remove Pier 12, which adjoins the ramp, to make space for several additional planes. The ramp at the 31st Street pier and the East River was scheduled for opening on June 1st.

The British government is planning to open a regular Pacific air line service between Canada and New Zealand. The matter at present is bound up in the question of the ownership of certain islands in the Pacific.

The Mayo-Composite tests are being continued at Felixstowe and the details of the problems involved are slowly being worked out. The most recent test involved the launching of the upper component (*Mercury*) from the lower (*Maia*) while fully loaded with sufficient fuel for a non-stop flight from London to New York. When the separation was made the *Mercury* was carrying 1,180 gallons of gasoline, and its loaded weight was 20,800 pounds. With a special fuel-jettisoning gear, the *Mercury* was able to dump 900 gallons of gasoline in 15 minutes.

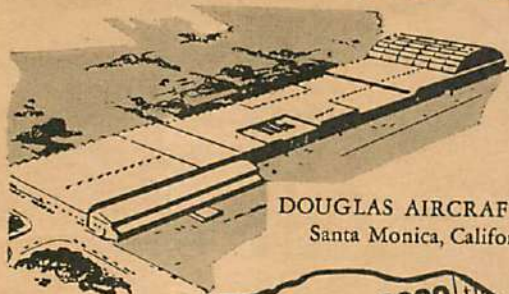
An air-mail system is to be pushed north into Alaska. The first flight was recently run by Lockheed Electras carrying more than 60,000 letters. Letters from the United States leave from Seattle by boat and are put aboard the Pacific-Alaska planes at Juneau and are carried over routes including White Horse and Fairbanks.

Pan American Airways has started a new weekly service between Rio de Janeiro and Buenos Aires via Asuncion. It was started first as a mail run only, but the Douglas DC3's used on the run should be carrying passengers by now. The route passes directly over the famous Yguazu Falls, which should be interesting to tourists.

(Turn to page 91)



# MORE PROOF THAT YOU SHOULD COME TO CALIFORNIA FLYERS LEARN AVIATION IN LOS ANGELES



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# Eyes and Ears—Man-made

An Editorial by *Vincent Bendix*

*The President of Bendix Aviation Corp. is our August Guest Editor.*

THE eyes and ears for aircraft flight as provided by modern instruments and navigational equipment are to the average layman among the less spectacular elements of aviation, but to the trained observer they constitute an indispensable factor in the progress of all aeronautics.

A generation ago instruments were relatively crude, heavy and only approximately accurate, constantly subject to the savage rigors of vibration, weather whims and other vagaries of nature. Today they have been refined to a near-ultimate degree. They are compact, light and highly sensitive in their function, firm against shock and strain, thanks in part to the vast improvements in airplane construction, and they have been so improved and supplemented that they may be trusted over the human senses. For proof, witness the perfection of blind flying and the development of blind landings.

Aircraft radio equipment, aside from a long list of conventional instruments and similar accessories, is playing an important part in advancing the modern concept of reliability and safety in air travel. In order to provide thoroughly dependable communication and naviga-

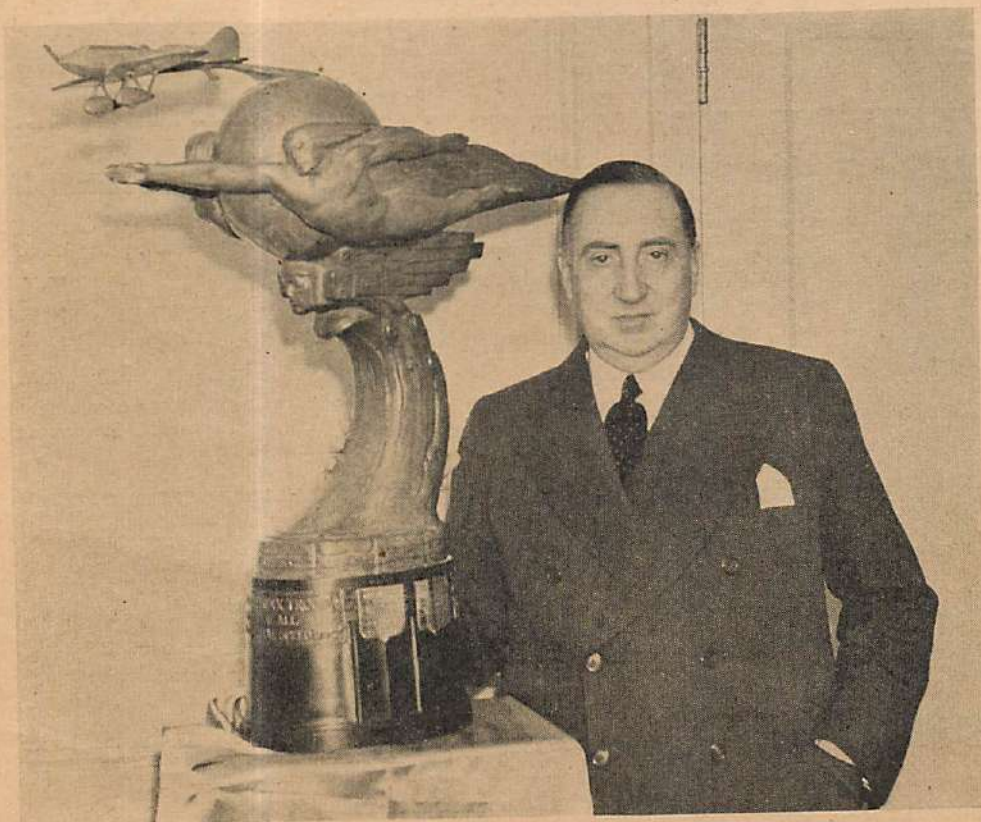
tion facilities for the commercial, military and naval aviation services, radio equipment must be capable of performing efficiently under extremes of climatic and atmospheric conditions greater in range than those required for any other type of transport.

The mobility of armed forces, for instance, in addition to the long ranges of present-day aircraft, has eliminated the horizons which previously restricted aerial maneuvers. In a matter of hours squadrons may be shifted from the dry, penetrating cold of the North to the humid warmth of the Tropics.

Accordingly, engineers have designed and constructed special test equipment which faithfully reproduces climatic and atmospheric variations far greater in range than any ever encountered in actual service. Temperatures from  $-70^{\circ}$  to  $50^{\circ}$  C, humidities from 0% to 100%, pressures equivalent to altitudes from sea level to a ceiling of over 31,000 feet, vibrations reaching frequencies of 7,000 per minute and amplitudes of  $\frac{1}{8}$  inch or more—these are some of the ranges under which some equipment may be tested for performance. In order to meet the highest standards, then, the equipment must perform with equal efficiency from one extreme to the other, as is obvious.

To insure conformation to these standards, engineers exercise the utmost care in the selection of component parts and materials entering into the construction of their equipment. Exhaustive tests must be conducted on each part and each item of material prior to its final selection. Individual items are minutely inspected and tested both before and after assembly to detect the slightest flaw, either electrical or mechanical. Throughout the entire assembly process a definite routine of tests and inspections follows each unit from integral part to completed equipment with the result that only mechanically and electrically flawless apparatus is turned out.

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Vincent Bendix

# Our Guest Editor

*About Vincent Bendix, famous President of Bendix Aviation Corp.*

Compiled by Tracy Richardson

VINCENT BENDIX is probably best known to the general aviation public for his donation of a \$25,000 cash prize to the winner of the annual Bendix transcontinental air race, the classic flying event of America. To those inside the industry he is better known because there is not an airplane flying in America today that does not have as some part of its equipment a Bendix product. Likewise there's not an automobile rolling the highways that is not equipped with one or more Bendix accessories. Every person who's ever looked under a motor hood has heard of the Bendix drive, that vital link between the motor and the starter, without which we'd still be using a crank.

Born in Moline, Illinois, son of a clergyman, Vincent Bendix started earning money as a stenographer. In the course of a short spell in a law office, however, he became convinced that his real bent was mechanics. While pushing the stenographic pencil he studied mechanical engineering and electricity. His real break into mechanical circles came when he bought a second-hand motorcycle. It didn't suit him, so he set about redesigning the frame work.

Shortly afterwards he left Moline and came to New York. There he drew the plans for and worked on the building of the redesigned motorcycle, made application for patents on his newly devised spring frame, and then took it to Hammondsport, New York, where a man named Glenn H. Curtiss was in the bicycle business. Curtiss was interested enough to offer young Bendix a partnership, for a cash consideration of one thousand dollars. Bendix didn't accept the proposition, and although the motorcycle was relegated to the background, the inventive bug had bitten deeply into the soul of the young mechanic.

From then on he was definitely committed to the business of inventing and producing. He obtained another job, as an elevator operator, and with a sketch pad in his pocket he recorded the ideas that came to him during what he refers to as "his ups and downs of life."

His actual practical start was in his motorcycle shop, and his first patents naturally had to do with bicycles and motorcycles. Later he devised the "Bendix Drive" that made the electric starter possible for gasoline motors. Over sixty million of these drives have been used throughout the world on automobiles and airplanes, which establishes something like an all-time record for a single automotive appliance.

Contrary to the general run of inventors, Vincent Bendix also developed a rare business ability. He not

only made money with his own ideas, but as prosperity came to him he was able to extend a helping hand to others who had the ideas but lacked the necessary financial backing and business ability to develop them. In this way he drew around him a staff of experts—and today he is the active head of thirty-two corporations that are manufacturing more appliances for the aviation industry than any other single company in the world. Some of these notable products include aviation spark plugs, radio equipment, airplane landing equipment, starters, generators, pumps, carburetors and every type of instrument used in flying. In addition to automotive and aircraft equipment, items bearing the Bendix name range from outboard motors to a new automatic home laundry.

Vincent Bendix realized that, since the Indianapolis automobile speedway was a proving ground for automobiles, something similar was needed for aviation, where a plane could be put through a grueling test in which every single part would have to be at maximum efficiency. With this in mind he initiated the "Bendix Trophy Race" from coast to coast, the prize money aggregating \$25,000.

Likewise, looking over the results obtained from glider and sailplane training in Europe and realizing the importance of these motorless flying ships in relation to more advanced aviation, he posted the "Bendix Glider Trophy." He has been a consistent and enthusiastic supporter of American youth in their desire to enter the rapidly expanding field of aviation.

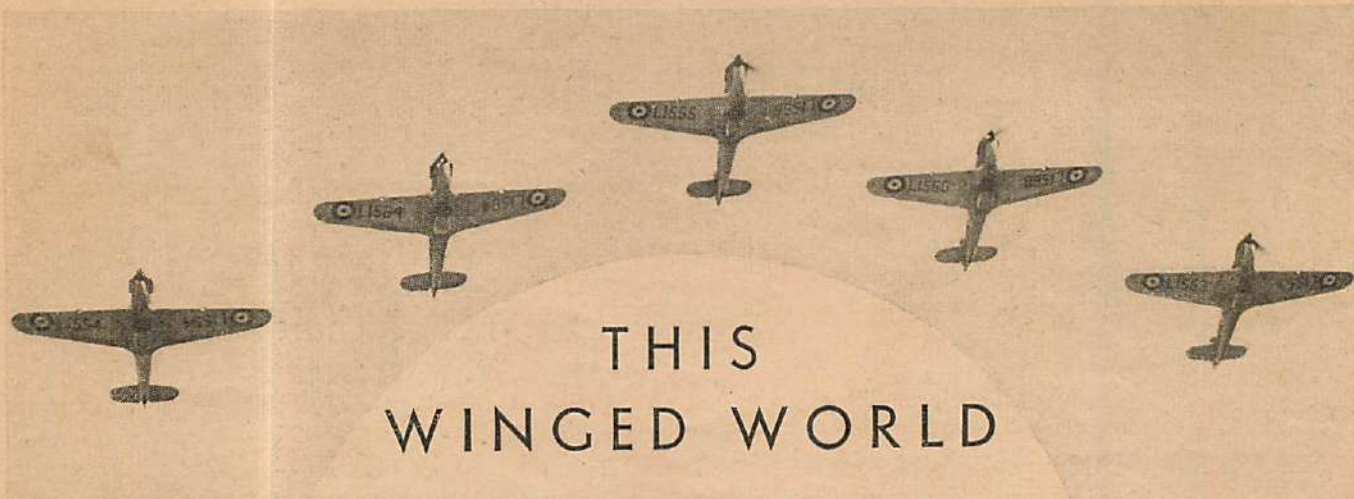
Bendix spends a great deal of time traveling between his various business enterprises. From Bendix, New Jersey (formerly Teterboro) to his principal plant at South Bend, Indiana, and on to the Pacific coast he travels by train, automobile and airplane. Extensive manufacturing interests in Europe call him often, and he expects to see the day when he will be able to commute across the Atlantic by airplane. France has decorated him with the Legion of Honor, and Sweden's King Gustave made him a Knight of the Order of the North Star.

With all his traveling he never loses a minute. Executives board his train enroute and decisions are made with a rapid-fire certainty that is the index to his rise as an outstanding figure in the manufacturing world. Business is his dominating passion in life, and most of his side interests are in some way or other connected with this business.

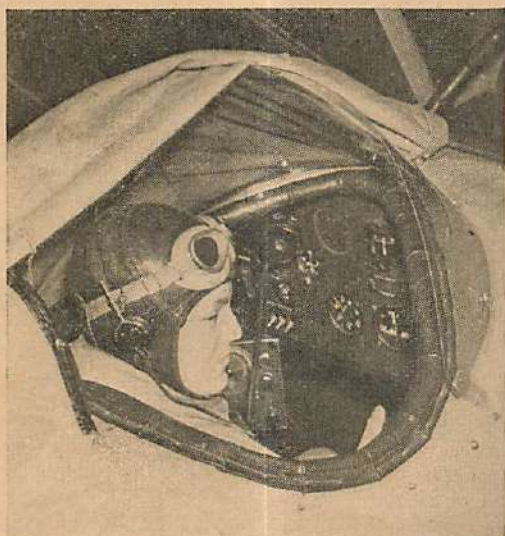
From the Bendix headquarters in towering Rockefeller Center in New York City, there flows a constant stream of life to the aviation industry.

Vincent Bendix's formula for success is "Work."





Wide World



Acme

FRIEDL LANG, son of Anton Lang, the Christus of Oberammergau, takes up aviation as a student at Parks Air College.

HELIUM, whose father was a husky with Admiral Byrd at the South Pole, is the mascot member of a blimp's landing crew. Has assisted 3,000 landings.

Wide World



Rudy Arnold

LEE GEHLBACH prepares to test the Seversky amphibian fighter for Russia. The ship is probably a version of the Convoy fighter.

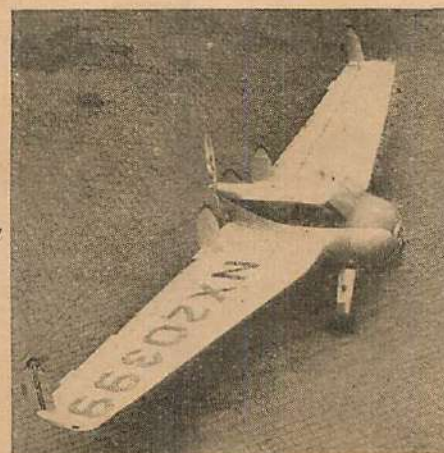
Pictorial

RIGHT—The Boeing YB-15, big sister of the "Flying Fortresses," and a pee-wee follower—a P-26A pursuit.

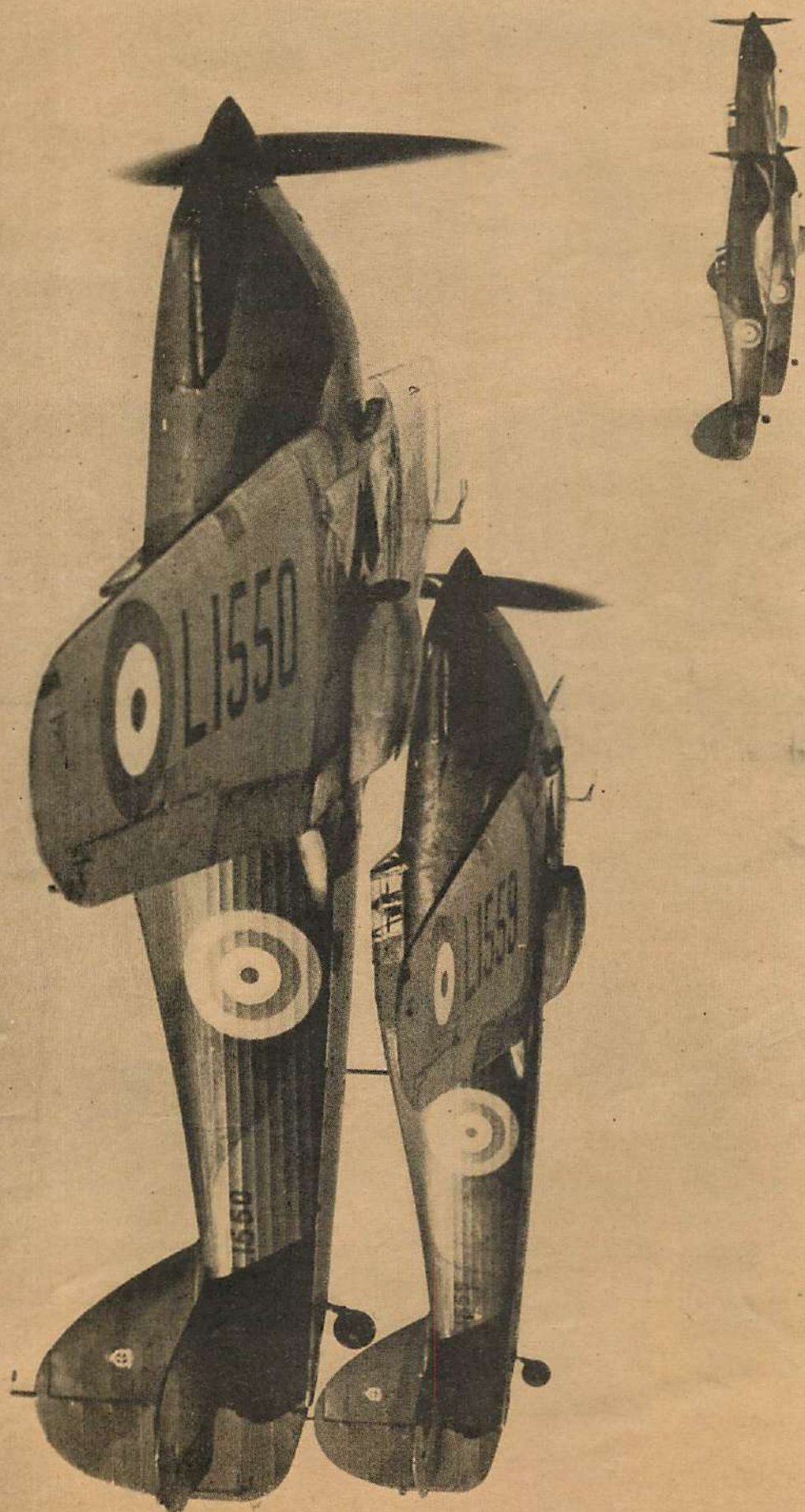


Rudy Arnold

RIGHT—Tested by Jimmy Taylor was this new and novel tailless machine.







HURRICANES bore through the air over England. Rolls-Royce Merlins of approximately 1,000 h.p. drive these swift interceptors nearly 400 m.p.h. Designed for interception only, these ships, judged from their fabrication and climb, are probably more lightly built and loaded than American fighters. See top of opposite page.





Globe

REFUELING on the line, this Douglas bomber was snapped on a recent jaunt to the South. Considered merely as a "medium-class" bomber, the contrast between ship and truck is truly remarkable.

Wide World

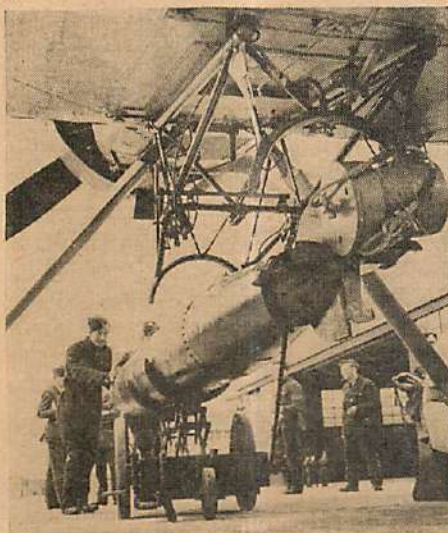


BLACK-OUT test at Farmingdale, L. I., witnessed the unsuccessful attempt of these nine Consolidated pursuits—assisted by anti-aircraft—to repel a test bombing attack. The raid was the first tried in the United States; climaxed the recent war games.



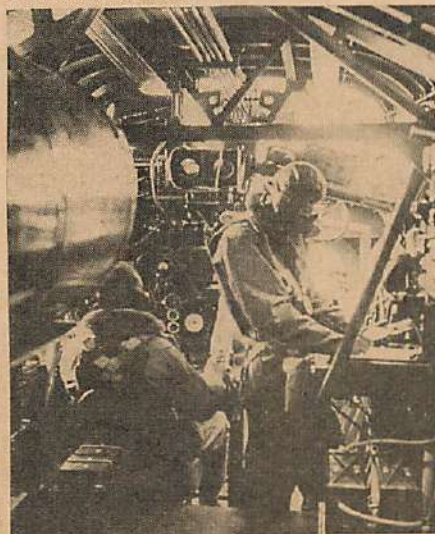
POPOCATEPTL VOLCANIC peak forms the background for this Mexican Army Air Force trainer. Flying at 19,500 feet, the ship is equipped with a supercharged engine, is well suited for operation from high-altitude fields. Ryan is the manufacturer.

Wide World



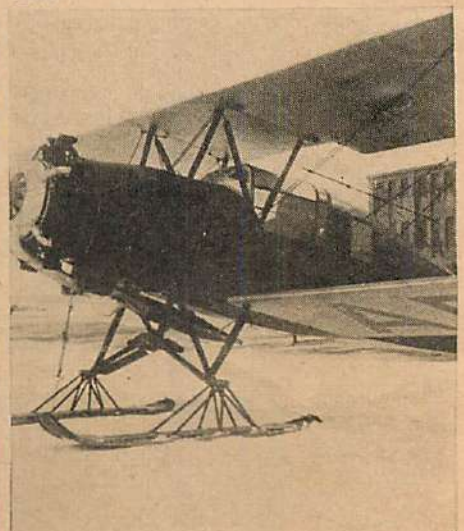
TORPEDO being wheeled into position beneath an English torpedo-bomber. Many of these ships participated in recent maneuvers between the forces of "Redland" and "Blueland."

Authenticated News



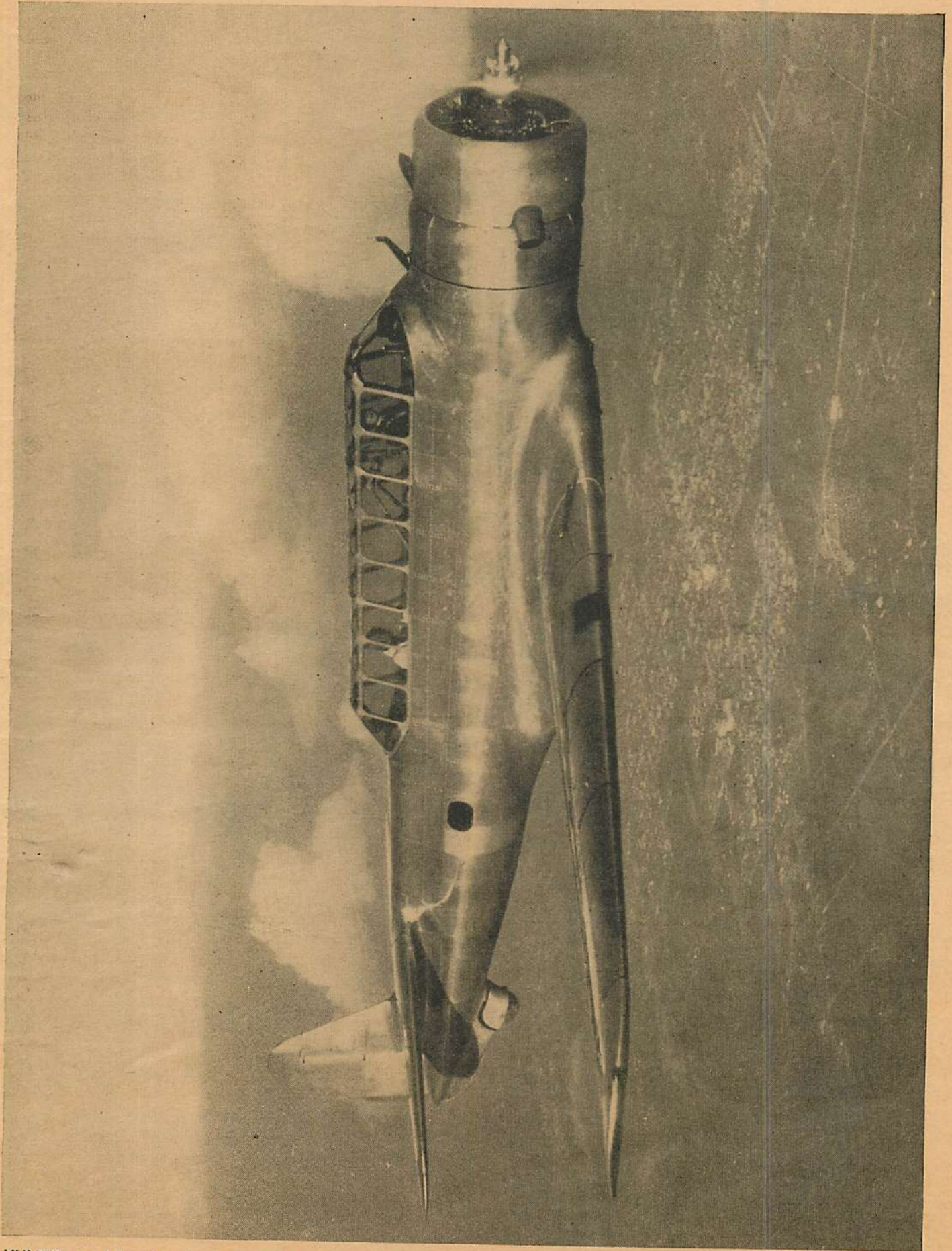
BRAINS of a bomber. Shown here are two crew members of a Handley-Page Harrow. Second pilot, standing, is checking navigation. Seated, the radio operator. Cockpit is forward.

Acme



SILENCER, developed by two engineers, is 90 per cent effective. The torpedo-shaped silencer—beneath fuselage—is considered to be of military significance. Benefit to air transport is obvious.





VULTEE attack bombers have attained such success in export competition that enlargement of the plant was compulsory. With a Cyclone these ships hit 227 m.p.h. at 13,500 feet. Range is 1,000 miles. Fitted as a bomber the range jumps to 2,600 miles at a slight sacrifice in speed. Gun hatch opens beneath fuselage to rear of cockpits.





A squadron of speedy Messerschmitt Bf-109 single-seaters. Usually powered by the 640 h.p. Jumo, one of these fighters broke the world's land plane speed record when fitted with a 950 h.p. Daimler-Benz.

THREE years ago there was no such thing as a military plane in Germany, but to-day that nation holds an impressive position among the world's leading air powers. To attempt to rank the power of the Nazi government air force is almost impossible, for there are few reliable figures available to work on. As best as can be learned, Germany has about 700 first-line aircraft and approximately 2,000 other types available, should an emergency arise.

These figures, however, are not a true indication of the country's potential strength, for it must be admitted that in the first place, owing to the particular form of compulsory training now in vogue there, the Germans have a wide group of well-trained airmen and mechanics to draw from, and the personnel strength is an important factor in the strength of an air force. On the other hand, no one can deny the engineering skill of the German and his dogged plodding to attain perfection in any field that attracts his attention. For this reason, then, the rise of the new German Air Force can be credited to personnel and creative engineering ability.

For years now, Germany has maintained a high standard in her commercial planes and ground management. Her transports have long been among the leaders in European commercial aviation. She has always had some form of directional beam and blind landing equipment, which if not as yet actually perfect, are nevertheless as far advanced as any produced by any other nation.

Then, as has since been admitted, the pilots of the government-controlled air lines have been receiving military training along with their tuition as air-line employees. The transports have done what is virtually formation

## GERMANY FLIES AGAIN

By Arch Whitehouse

*In collaboration with*

W. and H. Zuerl

Air Trails wishes to acknowledge the assistance rendered by W. and H. Zuerl in the compilation of data on service types. To this data Arch Whitehouse has added what is representative of international opinion on the new German air force.

—The Editor.

flying and carried out semi-military missions for years, under the guise of commercial cross-country training. German flying clubs admittedly have been government-controlled instruction centers where bomb-dropping, aerial fighting tactics and formation maneu-

vers were considered equally as important as absorbing the art of taking off and making three-point landings.

We have known for years that many of the country's regular-run transports of the Junkers and Heinkel types were designed so that within eleven hours they could be completely transformed into high-speed bombers with tremendous ranges of action.

For these reasons it is easy to see why the present German Air Force is predominately composed of bomber-fighter squadrons. The German military motto has always been to the effect that a good offense is the best defense, and should another European war break out tomorrow, it is obvious that General Goering, head of the Nazi air services, would place much trust in the terror his bombers might deliver in the way of high explosive and chemical warfare.

It is all the more impressive, then, that within a space of three short years, Germany should also develop single-seater fighters which in performance, at least, compare with the finest in the world. Most military aviation experts declare that it takes five years to develop a first-class single-seater fighter. A glance back over the progress of most of the world's leading pursuit ships justifies this claim. We in the United States have only to look back and figure how long it took us to produce the Seversky P-35, the Curtiss P-36 and the Boeing P-26a from their basic types.

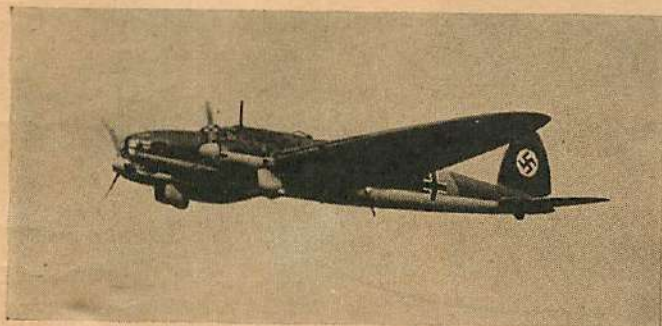




The new Ju-87 two-seater bomber. Special flaps retard the diving speed for accuracy in bombing.



A fighter-dive-bomber; the Henschel Hs-123. This ship, on which performance data is withheld, is powered by the P. & W. Hornet—also built in Germany under license.



Heinkel He-111 K fighter powered with Junkers Diesels. The commercial version has a maximum speed of 254 m.p.h., when fitted with 880 h.p. engines.



An unusual shot of a Heinkel low-wing bomber taking off. The wheels are folding up into the wings as is characteristic of many of Germany's fighting planes. This design is a modification of the He-170 mail plane. Top speed is 248 m.p.h.

How, then, was it possible for German designers to produce a single-seater in three years which up until a short time ago held the world's land-plane speed record of 379 m.p.h.? How did men whose hands and technical skill had been tied for sixteen years by the Treaty of Versailles manage to bring into being such a winged weapon?

Much credit, of course, must be given to the steady growth of what was once called sport flying clubs and the continued practice of motorless flight. Much, also, must be assigned to the new Nazi regime and the blazing spirit of the men at the head of the government.

As evidence of the rapid development achieved, we can consider the all-important Air Meeting of 1932 in Zurich, when the best Germany could do was to enter a few commercial planes; and then glance at the records five years later when German military planes proved themselves superior to the others in the Zurich meet—at least against the others that were entered.

For as true a picture as possible of what has been accomplished, and to understand the extent of Germany's power in the air to-day, let's examine planes and their records.

Take the new Messerschmitt Bf-109 fighter which set up a mark of 379 m.p.h. The particular ship in this case of course was supercharged to the limit and flown over a closed course, but the fact remains that 379 m.p.h. was clicked off, and it is no secret that others will be thus supercharged if such a speed is required to face an enemy force.

Professor Willy Messerschmitt developed the Bf-109 from a string of Messerschmitt machines which really started back as far as 1928 when one took the International Challenge Trophy. The original types were formerly high-wing monoplanes from which the present low-wing models have been developed. And the original types were designed from ideas gained from a Messerschmitt glider. His express plane, called the Typhoon, was gradually scaled down until the Bf-109 came into being.

In general the Bf-109 is a single-seater of dural construction using a tapered cantilever wing of positive dihedral. The plane's special feature, which has left other countries somewhat disturbed because their own designers never thought of it themselves, is the incorporation of both Handley-Page slots and flaps. These two devices allow the pilot to make comparatively slow landings, in spite of the high speed of the ship in the air. The British in particular have been kicking themselves for not thinking of this device in relation to the design of a military plane. However, whether all this somewhat complex arrangement of controls will fit into the harrowing conditions usually found in active service, has yet to be proved.

The fuselage is built as a monocoque of dural construction with a special sheet-metal covering as carrying surfaces. The pilot's cockpit is completely covered in and fits neatly into the fuselage without changing its section. The empennage resembles the earlier Messerschmitt types, the M-29 and the M-35. The elevator unit is braced to the fuselage, whereas the vertical tail surfaces are cantilevered. All control surfaces are balanced and the elevator is hinged relatively high above the upper line of the fuselage.

The undercarriage consists of two struts with shock absorbers, which unlike those in the Typhoon are some-





An interesting two-place Henschel Hs-126 observation plane.

A Heinkel single-seater He-112 equipped with two-way radio.



what splayed out toward the wing-tips, but beyond this they are practically the same. The wheels are retracted by means of a hydraulic gear and drawn up and outward. Folding metal panels cover them when they are inside the wing. Wheel brakes are provided, and the tail-wheel also retracts to lower wind resistance.

The standard engine is the Vee-type Junkers Jumo-210, a liquid-cooled power plant rated at 640 h.p. An alternative engine is the Daimler-Benz of 950 h.p. The radiator retracts into the throat of the fuselage with extra shutters which can be operated by the pilot for heat control. The exhaust pipes are trimmed off flush with the curve of the engine cowling, and either a standard wooden prop or a variable-pitch prop can be fitted.

Another single-seater fighter is the Heinkel He-112, which many German writers studiously avoid mentioning when they offer articles on German military aviation. This is a low-wing monoplane using a cantilever wing and incorporating the all-metal idea of construction. Equipped with the 660 h.p. Junkers Jumo, it has a speed of 295 m.p.h. and a cruising speed of 267. Two fixed machine guns set in the fuselage fire through the airscrew, and there are two automatic guns of unknown caliber mounted in the wings. They are in all probability Oerlikon air cannon. In addition the ship carries racks to accommodate six 22-pound bombs under the outer wings, and a complete two-way radio set. The cockpit has a sliding hatch and the landing gear retracts into the wings. Much of the construction detail on this plane is unknown.

Still another Heinkel single-seater is the He.51, which comes either in a land-plane version or as a two-float seaplane. It uses the 750 B.M.W. VI engine and has a top speed of 204 m.p.h., carries two machine guns and two-way radio equipment. This is in all probability one of the few types used in connection with the present German navy.

The new Hamburg Ha137

has received little notice or publicity in this country. Listed as a fighter-dive-bomber, this is an unusual one-place fighter using a cantilever low wing in which the main load-carrying member for either bending or torsion is a tubular spar located at the thickest point of the wing-section. In the center-section, this tubular spar is of welded chrome-molybdenum steel sheet, and in the outboard panels it is made up of what is known as "Duralplat." This entire center-section is used as a fuel tank and is directed downward and outward to a point where the fixed undercarriage is bolted to the wing. The outer panels are tilted upward, giving the machine an appearance of an inverted gull-wing job. Incidentally, the tubular spar is a characteristic of Hamburg construction.

Here again we have two fixed machine guns and two more weapons of unknown caliber set in the outer wing panels. Ten 10-kilogram or four 50-kilogram bombs may be carried in racks under the fuselage. Fully loaded, the maximum speed of the Ha.137 is 205 m.p.h. It cruises at 180 and lands at 65.2 m.p.h. It has a cruising range of 360 miles, or a duration of about two hours.

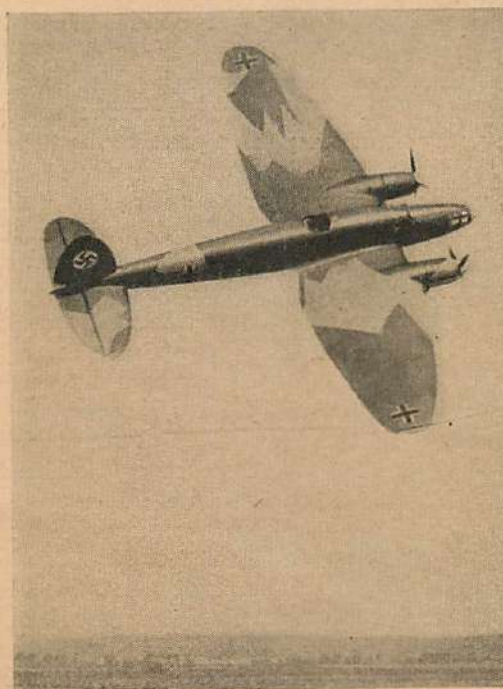
The Arado Ar.68 is a single-bay biplane powered with the 750 h.p. B.M.W. VI engine. In this ship the lower wing is narrow of chord and flat in mounting. The upper wing has a slight degree of dihedral. The fuselage is rectangular and built up on welded steel tubing and faired to an oval section. Quickly detachable metal panels cover the forward portion and along the upper decking, the remainder being covered with fabric.

It carries two fixed guns and racks for ten 22-pound bombs. As compared with the others mentioned above, this cannot be considered a real first-line piece of equipment, and to-day is probably used for advanced pursuit or fighter training. Nevertheless, the design is noteworthy.

Germany has not forgotten the old Bristol Fighter, either,



Another view of the Ju-87 showing the gull wing and flaps.



Another Heinkel: the He-111 twin-engine fighter with service camouflage.

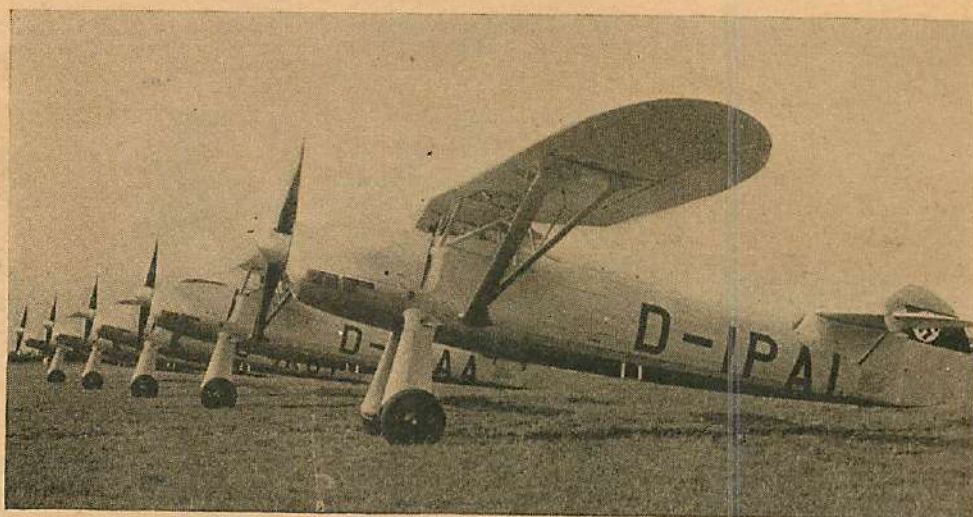


for there are a number of good two-seater fighters in the new German Air Force. Take the Heinkel He.118, for instance, which according to most German experts was developed from the Heinkel express commercial plane known as the He.70 used during 1932 and 1933.

Actually this He.118 is a dive-bomber and attack plane as we know the accepted types. It uses the 910 h.p. Daimler-Benz 600G engine and in general is a low-wing cantilever monoplane with the wing-roots swept upward at the fuselage. The outer portions of the wing are elliptical in plan and taper in thickness. It has tandem cockpits for pilot and bomber-observer and carries four machine guns in the wings and another on a flexible mounting in the rear turret. There are racks for twenty 22-pound or accommodation for one 1,100-pound bomb for attack duty. It does 248 top.

Another two-seater of good design is the Henschel Hs.126, used for artillery-cooperation and bombing. This is a braced high-wing machine carrying one fixed and one movable machine gun. This appears to be an advanced version of the earlier Hs.122, which had a top speed of 164.

But there are other planes listed in the fighter category, some with two and some with as many as four engines, and it is easy to see that while Germany has shown the world that she can turn out practically all



Five Focke-Wulf Fw-56 training and home-defense planes powered with Argus 40 h.p. engines. Known as the Stoesser, this type ship is renowned internationally for maneuverability and fine performance.

haps we are expecting too much from a nation that has been in the race for air power only a few years, yet to many it appears that Germany's numerical strength as to types is only an indication of her actual weakness.

For instance, the Dornier Do.17 bomber monoplane (known abroad as the Flying Pencil because of the sleekness of the fuselage) is said to attain a top speed of 267 m.p.h. from its two 950 h.p. Daimler-Benz engines. This is much faster by contrast than the French Dewoitine D-510 fighter, and the plane carries a greater armament. But then we find the Germans also have the four-engined Dornier Do.19 heavy bomber using four 650 h.p. Bramo engines; the Dornier Do.23 bomber transport, using two 750 B.M.W. engines; the Focke-Wulf Fw.58, another two-engined fighter-bomber; the Junkers Ju.86K two-engined bomber-fighter, and several other lesser publicized types. If all these are accepted service ships, it is obvious the experts have no idea what is to become the standard, and if they aren't, just how many actual service types does the German Air Service have? Here we find the problem evolves into a question as to actual merit or actual strength.

We do acknowledge the high performances of many German transport planes, for their records are undeniable, but we still feel that a real sound program is lacking and that all the clever German skill is being wasted on so many types rather than being concentrated on a few.

This seems to be the general opinion all over the world, but German writers continue to point out that in three short years they have caught up to the world in designing skill and military performance and they seem satisfied with that accomplishment. That point is acknowledged again, and it will be interesting to watch the course of events to see how all these triumphs can be eventually drawn into one concerted effort should a national emergency arise.

For the benefit of those who would make a thorough study of these German types, see page 82 for details and specifications on the better known German military machines.



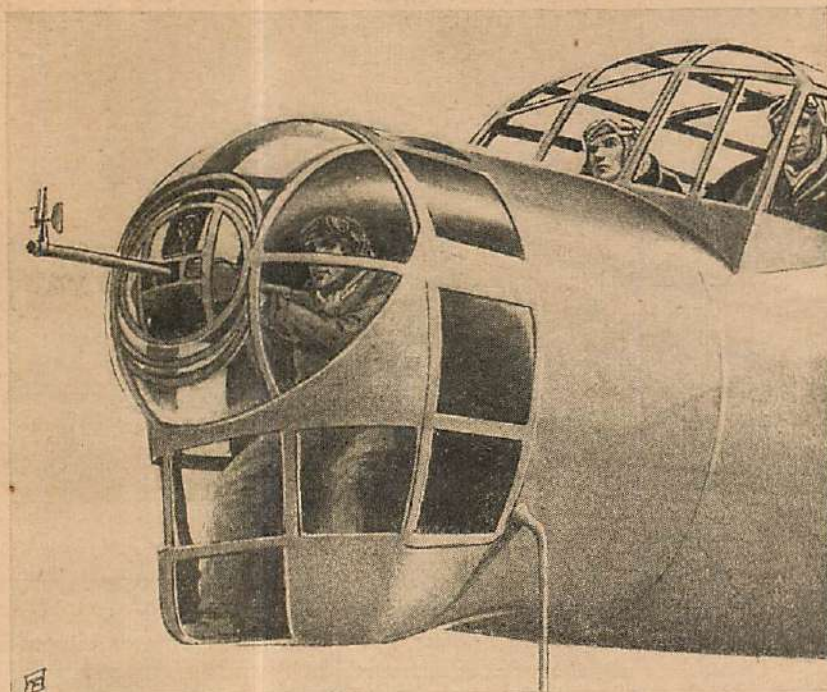
Farewell to Germany's World War armada. German planes at the close of the war piled for burning according to the Treaty of Versailles.

types, there has been no sound effort to limit the types and concentrate on a set number of classes which would make high-speed production possible. For this reason, then, many foreign observers are of the opinion that while German planes of to-day appear to have everything, at least as far as speed and equipment are concerned, there must be something wrong with them basically, or the experts would have selected several types and concentrated on them for service production. Per-



# The Junkers J. U.-86K Diesel Bomber

By  
Frank Tinsley



The nose of the J.U.-86K, showing details of the flexible gun and observation windows.

THE late Professor Junkers, distinguished German airplane and engine designer, began working on an aircraft adaptation of his ingenious opposed-piston, two-stroke Diesel engine before the World War. Development continued throughout the war period, during which Junkers also perfected the first all-metal, cantilever, low-wing monoplane. The provisions of the Versailles Treaty forced a halt in the work, which was not resumed until 1925. The Junkers Diesel engine was completely redesigned in 1929 and passed both German and international type tests. This engine was the prototype of today's Jumo models. The present model 205 is a six-cylinder, vertical, compression-ignition engine developing a maximum output of 600 h.p. at 2,200 r.p.m. It is liquid cooled and has a dry weight of 1,144 pounds.

Professor Junkers' highly original, all-metal airplane designs kept pace with his engine development. During the post-war years he produced a number of excellent transport models. These were widely used by the German Lufthansa Airways and may be fairly credited with much of the popularity enjoyed by that pioneer transport system. The all-metal, low-wing monoplanes of characteristic Junkers design are famous as efficient weight carriers and are still employed in many parts of the world for the transportation of passengers and heavy freight.

In 1929 Professor Junkers amazed the aeronautical world with his giant G-38. This huge, four-motored transport was the largest land plane of its time and embodied design features far in advance of even today's developments. Thirty passengers were accommodated in cabins situated in both the fuselage and wings. Wide, glazed windows in the leading edge of the wing and nose of the fuselage permitted a breadth of view enjoyed by passengers in no other-type of heavier-than-air transport. The power plants were housed inside the great cantilever wings, where they were fully accessible for repair and adjustment during flight. Powered with 750 h.p. Jumo

Diesel engines and fitted with all the latest conveniences, the big G-38's are still in active service on Lufthansa lines.

The sudden revival of the German Air Force in 1935 brought about an immediate demand for fighting planes of all types. To meet the need for heavy bombardment ships, the *Junkers Flugzeugwerk A. G.* promptly produced a military version of their tri-motored Ju-52 transport. This seventeen-passenger, low-wing monoplane had been designed and constructed to permit quick conversion to war use. Fitted with machine guns and bomb racks, the Ju-52's have seen plenty of active service both with German Air Force units at home and over the fighting areas in Spain.

A smaller twin-motored, ten-passenger transport, the Ju-86, has also been converted to military use and designated Ju-86K. Fitted with 760 h.p. B.M.W.-132 engines (German built P. & W. Hornets), the 86K has been supplied in large quantities as a medium bomber to the German Air Force, and forty have been built for the Swedish Royal Air Force. The latest model of this highly efficient bombing plane has been fitted with Jumo 205 Diesel engines for long-range work. This is the plane featured on this month's cover.

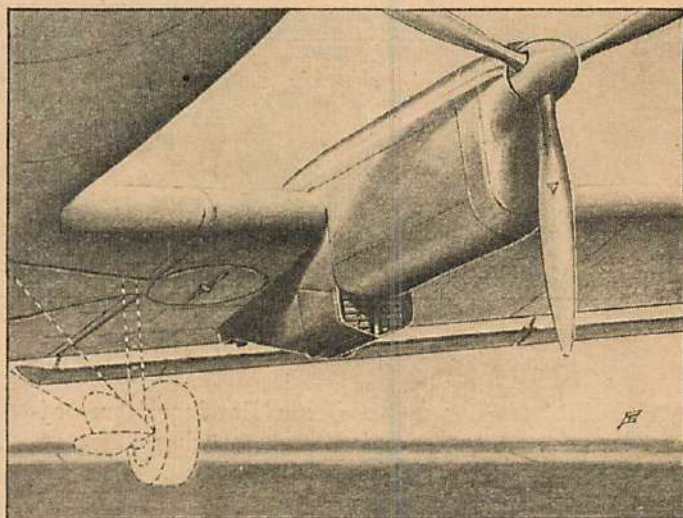
The Diesel-powered Ju-86K is a twin-engined, low-wing monoplane of all-metal construction. The wings are of the full cantilever type built in three sections. The center section, bearing the engines, fuel tanks and retractable landing wheels, is built integrally with the fuselage. Tapering outer wing panels are attached to the center section by ball-and-socket joints. Along the entire trailing edge is a narrow-chord, adjustable auxiliary airfoil which in conjunction with the main wing forms the patented Junkers "double wing." The outer sections of the auxiliary surface function as ailerons.

The fuselage is oval in section with a circular taper forward from the pilot's cabin. The nose is finished off



*The Diesel, for many years neglected in aviation, steps forth to make the bomber safer to friend and more deadly to foe.*

The installation of the Diesel in the Junkers bomber. Landing gear is shown in extended and retracted positions.



with transparent panels and is fitted with a bomb-sighting window and a hemispherical turret for a flexible machine gun. Two additional gun positions are located aft of the trailing edge, one on top and one beneath the fuselage. A monoplane tail unit with small twin vertical surfaces permits a clear field of fire for the rear guns.

The specifications and performance of the Junkers 86K bomber are still numbered among Germany's military secrets. We know, however, that the transport model has a span of 73' 10", is 57' 5" in length and is 15' 8" high. It has an empty weight of 11,200 pounds, and lifts a useful load of 6,500 pounds. Fitted with B.M.W.-132 engines of 760 maximum horse power, the civil ship hits a high speed of 248 m.p.h., cruises at 224 and lands at 62 m.p.h. Her service ceiling is 25,580 feet and she has an extreme range of 930 miles. Equipped with Mercury 111 engines, the Swedish bombing model is said to have a maximum speed of 202 m.p.h. As these motors develop about the same number of horses as the Jumo 205, it is reasonable to conclude that the Diesel-powered model has a top of around 200. Her range, however, should be about 25 per cent greater than the gasoline-driven ship.

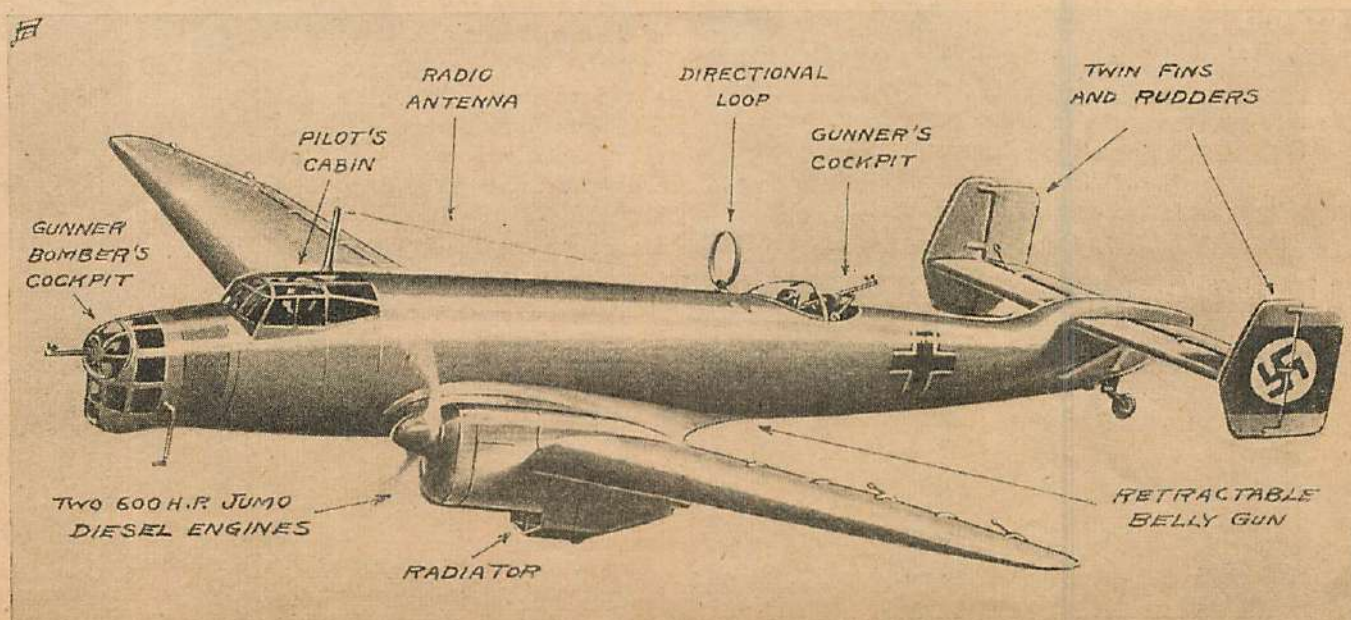
The current German experiments with Diesel operation under both civil and military conditions should prove

of great value to aviation. They will constitute the first practical test of the compression-ignition engine in direct competition with gasoline. The Junkers company has undoubtedly progressed further with the airplane Diesel than any known competitor, so the test is a fair one. The Jumo 205 has the edge in range but is still on the bad side in regard to weight. A comparison with a gas engine of equal power may prove interesting.

JUNKERS JUMO 205				Lbs./
Horse Power		Fuel Consumption	Weight	H.P.
Maximum	600 @ 2,200 r.p.m.	375-396 lbs./h.p./hr.	1,144 lbs.	1.91
Normal	510 @ 2,100 r.p.m.	353-375 lbs./h.p./hr.		

P. & W. "WASP" S1H1-G				Lbs./
Horse Power		Fuel Consumption	Weight	H.P.
Maximum	600 @ 2,250 r.p.m.			
Normal	550 @ 2,200 r.p.m.	482 lbs./h.p./hr.	930 lbs.	1.52

Reported but not confirmed is a new and more powerful Jumo 206. This is said to develop over 1,000 h.p. and have a weight ratio of 1.39 lbs./h.p. If true, this represents an amazing advance in efficiency and compares very well with the 1,050 h.p. and 1.32 weight ratio of Britain's boasted Rolls-Royce Merlin. It would seem that the aircraft adaptation of Rudolph Diesel's famous brain child is at last coming of age.







# GLIDING AND SOARING

Conducted by Alexis Dawydoff

**E**VENTS leading up to Lewin Barringer's record-breaking distance and altitude soaring flight recently may be of interest. Enroute to Texas for flat terrain soaring, he and Pete Bonataux and Ken Findieson first stopped at Nashville, Tenn., where through the kind invitation of Major Walter Williams, State Director of Aviation, Lew was planning to make flights in his Minimoa in the endeavor to locate a suitable soaring site. The first day he took off a number of times from the Nashville Airport, staying up 29 minutes during one of the attempts. The following day he was airplane-towed to Monteagles, 80 miles away, where he bettered the American altitude record by climbing to 6500 feet, remaining aloft for three hours. Leaving Tennessee, Lew and his companions went on to Wichita Falls, Texas, where they visited Harlan Ross, who was building a Ross-Stephens sailplane for Barringer. Lew's first cross-country flight in that section was for 28 miles, from Wichita Falls to Loveland, Okla. Subsequently, he broke the American distance and altitude record with the flight from Wichita Falls to Tulsa, Okla., during which his maximum altitude was 7500 feet. A detailed description of this flight will appear in the near future. Gliding enthusiasts will find it of vast interest.

Not long ago Emil Lehecka soared for over two and a half hours in his Rhonsperber over Hicksville, L. I., finally landing at Mitchel Field, where he created quite a sensation among the Army boys. They greatly admired the sleek sailplane, as well as Emil's flying skill. The flight was made from winch tow. Emil's Cadet II

has been dusted off and made ready for a busy stunt-ing season.

The Airhoppers Gliding and Soaring Club of Astoria, L. I., has been putting in a number of flights at the Hicksville field with their Franklin, the longest of these being 16 minutes in duration. The two-place sailplane ordered by them from the Schweizer Brothers is nearing completion, and will be ready in time for the 9th Annual Soaring Contest.

The Falcon Glider Club of Pittsburgh, Pa., whose members are of Polish origin, are expecting delivery of a high-performance sailplane from Poland. This ship also will be entered at the Elmira contest.

Parker Leonard, of Osterville, Mass., soared his Wolf sailplane for 3 hours, 10 minutes over the bluffs of Corn Hill on Cape Cod.

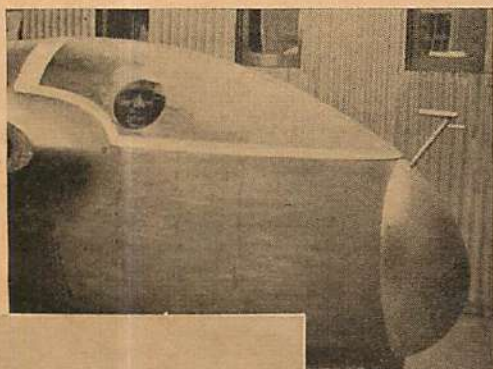
Who says a primary glider cannot soar? Junior Blue, of Neenah, Wis., soared his for 4 hours over a small ridge located on the shores of Lake Winnebago.

A soaring meet was held recently at the newly discovered site near Bakersfield, Cal. This site is located in the southern end of the San Joaquin valley, 2800 feet above sea level and 900 feet above the floor of the valley, which, because of its size, affords ideal landing facilities. During this meet Hawley Bowlus' new sailplane, the Baby Albatross, made its aerial bow before the public. Piloted by Stan Hall, the ship soared on thermal currents for over an hour, eventually landing back on the



The nose of the Rhonsperber, showing round vent in center which can be opened from within for ventilation.

The editor snaps Harvey Stephens through the window of his new molded enclosure.



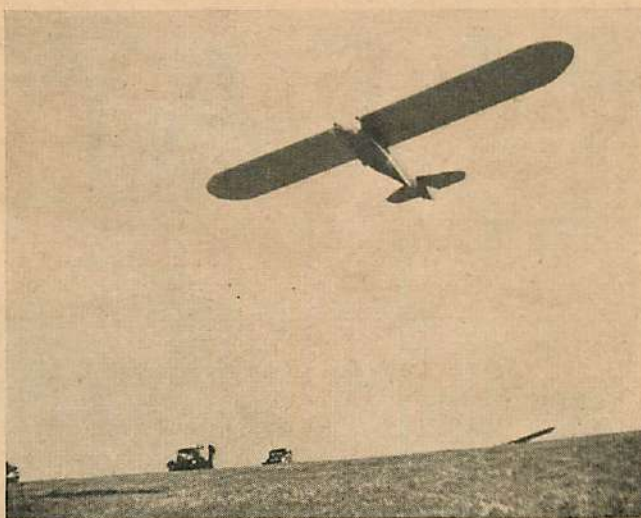
Assembling Emil Lehecka's Rhonsperber at Hicksville, L. I., for Sunday of soaring.



Air Trails staff at Hicksville, L. I. to R., Dawydoff, Colby and Winter.

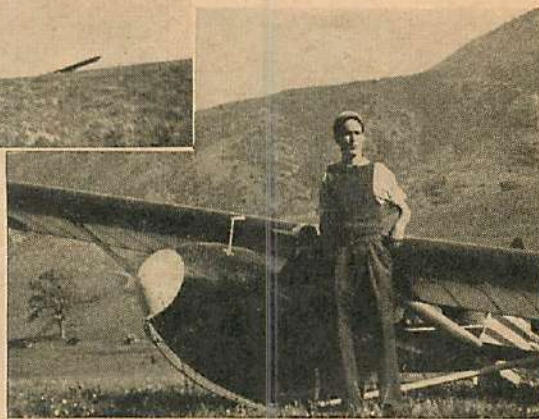


The two-place "Cherokee" of Stan Hall takes off with newsreel cameraman to photograph a California meet.



Stan Hall ends an hour flight in the sensational new "Baby Albatross" of Hawley Bowlus.

Stan Corcoran's "Cinema" blossoms out with a new cockpit enclosure and makes a record flight of 5,200 feet.



take-off site. Stan Corcoran's Cinema intermediary sailplane made the best flight of the meet, reaching an altitude of 5000 feet, which is a record for California, and staying up for a duration of 5 hours.

Jacqueline Cochrane, the prominent woman flyer, has joined the S. S. A., according to an announcement in *Soaring*.

According to this same magazine, Pete Bonataux, after making a visit to Washington, D. C., to find out how gliding and soaring could be aided by various branches of the government, reports that every person he spoke to in the Capital was willing to help in every way possible to adopt and carry out any reasonable, sound and not too expensive program that would further the movement in this country. Which sounds very encouraging if they'd only show some speed.

The International Committee for Study of Motorless Flight (I.S.T.U.S.), which issues the Silver "C" certificates, is planning to establish a new award for high-performance soaring, to be known as the gold high-performance award. The pilot eligible for it must be a Silver "C" man, must have flown a distance of at least 300 kilometers (187.5 miles), and have reached an altitude of 3000 meters (9850 feet).

Wolf Hirth, the designer of the Minimoa, while flying his power plane from Germany to South Africa, soared it under a mass of cumulus clouds, and the up-current was so strong that he gained 300 feet of altitude in three circles.

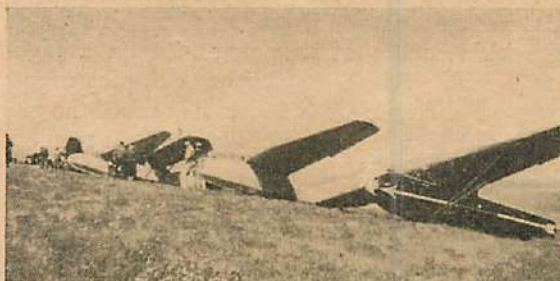
At the annual meeting of the Wings Soaring Club of Philadelphia, the following officers were elected for next year: President, Lewin B. Barringer; Vice-president, Samuel T. Freeman, II; Secretary, Helen M. Barringer; Treasurer, Dr. W. Edward Chamberlain.

The club is tentatively planning to leave Wings Field in the near future and start operations on a farm a mile or two west of the Main Line Airport at Paoli, which is 20 miles from Philadelphia. Members are trying to get the use of a winch and expect to operate there throughout the summer with their Stevens-Franklin, Mr. Brown's Wolf, and the new Ross R-2 high-performance sailplane scheduled for delivery to the Soaring Society very shortly. With this ship Lewin Barringer intends to continue the experimental work started in Texas and thereby prove, if possible, that thermal soaring can be done anywhere in the United States from winch tow over level fields.

The movement grows!



The holder of the unofficial American altitude record, John Robinson's "Robin," showing transparent nose.

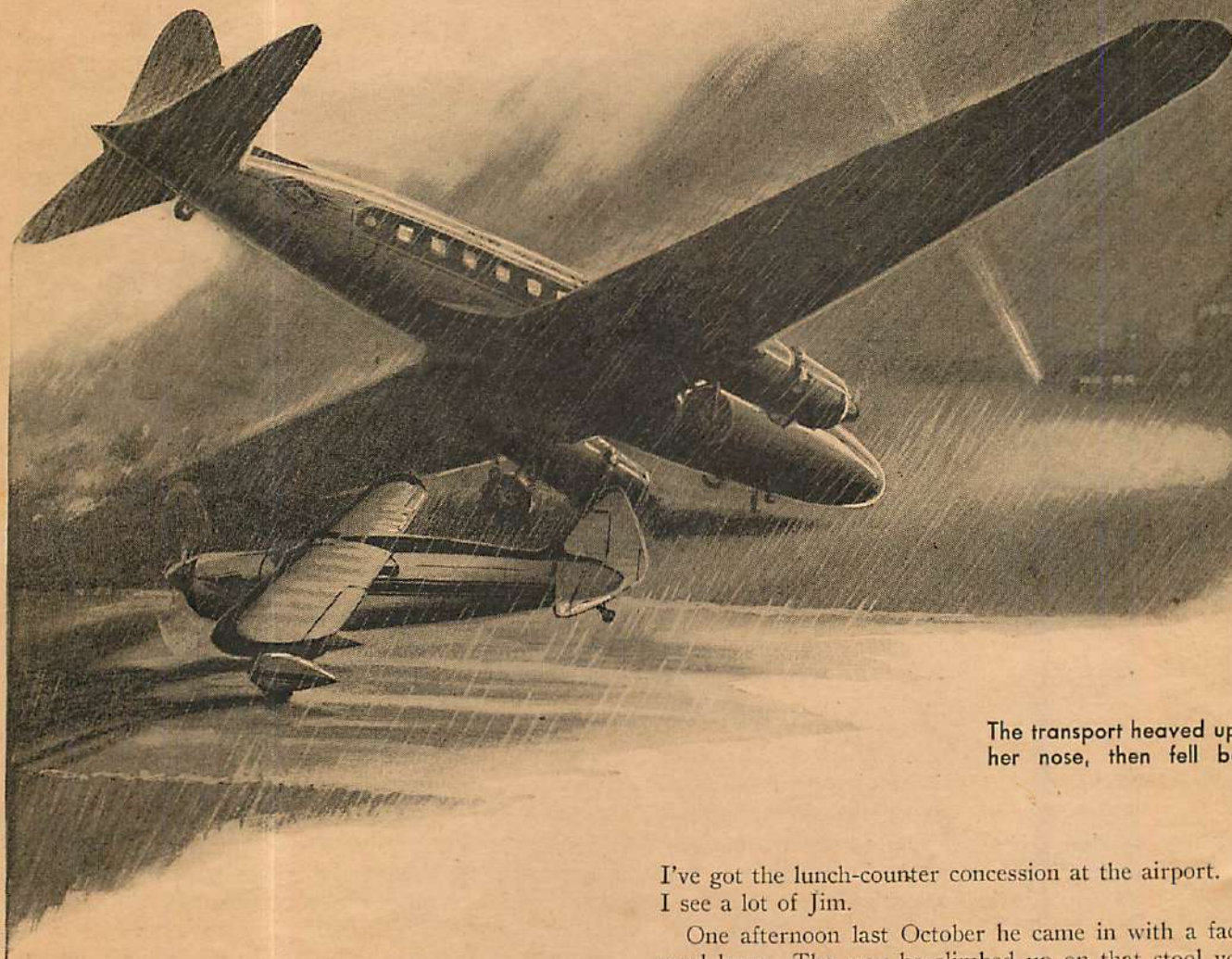


A lineup of ships on a California soaring ridge. R. to L., the "Swift" "Robin," "Soloflugen," and "Transporter."



# LUCKY DAY

By Charles S. Verral



The transport heaved up on her nose, then fell back.

ANY other pilot would have been dead or in a wheel chair long ago. But not Senior Pilot James Jefferson Day of Coastal Airways. Not Jim. He was always getting into the damndest jams and always coming out right-side up and still kicking. That's why we called him "Lucky" Day.

He'd got the label when he'd jumped from a burning ship on his first solo as an air corps cadet. His 'chute had come within inches of dropping him on a high-tension power line. Only the grace of God, plus a gust of wind and a yank on the shroud lines had saved the guy from frying. The handle Lucky had stuck from then on. And time after time in his hair-raising career Fate had snatched him from a wooden kimono.

Jim hated the nickname. He knew why he'd had those crashes. It was the jinx. But he kept mum about it to everyone but me.

I've been a buddy of Jim's since the days when I flew the mail. This empty sleeve is a souvenir of my last hop.

I've got the lunch-counter concession at the airport. So I see a lot of Jim.

One afternoon last October he came in with a face a yard long. The way he climbed up on that stool you'd think it was the electric chair.

It'd been a month since Jim's last narrow escape when he'd piled up one of Coastal's transports in an emergency landing. With his fuel running low, the beacon receiver out, he'd groped his way down through heavy fog, not knowing where in blazes he was. But he landed all right. He picked the only clearing in a hundred square miles of forest. Oh, sure, he crumpled back his wings and knocked himself cold, but his passengers and crew got by without a scratch. It was smart flying—but you can see why he was tagged Lucky.

I happened to know that the committee investigating the pile-up was going to return a verdict that afternoon. And when I saw Jim dragging his anchor, I got worried. But I didn't let on. I came breezing down the duck boards back of the counter and said, "Why the sour puss, Lucky?"

Jim's short and wiry, with close-cropped hair and a mapful of freckles. Generally he's pretty cheerful-looking.



## *Lady luck makes a down-wind landing and saves the day for "Lucky."*

But today the corners of his mouth were drooping and his blue eyes were sort of glazed.

"I've just come from the investigation," he said gloomily.

"Well—weren't you exonerated?" I asked, a darn sight more cheerfully than I felt.

"Oh, sure," Jim said.

"What's biting you then?" I said, relieved. "This is another of your lucky days."

He looked at me as if I'd knifed him. "Hell, Pete," he said. "Can't you see I'm not lucky? I'm jinxed. This last pile-up shows it. Listen. I washed out three ships in the Army. Two more when I flew the mail. I thought when I got into transport work my luck would change. But it hasn't. This last thing makes six crashes, Pete."

"What about it?" I said. "None of them has been your fault. No one's been hurt. You've always been cleared."

"Sure I've been cleared," he said dismally. "But if I'm not jinxed, why don't other pilots get the lousy breaks, too?"

"They do," I pointed out. "Only most of them are under the ground. Or crocks like me."

"Eyewash," Jim said. "One of these days Cap Richardson and the other big shots are going to get wise. Once they realize I'm a jinx pilot—I'll be fired. No one will give me a job. I'll be through."

I'd heard Jim act like that before. Sort of dramatizing himself. So I gave him the horse laugh. "Your luck will hold," I told him.

I guess I've never spoken truer words. Jim's luck held, and how. He took 'em up and he set 'em down neat as a pin. Even the weather seemed to break right for him. But the pay-off came when he met Marj McInnis.

This McInnis girl was the niece of old "Moneybags" Duncan McInnis, the lumber tycoon. She was a sweet job. Blond hair, a slim little body and a cute face. I'd seen her any number of times. She was taking flying lessons at the Thomas Air College directly across the field from Coastal.

A bunch of the other guys had seen her, too. Especially Pat Brown and Kennie Hunter. But Marj hadn't given any of 'em so much as a tumble. Although Pat and Kennie had done just about everything but kidnap her.

Jim didn't know she even existed and probably didn't care.

One morning he'd brought his trip in and was moping around the lunchroom trying to unload his grief on me. I was getting fed up by this time and a little worried, too. This jinx idea had really grabbed hold of Jim and I figured maybe I'd better have him psychoanalyzed or something.

It was a honey of a day, with the sky scrubbed clean of clouds and the sun reflecting on the concrete of the runways. There was only one plane in the air—an open cockpit job belonging to the flying school. It was swing-

ing low over the field in big lazy circles, the drone from its engine steady and monotonous.

Jim was standing in the doorway, staring at the ground. "Everything's going too good," he said dolefully. "It's only the quiet before the storm."

"Snap out of it!" I blazed at him. "You're sitting on top of the world. Think of the starving Chinese—"

"I've even considered resigning," Jim went on. "Just to get it over with quickly. But all I know is flying. Maybe, Pete, if the worse comes to the worst, you'd give me a job washing dishes."

I started to laugh until I saw Jim was deadly serious. "Sure," I said. "But first I'm going to give you a swift kick in the pants." I meant it, too.

Jim looked at me like a beaten dog, then walked away. I watched him go down the apron toward the hangars, his shoulders slumped, his feet dragging.

Beyond him, the training plane was coming down in a shallow dive over the air school. The drone of its engine stopped. The pilot was going to land—was going to land down-wind!

The ship was coming in fast, too fast, riding a thirty-mile-an-hour breeze. The wheels touched the ground. The crate bounced, staggered and then came down again. It had covered half the field and was streaking in the direction of Coastal's hangars—and Jim. He had stopped and stood watching the oncoming plane. I knew there was going to be a smash-up and I went cold.

The ship porpoised across the field. Suddenly she rocked. One wing dipped, gouged into the ground. She spun around like a top and smashed down in a cloud of dust—not fifty yards from where Jim stood.

Remember what I said about his luck holding?

I started running. The ship was lying on her belly, her undercarriage crushed, one wing crumpled up. I saw Jim race over and before I had covered half the distance he'd cut the ignition switch and pulled out the pilot.

Yeah. It was Marj McInnis.

When I got there Jim still had her in his arms. She had a small bruise on her tanned forehead, but aside from that she seemed intact. She opened her eyes and looked up at Jim for a long minute. Then she smiled and said, "Thanks, fella."

She was wearing jodhpurs and leggings and a kelly green shirt. Her helmet had fallen off and the sun was in her blond hair. She was an eyeful, I'm telling you.

But Jim just glared down at her. "Don't you know enough not to make a down-wind landing?" he said.

She twisted her head and grinned. "I do now."

By this time half the birds from the shop were gathered around and a dozen pilots. The ambulance and the crash car came screaming across from the air school. There was much excitement.

Jim lifted Marj into the ambulance, although she didn't seem to be hurt. But the air-school doctor wanted to give her the once-over. I heard her whisper to Jim, "Don't leave me."

Yes. It was like that.

Jim went with her.

I saw Pat Brown and Kennie Hunter standing there as the ambulance drove away. Pat was (Turn to page 87)



# Official Senior N.A.A. News

*The news and current developments in aeronautical activities as reviewed by the National Aeronautical Association.*

## F. A. I. STUDIES WORLD AVIATION

FROM an international standpoint, the most important aeronautical event of the year is the annual conference of the Federation Aeronautique Internationale. The 1938 gathering of air leaders from all over the world was scheduled to be held in Berlin, June 22nd-28th, when questions affecting the whole international aeronautical scene were to be discussed.

In the American delegation, a galaxy of aviation notables were invited to serve under the chairmanship of Godfrey L. Cabot, pioneer American seaplane pilot and aviation philanthropist. Other delegates included John J. Ide, technical assistant in Europe of the National Advisory Committee for Aeronautics; Sidney Veit, chairman of the N.A.A.'s Foreign Relations Committee in Paris; and Mitchell Carroll. Alternates were Grover Loening, early American airplane pilot and long a prominent designer; and J. J. White, former president of the Private Flyers' Association.

Cabot, the delegation's chairman, has had a distinguished record. During the World War he was the oldest pilot in the Navy and commanded the Marblehead Aviation Camp. Following experimental duty at Hampton Roads, Virginia, and duty in the Naval Reserve, he served as president of the N.A.A., 1924-25. Mr. Cabot has long been one of aviation's greatest benefactors.

The F.A.I., since its organization in 1905, has been the international governing body for competitive flying and air records. Its current sporting laws and record categories are recognized as official throughout the world. These are based on the F.A.I.'s more than quarter century of air sports activity.

For many years this international organization was the only body which officially certified individual piloting proficiency. In many countries its aviator's certificates are still the only official heavier-than-air and lighter-than-air pilot licenses.

The F.A.I. recognizes only one sporting authority for each nation, and the supervision of sporting events in a country is limited to officials appointed by this affiliated club. The results of every sporting event must be



Dr. George W. Lewis, director of research of the National Advisory Committee for Aeronautics and chairman of Council on N.A.A. affairs.

Prepared  
by  
William R.  
Enyart  
Secretary, N.A.A.

homologated by the Contest Board of this national club. Insofar as nationals are concerned, the affiliated club is sovereign judge for aviation sport within the boundaries of its country. In case of international disputes, the F.A.I. is the court of appeals.

For many years the annual conferences of the F.A.I. have been outstanding gatherings of international aviation leaders. At these conferences, revisions are made in the organization's sporting laws, action is taken to further stimulate international air sporting competitions and to facilitate international air touring and general international aeronautic cooperation.

## BARRINGER BREAKS RECORD

The existing American glider distance record was broken recently when Lew Barringer, manager of the



Major Jimmie Doolittle.





Loening Intercollegiate Flying Trophy, won by Leland Stanford for 1937.



The Collier Trophy awarded for the year's outstanding achievement in aviation.

Soaring Society of America, rode the wind for 212.45 miles between Wichita Falls, Texas, and the Tulsa Municipal Airport, in his motorless craft. Barringer, one of the handful of "Silver C" soaring pilots in the world—and that's the highest rating—may also have set a new altitude record.

Low exceeded by a wide margin the former excellent distance record of Dick duPont of 158 miles.

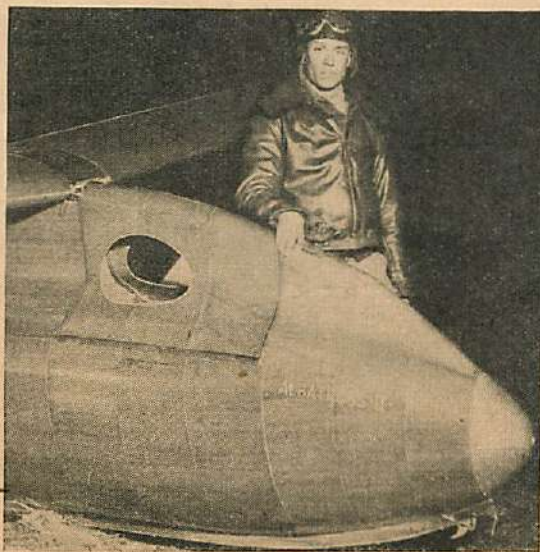
Downtown throngs at Oklahoma City first noticed the sailplane wheeling noiselessly overhead at one o'clock in the afternoon, and thought that the machine was coming to earth there. But Barringer, riding easily in the ideal soaring conditions, decided to continue on to Tulsa, where he landed at 4:30. Incidentally, he became \$1,000 richer by smashing the existing record and copping the Martindale prize.

Barringer reported that thermal currents had boosted his sailplane to 7,500 feet, according to his altimeter. If, when his barograph has been corrected, this is proven to be accurate, he will have set a new altitude record in addition to the distance mark. The old altitude figure is 6,250 feet.

#### BOY KING TO SPONSOR MODEL CONTEST

His majesty, Peter II, King of Yugoslavia, has announced that he will sponsor an international model contest to be held annually under the F.A.I. Sporting Code.

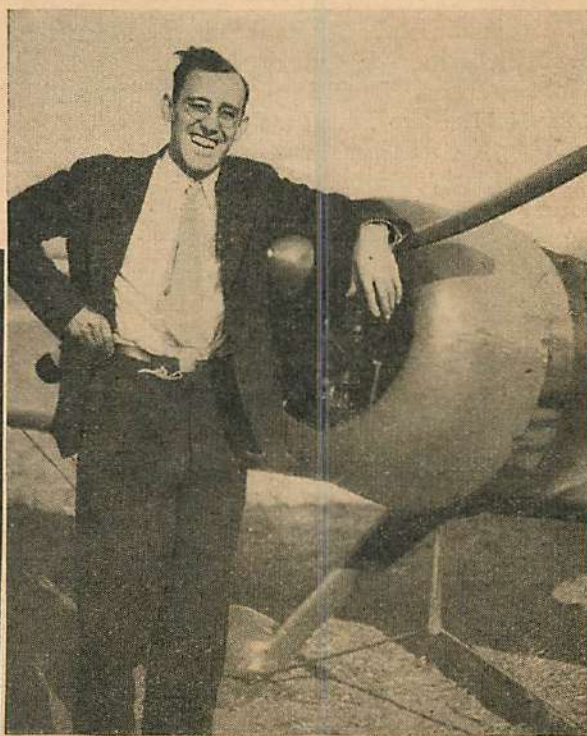
Lewin Barringer, Silver "C" pilot, recently credited with the new American distance record for gliders of 212.45 miles.



His purpose, it is stated, is to stimulate "interest which youth has for aeronautics and to enlarge the domain of model sport beyond national contests, with the purpose also of developing relations between ardent model builders of the world, the future technicians of aeronautics, and for general progress." Toward this end, the King has established a cup destined as a periodic award.

The contest comprises two categories of models: A, gliders, and B, rubber-powered models. For rubber-powered models, the contests will take place on even years, and the glider events will come on odd years. Thus the club which wins the cup in any given year must, the following year, defend it in a different category, which will encourage builders to work on the construction of both types of model craft.

The contest for the cup will be held each year and will be organized by the National Aero Club which won it the preceding year. Teams may be entered (*Turn to page 84*)



S. J. ("Oshkosh") Wittman.



*One of aviation's most hotly contested debates is the Diesel versus gasoline engine. An international authority here presents the case for the Diesel.*



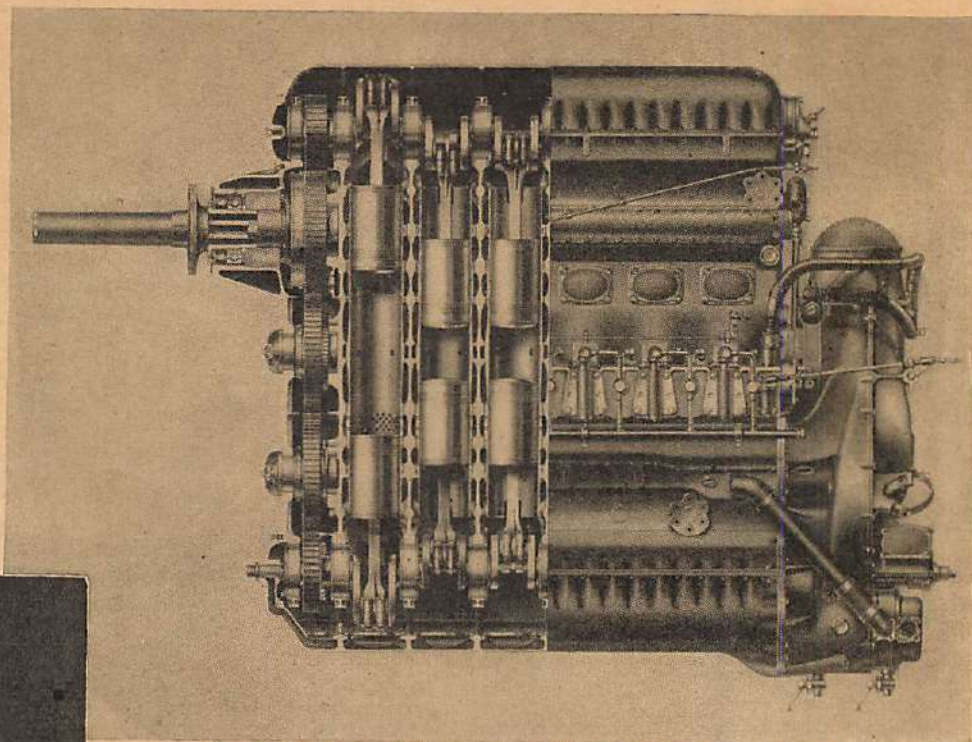
Dr. Rudolf Diesel, 1858-1913.

#### PART I—HOW THE AIRPLANE DIESEL OPERATES

ON December 2, 1936, was celebrated the fortieth anniversary of the introduction of the Diesel engine into the United States. More than three hundred business leaders of the nation gathered at the Waldorf-Astoria Hotel in New York City and gave full credit to the late Dr. Rudolf Diesel for designing and building the first practical compression ignition engine. At the luncheon which followed, Capt. Eddie Rickenbacker predicted that eventually we would have Diesel engines of 1,000 to 5,000 h.p. in giant airliners carrying 100 to 300 passengers, as well as mail and express. "The plane of the future in which this engine will be installed," he said, "will have all the comforts of home, with a cruising speed from 200 to 300 miles an hour."

How near we are to this plane, you can judge for yourself from the call for designs for 100-passenger airliners recently sent out by Pan American Airways. How near we are to Diesel engines to power these planes, will be explained later in this article.

Before discussing the airplane Diesel as we know it today, let us go back for fifty years or so and trace the origin and development of the engine which has solved so many of our transportation problems on land, on sea and in the air. We find, for instance, that the inventor of the engine, Rudolf Diesel, was not born in Germany but in Paris, in the year 1858. His parents were German, however, and so when Paris was besieged in 1870 during the Franco-Prussian War, his family fled to Eng-



Sectional view of the Junkers "Jumo" 205 Diesel. Two pistons are fitted in each cylinder. The two crankshafts are geared to a single propeller shaft.

# THE DIESEL IN AVIATION

By Paul H. Wilkinson

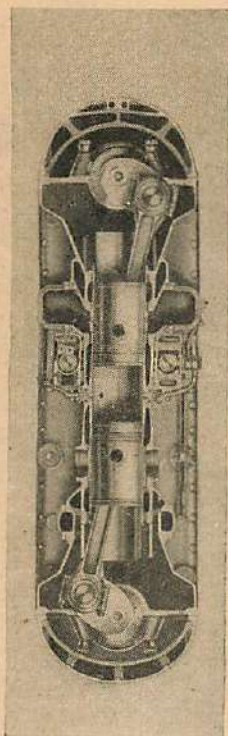
*Author of "Diesel Aircraft Engines"*

land and took him with them. Later, Rudolf was sent to live with relatives in Germany, completing his schooling at Augsburg and then graduating from the Polytechnic School in Munich. It was while studying at Munich that he learned that the steam engine was so wasteful that not more than 10 per cent of the heat produced was converted into mechanical energy. This made a deep impression upon him, and he decided to invent an engine of his own which would be far more efficient.

It was not easy for Rudolf to accomplish the task he had set out to perform. For fourteen years he labored, and during this time he tried out many ideas. He learned that when air was compressed, its temperature increased in proportion to the pressure that was applied to it. There, perhaps, was a means of igniting his fuel provided he could get the air hot enough. Then he remembered that while at college he had seen a "fire tube," consisting of a strong glass tube sealed at one end, in which inflammable material could be placed and ignited by rapidly thrusting a piston into it. This gave him the idea he wanted. Why not make the fire tube of steel to withstand greater heat, and compress the air with a steel piston to a much higher temperature to insure the instantaneous combustion of the contents?

He found that this would work and in 1892, satisfied that his theories were correct, he took out a patent for his invention. Virtually, this is the principle now used in





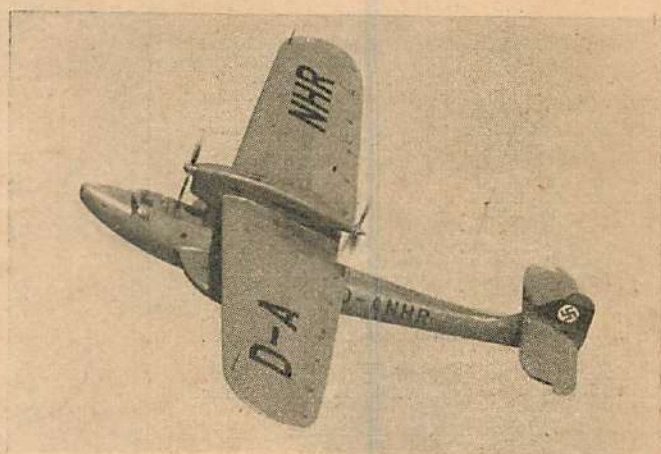
End view of the  
Junkers "Jumo"  
205 Diesel.

the compression ignition engine, with the modification that the fuel is sprayed into the cylinder after the piston has compressed the air to a high enough temperature to ignite it.

To return to Rudolf, or Dr. Diesel, as it would be more appropriate to call him, we find that he was fortunate in interesting two large industrial concerns—the Augsburg Machine Works (now the M.A.N. Corporation) and the Krupp Works at Essen—in developing and building his engine. With their assistance he made good headway, and although the first engine he built exploded and nearly killed him, he persevered and finally, in 1897, completed his first practical engine for commercial use. Tests of this engine showed that it transformed 35 per cent of the heat energy in the fuel into mechanical energy or power, compared with 12 per cent for the average steam engine then in use. For fuel, he used crude oil, although

originally he had intended to use coal dust sprayed into the cylinder. This first compression ignition, or Diesel, engine was of the single-cylinder, slow-speed type and developed about 25 horsepower.

After this achievement, his success was assured. Patents were taken and licenses to manufacture his engine in various countries were granted. The Diesel, as his engine came to be called, became especially important in the shipbuilding industry. It took up much less space than the steam engine with its coal bunkers, and in addition it was cleaner and required a smaller crew to look after it. In short, it was the answer to the mariner's prayer. So successful in this field did it become that, by 1912, there were twenty-eight factories in different parts of Europe building it for marine use alone. Ultimately it came to be used in submarines, and in fact the submarine owes much of its existence to the Diesel. Many other uses were found for the engine, which, in those days, was of the slow-speed type and of heavy construction. It was for the inventor's successors to develop the high-speed, light-weight Diesel for transportation purposes as we know it today.



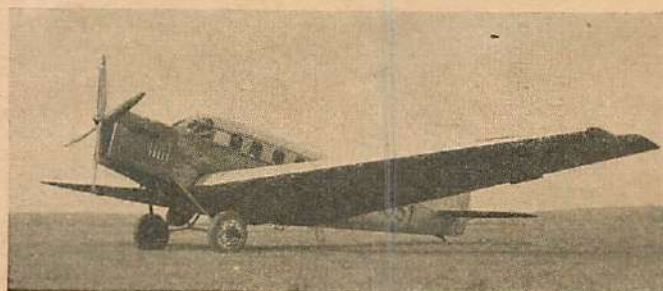
The Dornier Do-18 flying boat powered with two 600 h.p. Junkers "Jumo" 205 Diesels which recently broke the world's long-distance seaplane record.

In the midst of his success, Dr. Diesel met a tragic end. Soon after his engine had made the submarine possible, he was called to England for a consultation with the British Admiralty—perhaps to discuss this very subject. All we know is that while he was crossing from Antwerp to Harwich on the night boat, on his way to London, he mysteriously disappeared. The next day, neither he nor the important papers which he carried could be found. Whether he met with foul play or fell overboard, nobody knows. It was on September 29, 1915, that Rudolf Diesel passed from our sight, long to be remembered as a persevering inventor and a courageous pioneer.

Dr. Diesel's work was appropriately taken up by a fellow countryman, Dr. Hugo Junkers, who was the inventor of the remarkable airplane engine which bears both their names—the Junkers Diesel. Hugo, too, had been a keen student of thermodynamics, or the theory of the transformation of heat energy into mechanical motion. It was natural, therefore, that he should concentrate on the same type of heat, or internal combustion engine, for his experiments. His first patent for a compression ignition engine was taken out in 1907, and was for an engine of the industrial type. Dr. Junkers was also very much interested in aeronautics, and in 1910 he took out his famous patent for an "all wing" or "flying wing" airplane. This invention consisted of a single hollow metal wing which housed within its framework not only the engines and the fuel tanks, but the passengers and the crew as well. The engines, even at that early date, were shown to be of the opposed-piston type which now is considered so desirable for "in-the-wing" mounting of power plants. His thick-section metal canti-



A Swissair Junkers Ju-86 airliner equipped with two 600 h.p. Junkers "Jumo" 205 Diesels.



The Junkers J-41, the first Diesel-engined airplane in Germany, 1929.



**Two-cycle Diesel engine (top, right)**

(with inlet valve in cylinder head and exhaust ports around lower portion of cylinder wall)

**I Intake**  
Air inlet valve open. Cylinder fills with air under slight pressure.

**II Compression**  
Piston covers ports. Inlet valve closes. Piston ascends and compresses air in cylinder.

**III Expansion**  
Piston reaches top of stroke. Fuel is injected and ignited by hot air and expands, forcing piston downward.

**IV Exhaust**  
Piston nears bottom of stroke and begins to uncover ports. Burnt gases rush out. Inlet valve opens and air rushes in to scavenge cylinder.

**Four-cycle gasoline engine (lower, right)**  
(with inlet and exhaust valves in the cylinder head)

First revolution of crankshaft

**I Intake**  
Inlet valve opens. Piston descends and sucks in explosive mixture from carburetor.

**II Compression**  
Inlet valve closes. Piston ascends and compresses explosive mixture in cylinder.

Second revolution of crankshaft

**III Expansion**  
Compressed explosive mixture is ignited by electric spark and expands, forcing piston downward.

**IV Exhaust**  
Exhaust valve opens. Piston ascends and forces burnt gases out past exhaust valve.

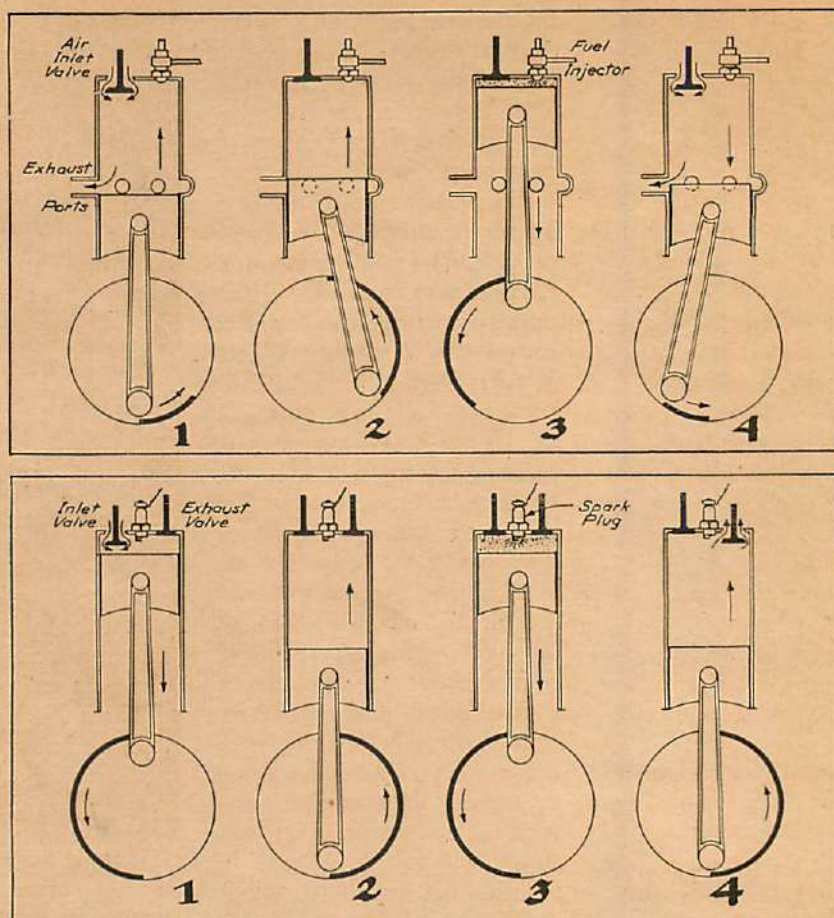
Note: The above operations take place while the crankshaft makes two complete revolutions.

lever wing, which at first was ridiculed and rejected as impractical, has now, twenty-eight years later, become the accepted pattern for all large aircraft.

From the very first, the Junkers Diesels were of the opposed-piston type with the reciprocating parts in perfect balance. Dr. Junkers started to build his first airplane Diesel in 1912, the first model produced being the four-cylinder MO-3 in 1913, which was followed by the six-cylinder MO-8 in the following year. Both these engines were of the horizontal type, with electric ignition. Then came the six-cylinder FO-2 in 1915, which had compression ignition and developed 450 h.p. During the following year, a 1,000 h.p. engine was designed, which shows the extraordinary progressiveness of Dr. Junkers. At that time the most powerful gasoline engines were of only 350 h.p., while today, twenty years later, we have only just progressed beyond the 1,000 h.p. commercially practical gasoline engine!

After the War, development of the Junkers engines was restricted due to the Treaty of Versailles, which limited to 200 h.p. the size of airplane engines which could be produced in Germany. It was not until several years later that the next model appeared, but when it did it created a sensation. This was the FO-3, which was exhibited at the International Aviation Exhibition in Berlin in 1926. A radical change in the design of this model was noticeable, for it was now of the vertical type which is characteristic of the latest Junkers Diesels today. It was also unique in that it had five in-line, water-cooled cylinders, and had a rating of 830 h.p., which was a powerful engine twelve years ago.\*

It was considered that a smaller size would be more useful, however, so it was redesigned and introduced again in 1928 as the six-cylinder FO-4, with a rating of 700 h.p. This was the first practical Diesel airplane engine. The following year it was installed in a Junkers Ju-41 all-metal monoplane and made its first cross-country flight from Dessau to Cologne. In 1931, after it had passed a further type test with a rating of 720 h.p., it was



christened the Jumo 4 and was placed in regular service on the Deutsche Lufthansa air lines. Thus, after twenty years, the problem of the airplane Diesel had been solved!

Subsequently, the Jumo 4 was further refined and was installed in giant four-engined Junkers G 38 airliners of the D 2,000 type. Then its power output was increased to 750 h.p., its weight was reduced to 1,650 pounds, and it became known as the Jumo 204. In 1933, however, it was replaced by the Jumo 5, an engine considerably smaller and lighter than its prototype. Originally developing 550 h.p., the power of this new engine has been stepped up until the latest model, the Jumo 205-D, now has a rating of 700 h.p., while the end of its development is not yet in sight.

While development work on airplane Diesels has not been confined to Junkers, nevertheless Germany is the only country in which this marvelous power plant is making appreciable headway in air service at the present time. Other countries have had plenty of opportunities, but so far have made little use of them.

In the United States, although the 225 h.p. Packard DR-980 and the 185 h.p. Guiberson A-980 engines made quite a showing from 1929 to 1931, nothing is heard about them today. Packard dropped the development of its engine soon after the death of its designer, Capt. Lionel Woolson; while work on the Guiberson engine has been confined to experimental orders for the Army and the Navy, and the production of a few engines for Army tanks. The same condition exists in other countries. In England, the 415 h.p. Bristol Phoenix showed great promise in 1934, and Napier interested themselves to the extent of acquiring a Junkers license and turning out a few 750 h.p. Culverins along the lines of the Jumo



204. France has seen a good deal of development work on the part of Clerget, Salmson and C.L.M. (the latter under Jumo 205 license), but so far there is little to show for the expenditure of time and money. Czechoslovakia became interested in the Diesel some time ago and acquired a Packard license—now all they have to show is the government-built 260 h.p. Z.O.D. model 260-B engine, which is still in the experimental stage.

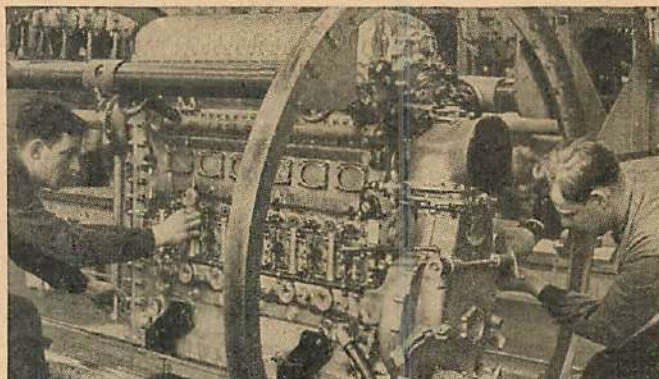
The most promising engines under development at the present time are the Deschamps Diesel in this country and the Coatalen 12 Vrs 2 engine in France. The Deschamps Diesel is a powerful, twelve-cylinder water-cooled engine rated at 1,200 h.p., which would be ideal for transatlantic planes and long-range patrol flying boats. It has been completed and parts of its tests have been run, but at the present time further work on it is held up for lack of funds. The Coatalen engine was exhibited at the Paris Aero Show in 1936, where it received most favorable comment from the President of France, M. Le Brun, and the Air Minister, M. Pierre Cot. Apparently M. Coatalen received assistance from the government, for now his engine is undergoing the homologation tests of the Air Ministry.

The Coatalen 12 Vrs 2 is a compact, twelve-cylinder water-cooled engine which is rated at 600 h.p. It should find many uses for multi-engine installations in small planes for passenger and mail work. There is an interesting story about the development of these engines, too, but inasmuch as they have yet to prove themselves in the air, it would be well, for the present article at least, to confine ourselves with the realities and not the possibilities in the field of Diesel aviation.

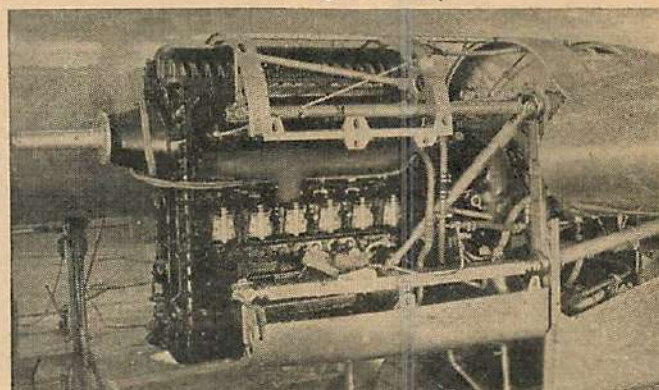
Now that we have seen how the Diesel came to be invented and developed, let us see how the engine operates. To the casual observer, there is not much difference between the high-speed Diesel and the gasoline engine. In size and appearance they are much alike. Both are internal combustion engines in which the fuel is burned inside the cylinders, rather than outside as in the steam engine. Many of their parts, such as the crankcase, cylinders, crankshaft and connecting rods, are of similar design. Close examination, however, will reveal that the Diesel has no carburetor, magneto or spark plugs, but in their place has a fuel pump and fuel injectors.

Most of us are familiar with the operation of the gasoline engine. We know, for instance, that air drawn at high velocity through the carburetor sucks out gasoline from the jet, mixing with it in just the right proportion for combustion. This explosive mixture is then sucked into the cylinder on the down-stroke of the piston, or is forced into it if the engine is equipped with a supercharger. The mixture in the cylinder is then compressed on the up-stroke of the piston and, at the right moment, an electric current from the magneto causes a spark to jump between the points of the spark plug and ignite the mixture. As the gases expand, they force the piston down on its power stroke, while on its up-stroke the burnt gases are driven out through the exhaust valves and the cycle of operations is repeated as before. During each complete cycle of operations, i.e., between one power stroke and the next, the piston of the gasoline engine makes four strokes (two up and two down), while the crankshaft makes two complete revolutions. The gasoline engine operates on the four-stroke, or four-cycle principle.

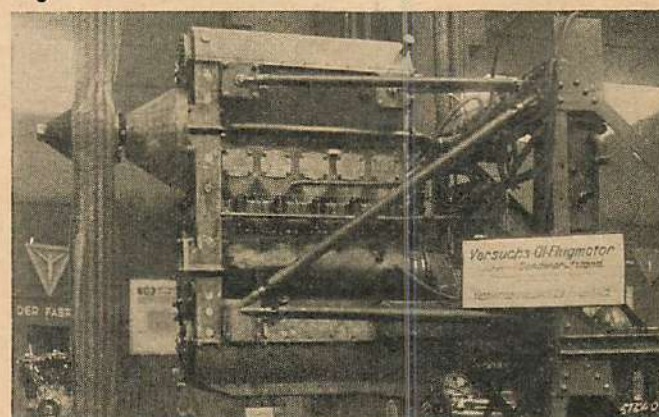
The sequence of operations in the four-cycle gasoline engine is:



A "Jumo" 205 on the assembly line in the factory. Note the novel circular frame that facilitates movement of the unit during assembly.



How the "Jumo" 205 is mounted in the wing of a twin-engined airliner. German aviation, is based on the Diesel.



The first Junkers airplane Diesel to be exhibited, 1926. Note the resemblance to the modern "Jumo." Strange to say, this early engine had five cylinders.

1. Intake of explosive mixture on the down (or suction) stroke.
2. Compression of explosive mixture on the up (or compression) stroke.
3. Ignition and expansion of the gases on the down (or power) stroke.
4. Exhaust of the burnt gases on the up (or exhaust) stroke.

Turning now to the Diesel, or compression ignition engine, we find that an entirely different method of fuel mixing and fuel ignition is employed. The carburetor, or fuel mixer of the gasoline engine, is dispensed with, while in its place are a high-pressure fuel pump and fuel injectors. This pump supplies fuel oil under pressure to the injectors which, when actuated by cams, permit minute quantities of the fuel to be sprayed into the cylinders. As to ignition, this is simplified (*Turn to page 93*)



# LIGHT PLANE FLYING CLUBS

CONDUCTED BY  
ARCH WHITEHOUSE



Globe

One of the Romford Woman's Air Patrol members explores the works of their ship, at their club at Romford, England.

Send in your snaps of clubs, new ships people.—A. W.

*Why the light plane flying club is the "future" of aviation—and about licensing home-built aircraft.*

I AM often asked just what all my interest in light plane clubs is leading to. I am often asked what it is all about and whether I have any personal interest in any particular light plane.

"Why do we need light plane flying clubs?" one gentleman inquired.

You know, he just said it, flicked the ash off his cigarette and slumped back, satisfied that he had done his share toward making the evening's chat bright and breezy.

I was all ready to enumerate several important reasons why the country needed light plane flying clubs, but was interrupted by another "aviation fan" who had a new story about an undertaker, and I never did get around to my end of the argument.

However, the question nettled me all the way home, and the more I thought about it the more I was convinced that it should be settled for once and all. I would have liked to have told that bird, moreover, that I was in no way interested in any particular light plane or have any interest in any particular firm manufacturing light planes.

It's the fellows who want to fly that I'm interested in. I have flown and I know how you feel.

In the first place, the cost of flying is still up in the luxury brackets as far as the average flying enthusiast is concerned. It takes money to learn to fly, whether you own a ship or not, and the modern flying club gives the ordinary man or woman a chance. It at least gives him an opportunity of first learning whether he *can* fly, or whether he—or she—is temperamentally and physically

capable. It gives one a chance to purchase flight training under a cooperative plan, under ideal conditions.

In a flying club properly administered one should be able to obtain first-class instruction under good supervision and backed by official regulations. Most people learn more quickly in groups, where they can sit in or stand around and benefit through the mistakes made by others.

As bad as war-time training was, and in spite of all the casualties suffered on student fields, we at least enjoyed working in groups, and learned from the mistakes of others. As soon as one pupil began to develop a queer twist in his flying, we were immediately lined up and

Wide World

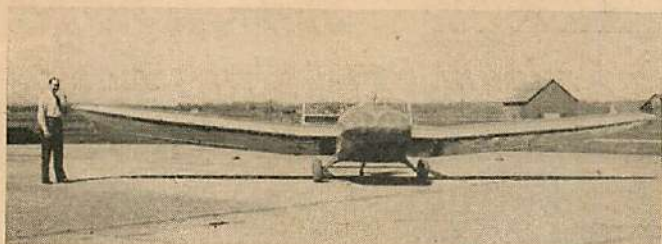


Bryan McGinney and Don Perkins of Georgia Tech train for the proposed aerial meet with U. of Ga.

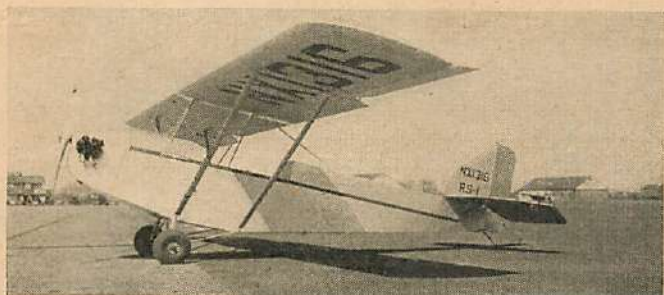




The new M50 "Air-Dale," top speed 110 m.p.h. and landing speed 40 m.p.h. without flaps. 150 of these are planned for 1938.



The new sister ship of the famous Knight Twister, the MC-7, and apparently destined to be equally famous. This ship is a side-by-side pusher monoplane using the new Franklin air-cooled engine.



What one school can produce in an interesting light plane. The Ross RS-1 designed and built by the Roosevelt Field Flying School students.



Practically a motorized glider, the B.A.C. Drone, designed by Silver "C" pilot number one, Robert Krohnfelt. The tiny power plant is an 18 h.p. Douglas engine.



A new addition to a long line of distinguished ships, the new Aeronca "KM" with wheel pants. This ship uses the 50 h.p. Menasco or Continental.

had it explained to the lot of us. The quicker these mistakes developed and were observed, the faster the group progressed toward "passing-out" flying.

Because of the many angles in flight training and the demands of the Department of Commerce, group training is almost necessary if we are to teach flying to a great number of people.

I am not certain where they get their information, but one contemporary technical air magazine recently stated that 30,000 people are at present taking flying lessons. Since there are about 6,000 holders of commercial tickets, that is to say, men who can legally give flight training, it works out that each has an average of five pupils. However, as is generally known, only a comparative few of those with commercial ratings are capable of giving flight training; likewise, only a comparative handful of the students have the time or money to enroll in the big schools like Boeing, Parks, Spartan and Ryan. Thus it becomes obvious that if all those receiving flight training are to get *safe* and *proper* instruction, the flying clubs are sorely needed.

Flying clubs, the more we think of them, are an absolute necessity if we are to build up aviation in this country. When I say build up, I mean exactly that, for I am of the opinion that commercial and military aviation can only advance with the progress of the masses. The more light plane pilots we have, the more the masses will become better acquainted with the safety and convenience of flight. Then and then only will the air lines become actually self-sustaining and not operating on the air mail subsidy. But what, you may ask, has club flying to do with the military side of the picture?

This morning I opened my paper and learned to my absolute amazement that only 217 first-line military planes could be mustered for the Northeastern States war games. As far as I can gather these were drawn from Army Air Corps fields in the Eastern half of the country. The Black Fleet, attacking the United States, had to be "imagined," as there were not enough ships available to carry out the General Headquarters Air Force defense plans to provide an "enemy" fleet to work against.

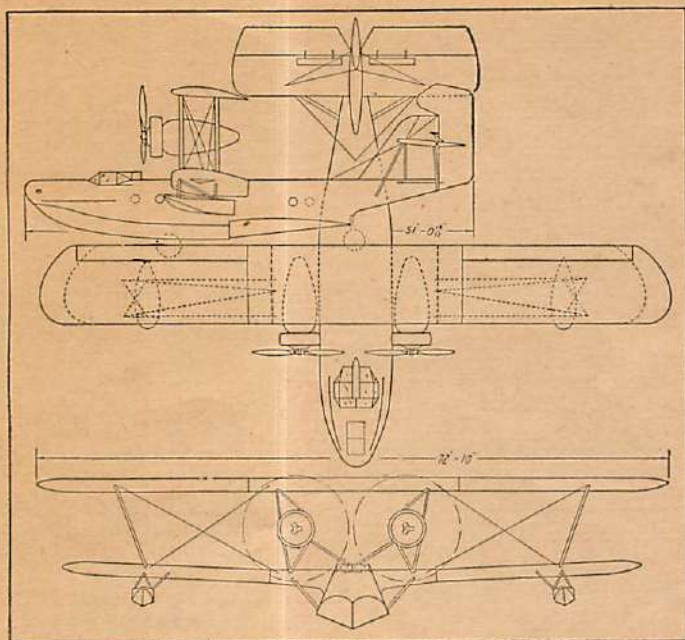
Let's consider the figure of 217 ships as a fair one for the purposes involved. Of this number only 185 were planes suitable for combat purposes. The rest were provisional transports. According to the intelligence reports, one enemy force approaching from Europe was composed of eight aircraft carriers, four battleships, ten heavy cruisers, a large number of light cruisers, destroyers, transport vessels, cargo vessels and supply ships. It is also presumed that they are bringing 700 military planes of various types.

(Turn to page 89)



A nose that's easy to follow, that of the Aeronca "K." Note the wheel control, single strut landing gear and good visibility.





# New Wings for the COAST GUARD

*About the staunch Hall-Aluminum PH-2 flying boat.*

By Nicholas E. D'Apuzzo

THE Hall-Aluminum Aircraft Corporation will deliver six large PH-2 flying boats to the U. S. Coast Guard. A seventh is building and will leave the factory several months later. These boats will be the largest ever built for this branch of the service. The original experimental ship has undergone acceptance trials at the Coast Guard station in Cape May, N. J.

These boats have been designed especially for patrol and rescue work in extremely rough weather. It is in rough weather that the Coast Guard is called upon to do most of its work and these ships certainly fill the bill. They have been called "badly needed equipment" by the Coast Guard, which has been using many ships six and seven years old that have long been obsolete for this type of work. The new boats have a quick take-off and a slow landing speed which combine to make operation in rough weather and choppy seas possible.

The addition of these ships will allow for the maintenance of a regular air patrol along the Eastern seaboard except when emergencies call for all equipment. The patrol radius will also be extended from the regular 400 miles to 750 miles. The top cruising range will be 2,000 miles.

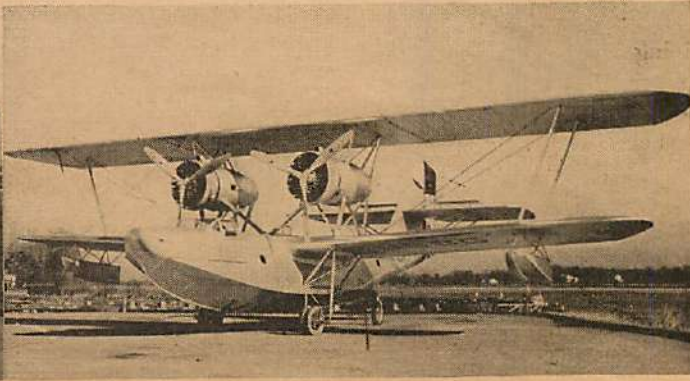
The radio equipment is the most modern yet to be installed in any aircraft. A two-way radio-phone system, radio direction finder and an amplifying system are part of this equipment. These amplifiers are capable of

sending the pilot's voice one mile down and may be used to warn fishing fleets of approaching storms or to pass out instructions to ships in distress.

The design of these ships is similar to the Hall-Aluminum PH-1, the model used in the Navy which has proven itself to be one of the best rough-weather boats in the service. These PH-2 boats are biplanes with fabric-covered aluminum alloy structured wings and tail surfaces. The hull and wing tip floats are of aluminum alloy.

The span of each ship is 72', 10", and the length is 51', 1/2". The height is approximately 17', 2". Each ship is provided with a special beaching gear consisting of two sets of double wheels and one tail wheel. Ball and socket joints are used to hold this gear in place and thus the ship may be moved about on land. The ships may taxi into the water with the gear in place, where it is then removed by two men in a very short time.

The hull of this design is a very clean and interesting one. It is of monocoque construction and is built up around five bulkheads which divide it into six watertight compartments. Two of these compartments are set aside with two bunks each and accommodate the passengers, who may be lifted aboard in Army litters through the hatches and moved to the compartments on a track through the bulkheads. These bunks may accommodate as many as twenty passengers in case the ship is called



Photographic studies of the Coast Guard's newest type.



upon to do rescue work, as in a shipwreck. The crew of each ship includes a pilot, navigator, radio operator and mechanic.

The power plants consist of two supercharged Wright Cyclone engines of 750 h.p. each. The maximum efficiency with the superchargers is obtained at an altitude of 2,800 feet. The ship may fly for twenty hours at this altitude at an airspeed of 152 miles an hour. The propellers are Curtiss controllables, and Breeze cartridge type starters are employed in starting the engines. The landing speed of these boats is 60 miles an hour.

The instruments are very complete and include Sperry gyro-horizons, directional gyros, rate of climb indicators, exhaust gas analyzers, and the latest power plant instruments and equipment. The electrical system is very compact and complete and is carefully shielded and guarded against leaks and possible water spray. An intercommunicating telephone system, fire-extinguisher system, life-saving and first-aid equipment are also carried. Towing, hoisting, and beaching equipment with the usual Coast Guard armament complete the list of standard equipment carried by each of these craft. A folding anchor is one of the novel features. It would require but a few minutes to launch it on an emergency call.

The gas and oil systems are contained in the bottom wings and engine nacelles. The oil cooler occupies a strategic place in each engine nacelle, with a small scoop projecting out into the airstream.

The surface controls in the tail group are all balanced. The rudder is balanced by a small area built at the top and ahead of the hinge line. The elevators are balanced by a paddle balance above and ahead of the hinge line of each elevator. The tail group is large and well up out of the spray. This combination provides for good control of the ship in choppy seas. The ailerons are of the Friese type. All the surface controls are cable-operated and the control wheels are attached to an inverted-U-shaped bridge which leaves the cockpit unobstructed. Six flying wires and two landing wires in each wing panel are used to take care of the enormous load factors encountered in rough weather operation.

The ships are painted in the regulation Coast Guard color scheme as follows:

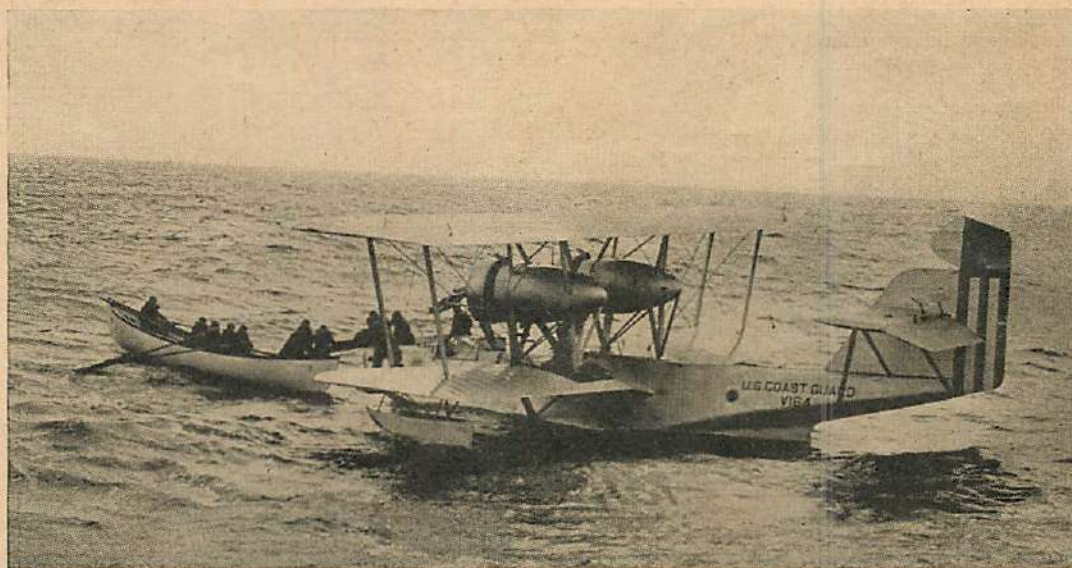
The basic color of each ship is aluminum with Army and Navy yellow for the top surface of the upper wing and for the top surface of the stabilizer and elevators, including the paddle balances. The top third of the rudder is painted insignia blue with the balance left aluminum. The remainder of the rudder has three red and two white stripes alternately in a vertical direction. The letters U.S.C.G. are on the bottom of the lower wings.

The name U. S. COAST GUARD and the plane number appear on the rear part of the hull. The plane number also appears on the bottom of the hull. All letters are block letters and are blue-black in color. The U. S. Coast Guard insignia appears on both sides of the hull slightly below the windshield.

To those who have been interested in the aerial activities of the Coast Guard, the acquisition of the biplane flying boats will, no doubt, come as a surprise.

In fact, the long years of service given by the twin-engined boats of the Douglas Dolphin and General Aviation types have caused the mistaken impression that the most rugged type possible to design would likewise be a monoplane of full cantilever construction.

It should be remembered that the Hall-Aluminum comes of a rugged line of service planes and, consequently, that its trial under fire has been just as long as the Coast Guard duty performed by its predecessors. It is likely that the wing loading of the new Hall-Aluminum is



The plane lands far at sea to pick up an injured sailor.

less than that of the older Coast Guard service equipment.

The effect on performance, especially take-off and landing characteristics in rough weather, should be marked.

For the benefit of model builders who may desire to utilize the three-view drawing of the PH-2 included in this article, it is suggested that the general procedure outlined in the replica model articles be followed.

The drawing may be enlarged to any convenient scale by having a photostat made to the desired size. Otherwise, the drawing may be crossed vertically and horizontally with lines spaced an eighth of an inch apart.

By preparing a larger ruled sheet with the same number of squares, but with the lines spaced as far apart as desired, a larger plan may be created. Simply fill in the drawing by counting squares.

For exhibitional purposes the glossiest of finishes can be obtained by the application of numerous coats to the model. A filler coat should be applied first, using if possible, a commercially prepared filler. Two, or even three filler coats can be applied with alternate sandings with wet-or-dry sandpaper. The top coats should also have alternate sandings. A rubbing compound may be used after the last coat to bring out a smooth finish.





## The Honor Roll for August

### FLIGHT LIEUTENANTS

Don Smith, Dillon, Mont.  
 Albert Alves, Fall River, Mass.  
 Ruth Boynton, Wilmington, Mass.  
 Teddy Cooperstack, New Haven, Conn.  
 Edward Cane, Toronto, Ont., Canada  
 John Abens, Chicago, Ill.  
 Andrew Hill, Dayton, O.  
 Joseph Kmiecik, Indian Orchard, Mass.  
 M. S. Lieberman, Quantico, Va.  
 Abel Villegas, Jr., St. Petersburg, Fla.  
 Bruce Payuter, Acton, Ont., Canada  
 Bert C. Alt, St. Louis, Mo.  
 William Andrus, Jr., Binghamton, N. Y.  
 David Thompson, Orlando, Fla.  
 Harold Aaron, Richmond, Ind.  
 Robt. Beecher, New Haven, Conn.  
 Phil Haglund, Minneapolis, Minn.  
 Everett Cutler, Prescott, Ariz.

### PHOTOGRAPHERS

Clark Dancy, Ottawa, Ont., Canada  
 Jack Maloney, St. Thomas, Ont., Canada  
 Hector McLean, Toronto, Ont., Canada  
 Alan B. Thayer, Athol, Mass.  
 Glen Suannie, Saskatoon, Sask., Canada  
 Eugene Sommerich, St. Louis, Mo.

### TOPOGRAPHERS

Maurice Gwynne, Victoria, B. C., Canada  
 Albert Alves, Fall River, Mass.  
 John Dancy, Fort Erie N., Ont., Canada  
 Joseph Grimaldi, Bronx, N. Y.  
 Godfrey Howard, Brockville, Ont., Canada  
 William Greeley, Milton, Mass.

### AIRPLANE MECHANICS

Jack Miller, Baxter Springs, Kansas  
 Bill Spamer, Tampa, Fla.  
 Mitchell Warzonek, Omaha, Neb.  
 Joe Scordo, Lafayette, Colo.  
 Fred Schilling, Vancouver, B. C., Canada  
 J. Filby, Toronto, Ont., Canada  
 David G. Boodle, Willoughby, N. S. W., Australia

### ENGINE MECHANICS

H. Holder, Napier H. B., New Zealand  
 Gordon Biederman, Pembroke, Ont., Canada  
 Don Smith, Dillon, Mont.  
 Bobby Beall, Sherbrooke, Que., Canada  
 J. C. F. Leachman, London, E. 13, England  
 Jerry Baer, Madison, Wis.  
 Charles Barnhart, Toledo, O.

### OBSERVER

R. Henders, Toronto, Ont., Canada

## Are We Downhearted?

**G**REETINGS, Air Adventurers!

There are times when I wish these pages could be wired for sound.

There are times when cold words in print somehow fail to put over what we are trying to say. If there was only some device which could somehow be connected to a sheet of print, so that the mere pressing of a button would cause the words to leap out properly pronounced, suitably delivered and in spots simply blared forth at you.

We all remember the old story of the British Tommies as they trudged up the line, year after year of the Great War. Whenever the pack became unbearable, whenever the hob-nailed boots took on an extra pound or two in weight, and when the nine-pound rifle became a ten-ton howitzer, some wag in the ranks would somehow gather enough breath and energy to bawl out: "Are we downhearted?"

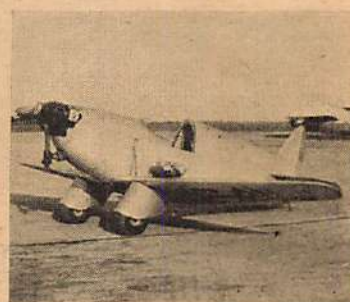
And the response all along the line would be the typical Tommy's answer: "Nao!"

On the strength of that, packs were hunched up again, the rifle was changed over to the other shoulder, and feet by some magic became lighter. Purely mental, of course, but somehow it worked.

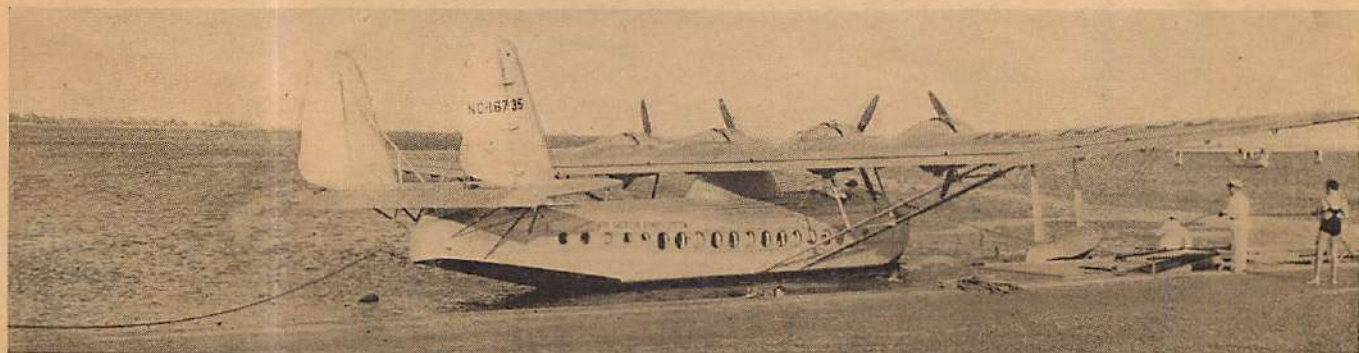
There are times when I wish I could yell out here:

"Are we Air Adventurers downhearted?"

I can only hope the response would be: "No!"



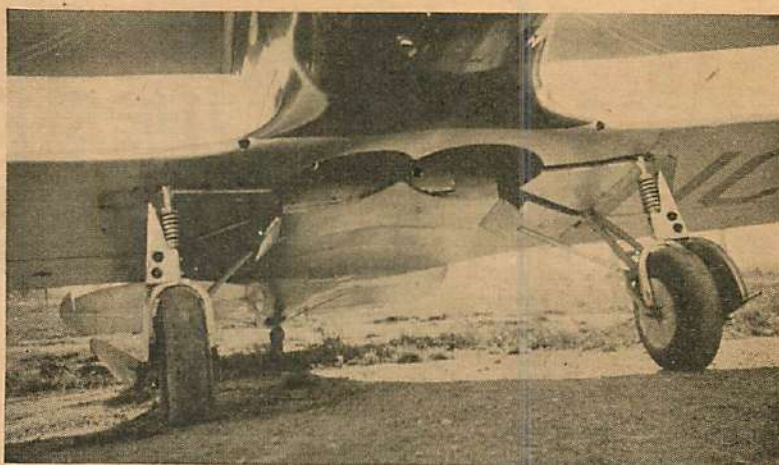
Dal Special manufactured by Wayne Dalrymple and Charles Pheiffer of Wichita, Kansas. Eugene Linn of that city sent the picture in to us.



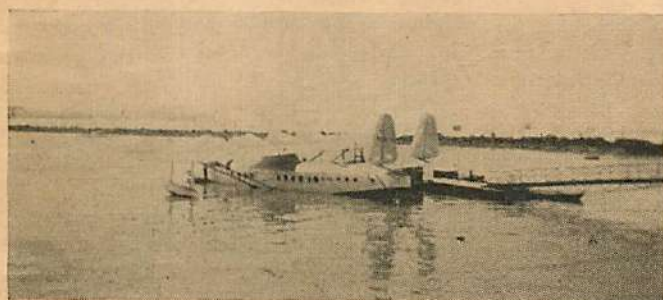
Pan-American Sikorsky S-43 being beached at Miami. Sent in by Gerald Leland of Dayton, Ohio.



A close-up of the retractable gear of the 4-place Beechcraft, showing shock-absorbers, wheel-wells and the general mechanism. Leon Phinney took it at the Portland Airport.



My newspaper this morning brings news again of another air crash. I felt that disaster keenly, because only a few hours before a lady of my acquaintance, whose profession as an interior decorator takes her all over the country on lecture tours, had talked to me about aviation. During the past few months she has been taking airliners instead of trains and she was telling me how much she enjoyed air travel and how much time and energy it had saved her. I thoughtfully added that I hoped she told some of her audience to spread the good word about flying. We who are given the responsibility of selling aviation to the public through the cold pages of magazines



This picture of the ill-fated Samoan Clipper was taken by Air Adventurer D. J. Sampson of Auckland, N. Z., before it started off on its last flight.

naturally leap at opportunities like this, and I tried to make the most of it.

"Of course I do," she said. "After all, it is good psychology in the first place for me to say that I use the air lines. It places me on a modern pedestal and I can demand better fees and at the same time satisfy my hearers that my personal attitude is modern." She said she was not afraid of flying because, as she stated, few accidents ever occurred on actual scheduled flights.

A few hours later I picked up the newspaper and read of that crash.

But are we Air Adventurers downhearted?

More than ever before, we must hitch up the pack, draw in a deep breath and bellow back: "No!"

I do not like to bring up these mournful subjects. It would be much easier, I know, to wave the flag and repeat over and over that American aviation leads the world. That's the Pollyanna attitude, and it is for those who really offer nothing to aviation. They are like the people who stand on the sidelines and cheer "our team,"

but refuse to turn out when two or three games are lost.

We of Air Adventurers should crowd in and ask a lot of questions. We know what American aviation has done and what can be done. That is our heritage, but we must put these triumphs on a sounder basis. What we really ought to do is to take time out, one of these days, and ask why speed is continually being substituted for safety. Why, when only 60 per cent of all seats available on scheduled airliners are filled on routine flights, the operators continue to bid for more and larger planes. Why licensed pilots disobey flight orders. . . .

But are we downhearted?

Of course not, but neither are we going to stride on blindly in this matter of safety in aviation. We Air Adventurers believe in the future of American aviation, but we are now becoming important factors in its future. It may be we who will be guiding American commercial flying tomorrow, and for that reason we are entitled to the best those in charge today can produce.

The youthful Air Adventurer, designing his own model planes today, will most likely be the man who designs the transports of tomorrow, and he should be protected. His future is sacred, and those in control now should never be allowed to forget it. Aviation is not simply an industry in the hands a few moneyed shareholders. It is something that belongs to the generations to come, and a fatal act of carelessness in flight does not simply crush a few passengers in a wrecked cabin; it strikes a blow at the future of aviation.

(Turn to page 85)

# (MEMBERSHIP COUPON)

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

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

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

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

Address .....

☐ Check here if interested in model building.

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



# What's Your Question?

## By CLYDE PANGBORN

### Wing Commander



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

*Question: Is there such a thing as an aneroid barometer and, if so, what is it used for in an airplane? H. L., Brooklyn, N. Y.*

*Answer:* Yes, there is such an instrument as an aneroid barometer. It is used to show the pressure of atmosphere to determine weather conditions, and is employed by the weather bureaus. In an airplane the altimeter is nothing more than an aneroid barometer, the scale of which is so arranged to read higher as the pressure, due to the ascent of the plane, becomes less.

*Question: I am interested in entering Randolph Field, San Antonio, Tex., but I don't think I will be able to go to college. If I went to some smaller field, such as Chanute Field at Rantoul, Ill., do you think I could pick up enough experience there so that they might accept me at Randolph? C. W., Kankakee, Ill.*

*Answer:* You might take a chance on enlisting and ask to be sent up to the Aircraft Technical School at Rantoul and, after a year, apply for flight training at Randolph Field.

*Question: Would you please send me information for flight cadet appointments in the Army Air Corps? D. L., Pittsburgh, Pa.*

*Answer:* Write to the Adjutant General of the Army, Washington, D. C. He will send you full particulars on how to enlist as an Army Air Cadet.

*Question: I am just finishing high school and would like to get into the Army Air Corps. Which would help me most, two years of college or a course at a good recognized air school? C. R., Chicago, Ill.*

*Answer:* To be eligible to enlist as a flying cadet in the U. S. Army Air Corps, you must have at least two years of college education or its equivalent. Previous flying experience is not allowed to take the place of this.

*Question: What changes are made in an engine when it is supercharged for racing? What is meant by a "full feathering propeller"? When companies give the speed of their planes, is this the speed with full load or with only a pilot? J. B., Santa Rosa, Tex.*

*Answer:* In addition to meaning simply that the engine has been supercharged, supercharged also means that the compression has been raised higher, tension ignition installed, the intake and exhaust valve openings changed, and numerous other changes made on the engine to give it a greater output.

A "full feathering propeller" is a propeller whose blades can travel from zero pitch to 90 degrees.

Top speed specifications of an airplane are usually with full load.

*Question: I would like some information, if possible, on the one-bladed propeller, which has been experimented with recently. I. R., Morrisville, N. Y.*

*Answer:* The one-bladed propeller was developed and is being manufac-

tured by the Everel Propeller Corp. of Baltimore, Md. Due to its single blade it reduces propeller torque, and because of its automatic variable pitch properties has shown quite a bit of efficiency, particularly in the climb. As it has been experimented with on only small ships so far, one cannot say just how successful it will be.

*Question: I would like to know where I can get maps for cross-country flying. How can I find the latitude, longitude and magnetic variation of an airport? W. L., Yukon, O.*

*Answer:* You can obtain Department of Commerce strip maps for cross-country flying by writing to the Bureau of Aviation, Washington, D. C.

For the answer to your second question I suggest that you read the articles on "Elementary Aviation" by James Smithson, which started in the May issue of Air Trails.

*Question: Will you please give me information on the plane which appeared on page 70 of the April, 1938, issue of Air Trails? How many planes have Seversky built for the Army? V. K., Snelling, Cal.*

*Answer:* The airplane you want the information about is a Seversky Convoy Fighter, powered with a Wright Cyclone engine. It is equipped with seven machine guns, four of which fire through the top of the engine cowling. Its top speed is claimed to be 300 m.p.h., and cruising speed 240 m.p.h. I don't know how many ships Seversky built for the

## NOTICE!

WE MUST ASK OUR READERS TO BE PATIENT WITH US IN REGARD TO ANSWERING YOUR QUESTIONS. THE TREMENDOUS AND EVER INCREASING AMOUNT OF CORRESPONDENCE PREVENTS US FROM ANSWERING AS RAPIDLY AS WE WOULD LIKE. TO GIVE EACH LETTER THE TIME AND RESEARCH REQUIRED NECESSITATES SOME DELAY.



Army, but it must be in the neighborhood of a hundred.

*Question: I would like to get into the Navy Air Corps. Please tell me if there is any way of doing so without going to Annapolis or serving four years in the Navy. C. G., Agawam, Mass.*

*Answer: Yes, you can enlist in the Naval Air Reserve if you have the qualifications. They are at least two years of college education or the ability to pass a written test equivalent to two years of college, plus the required physical examination.*

*I would suggest that you write to the U. S. Navy, Bureau of Navigation, Washington, D. C., for full particulars.*

*Question: Can you give me the details of the conversion of a Ford V-8 auto engine as used in the Arrow Sport described in the June Air Trails? It was stated that this is the most successful auto-engine conversion. If so, this would be the solution to the cost problem confronting most light plane fans. What would be the approximate weight of the engine by using a liquid cooling system? J. O., Pittsburgh, Pa.*

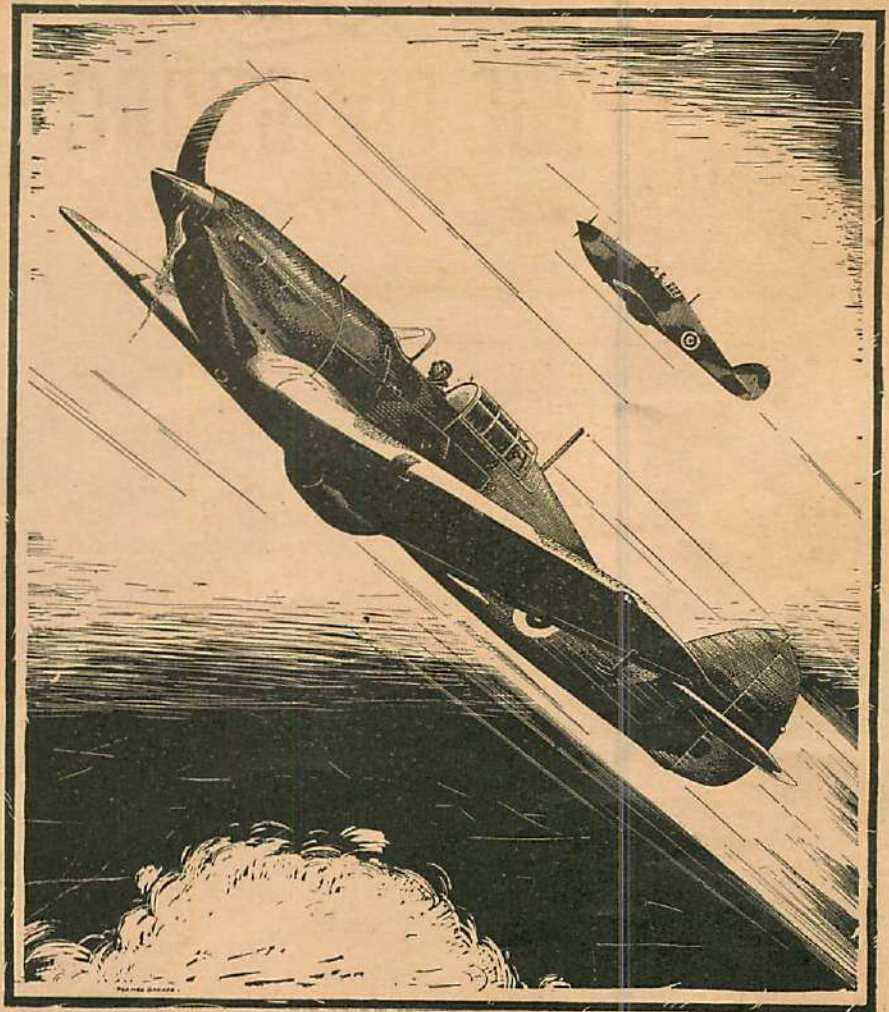
*Answer: I don't know the details of the conversion of the Ford V-8 from auto to aero engine beyond that it has a special head, lighter crankcase, higher tension ignition and a geared propeller drive. Its disadvantage is its weight. Developing 90 h.p., it weighs 402 lbs. dry, giving it a weight per horsepower of 4.9 lbs., while an air-cooled engine of the same h.p. weighs approximately 2.5 lbs. per h.p. An aircraft liquid-cooled engine of 90 h.p. would weigh around 300 lbs.*

*Question: In becoming a pilot of any kind, what tests must you pass and what must you be physically perfect in? Especially for a commercial pilot's license. Do you have to weigh a certain weight or over even if you are short in stature? Please name all major and minor physical causes which may hinder a man in passing a doctor's examination. S. A., Houston, Tex.*

*Answer: I suggest that you write to the Department of Commerce, Bureau of Air Commerce, Washington, D. C., for a copy of Civil Air Regulations, pilots' rating, which will answer all your questions. Physically you must be perfect to this extent: You should not have any organic or functional disease or structural defect or limitation which may interfere with the safe piloting of aircraft. Your size and weight do not matter in the least bit.*

*(Turn to page 82)*

## Ships In Black And White

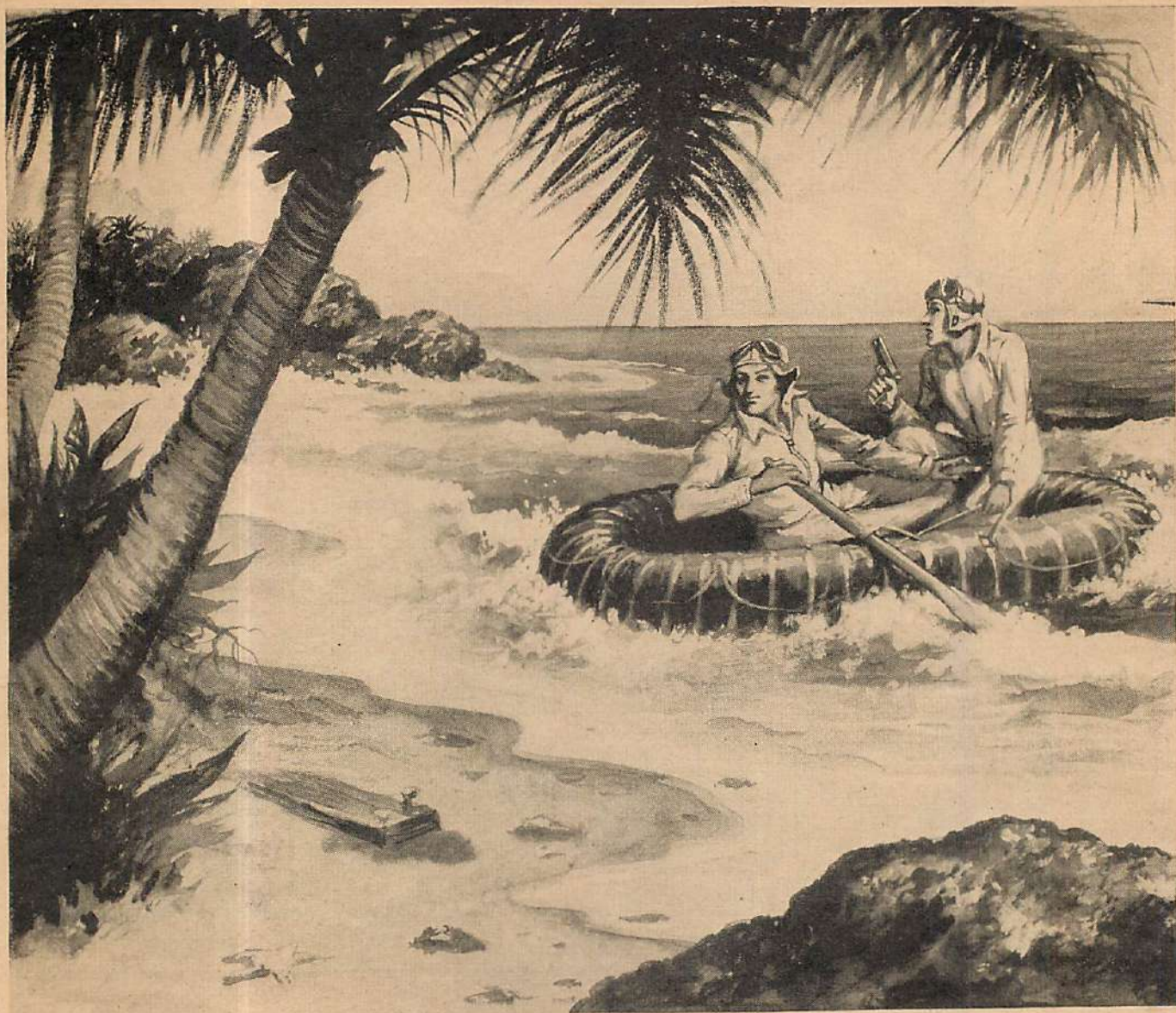


### The Hawker Hurricane

ONE of the most intriguing "hush-hush" planes in the world is the British Hawker Hurricane. Powered with a Rolls-Royce Merlin 990 h.p. geared and supercharged Vee engine, this single-seater fighter averaged 408 m.p.h. on a recent flight from Edinburgh to Northolt, England. Although one of the fastest military aircraft in existence, the Hurricane is fabric-covered, which is a British characteristic. Other interesting features are completely retractable undercarriage and tail wheel, split trailing-edge flaps and large-size belly radiator under the fuselage. The ship is dressed in the official shadow-shading camouflage. The low wing combined with the height of the pilot's seat above the thick fuselage tends to give the pilot splendid range of vision for both attack and defense. These planes are used by No. 111 (Fighter) Squadron of the Royal Air Force.

A full-page close-up of a Hawker Hurricane in flight may also be found on page 11 of this issue.





# WINGS OVER

*More than the ghosts of ancient pirates lie in wait as Bill Barnes zooms through Caribbean skies on a fateful hunt for buried treasure.*

THE cold moonlit waters of the race-way gurgled along the sleek sides of the long-boat as the half-dozen sea rogues bent their glistening backs to the oars. Ahead the foggy inlets and rolling dunes took on fantastic shapes as the boat cleaved toward the shore.

Only the guttural curses of the half-naked men at the oars interrupted the constant flow of foul language coming from the lips of the squat, hairy creature who held the tiller. Now and again he interrupted his lewd orders with snatches of vile songs.

"Curse my eyes and teeth!" he belowed as he deftly beached the boat and gave the tiller to the barefooted, scar-faced mate beside him. "Have your men lay the chests where the pines end at the dunes," he rasped. "And shoot the guts out of him that makes a hasty move."

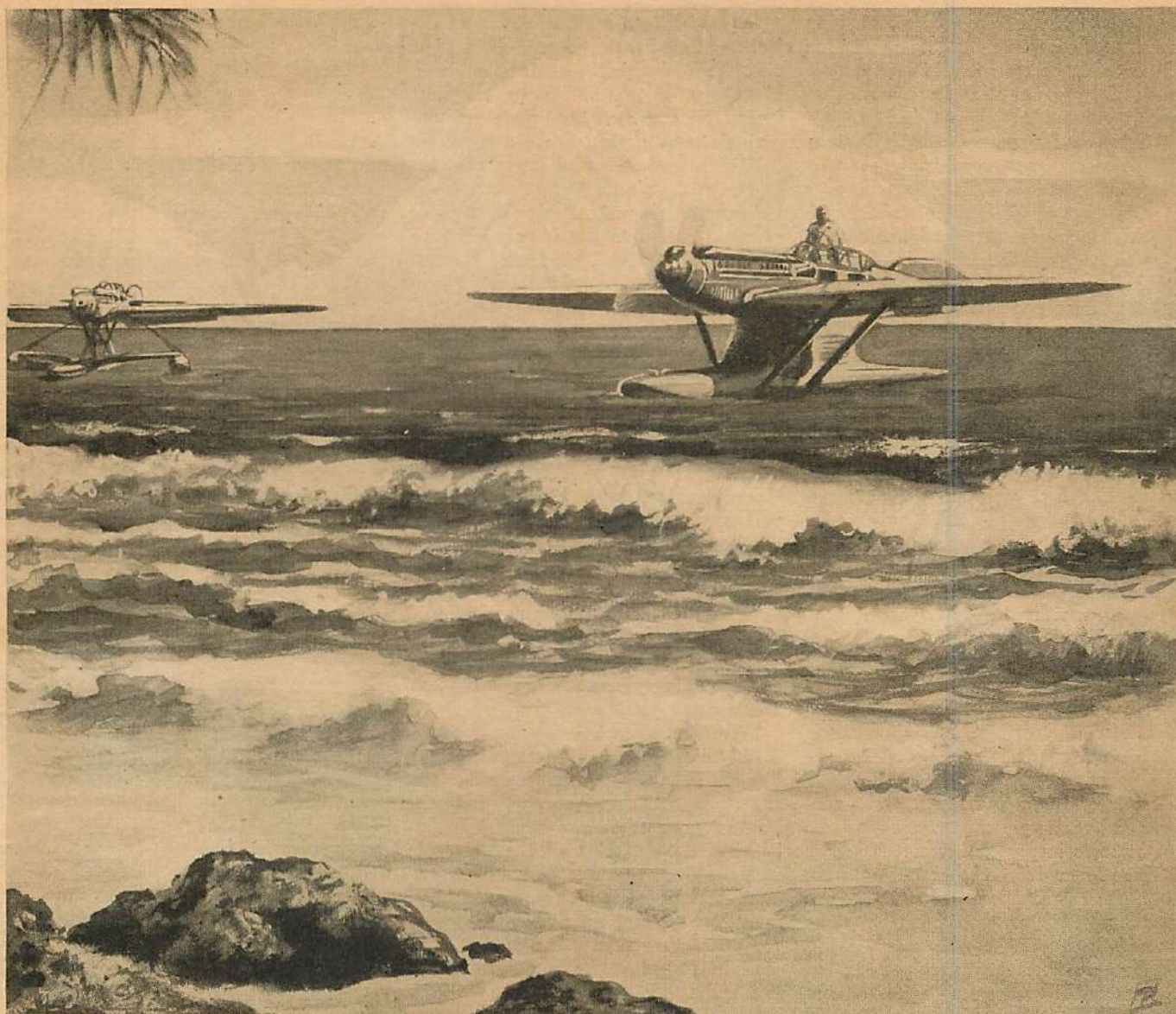
"Heave' ho!" the mate screamed at the sea wolves as they pulled the boat up on the sand and prepared to lift out the iron-bound chests riding in the bottom.

The man who had been at the tiller

chuckled deep in his chest and set off alone toward the tiny dots of light gleaming through the pines hard by the beach. He looked like some huge, disproportioned baboon as he waddled through the dim shadows toward the little inn those dots of light stood for. Arriving, he yanked the lanyard and shouted through the grilled window, and immediately a scullery boy threw the bar behind the tavern door.

The aromatic odors of lime juice and rum and cinnamon, of spirits and fresh pine, seemed to vanish as Francis Meech





# TRUJILLO

*A Complete Bill Barnes Air Novel*

By

GEORGE L. EATON

stepped into the dimly lighted tap room, and were replaced by the smell of cologne and the perfumed grease that matted down his shoulder-long hair.

He was built like a water-logged barrel. His whole face was a beard that had been braided into twenty-two pig-tails tied with colored ribbons. His legs were spindly and small, but his chest and paunch were enormous. From his ears dangled great golden hoops. Around his bloated middle was wrapped a scarlet sash from which jutted the carved handles of three Spanish dag-

gers, and from a shoulder belt hung five silk cords with a pistol on the end of each.

His eyes were like the angry eyes of a wild boar, and his long, bony hands were like the hands of a witch. He reached up now, with one of those hands, and tore a printed description of himself from the tap-room wall.

He, Francis Meech, was known as the boldest and the cruelest of all the pirates who terrorized the coasts of Virginia, the Carolinas and the Spanish Main.

His mission here at the Port of Missing Men Tavern was to meet and connive with the Governor of North Carolina, as he had met and connived with the Lords Proprietary before him.

"Snakes and lizards, damn you!" he growled at the boy who was pouring hot water into his buttered rum. "Where is that swab Jeremiah Smithers?"

"He's in the kitchen, sir," the frightened boy said. "Browning capons and sausages for you, sir."

"Tell him I am come," Meech roared, "or I'll smash this pewter mug across your mealy mouth!"

He aimed a kick at the tight breeches of the boy as the lad slid under the gate wicket and ran for the kitchen, his hair flopping in his wide eyes.

A moment later Jeremiah Smithers sidled into the room like a fiddler crab, to lay a cloth on the tap-room table. He raised the lid of his one good eye as Meech snarled at him, and there was something even worse than venom in his glance.

"Be damned to yourself!" Jeremiah



Smithers said in a cracked, rasping voice. "Close your bawling mouth or I'll cut out your lights and livers. I was sailing the Red Sea trade when you were a mewling brat!"

"Curse my eyes and teeth!" Captain Meech roared, and reached for one of the daggers at his waist. But the peal of the tavern bell stayed his hand. Quickly he stole across the room to gaze out through the grille at the end of the hallway.

"It's my good friend, Governor Mann," he shouted at Jeremiah Smithers. "Let him in before I slit your scrawny gullet."

Jeremiah Smithers edged down the hallway and drew the bar.

A tall man in silks and laces and high-heeled boots stepped through the doorway. His face was long and looked gray under his powdered wig. He took a scented box from his sleeve and held a pinch of snuff to his nose before he asked for Francis Meech.

"He's a-waiting in the tap room, sir," old Jeremiah said as he speculated on how much gold the governor might have on his person.

"My good friend, Anthony Mann, the Governor of North Carolina!" Francis Meech roared as Mann came through the door.

Anthony Mann ran his arrogant eyes over Meech's grotesque form as he might have inspected a slave or a race horse. Then delicately he dusted snuff from the tips of his aristocratic fingers. "Must you bellow like a mad bull?" he asked Meech quietly.

"Dammy, I'm glad to see you, Mann, though you'll cost me a half of a hundred thousand pounds in Arab gold," Meech shouted. "I am glad to see my good friend who keeps the rat-infested ships of the American Colonies and the Royal Navy from scuttling me and hanging my bones to dry in Charles-Town."

"Hush, Meech!" Governor Mann said.

But Mann might as well have asked the tides to stop flowing or the seasons to change their course. Francis Meech was in boisterous and mirthful spirits.

"Why should I hush when I see my friend who makes it possible for me to take all flags?" Meech wanted to know. "Only this afternoon I took an Indian that was flying a black flag and her hold was crammed with silks and madras, East India silver and spices, gums and ivory and bar Arab gold. She had a fortune in her belly, Governor Mann. And never fear you'll get your share!"

Mann's face was even whiter now and his eyes were blazing. He started to speak angrily, then caught himself as Jeremiah Smithers came sidling into the room with broiled capons and smoked sausages and great leather jacks of creamy ale.

Captain Meech grabbed at one of the jacks and gulped the contents, and what didn't go down his throat dribbled down his dozen beards and onto his shirt front. He crammed two whole sausages into his mouth, then broke a capon in half with his hands and began chewing on one of the pieces.

Governor Mann cut himself a piece of capon and sipped at his ale while he watched Meech wolf his food.

"You brought the gold ashore?" Mann finally said to him.

"Six galloping chests of it," Meech said with his mouth full. "We're going to bury it back of the dunes in the pines and bayberries. Then you'll give me a receipt for half of it to keep you honest."

"I'll give you no receipt, Meech," Governor Mann said. "How do I know you won't come back another night and dig it up? Then you'll have the gold and a receipt that can throw me into the Tower of London."

"You'll do what I tell you, dammy!" Meech roared. "I don't ask nothing or your—" He went off into a string of curses and incoherent pirate filth that Mann could not follow.

"Will you, please—" Mann began.

"Listen, damn you!" Meech screamed. "You'll do as I say. We'll bury the gold and we'll both have a chart that will lead us back to it and when I've finished along the coast of the Carolinas we'll go back together and dig up the gold. That's the bargain you made with me. You protect me and I'll pay you for your protection. And if you play me false I'll strip the skin off your lady-like body. I'll—"

"Meech! Please!" Mann begged.

"Meech! Please!" the pirate simpered after him, his beady eyes red with rage. "I'll cut off your lips and fry 'em and make you eat 'em and then make you try to whistle after you're through!" he bellowed.

Governor Anthony Mann was frightened now. He regretted the day he had gone to Francis Meech to offer him the protection of his office in exchange for half the pirate's plunder. He got to his feet and his hand slid toward the heavy pistol that was under the flap of his laced coat. He pulled it free, cocked it and held the muzzle close to Meech's head.

Meech watched him like a man who is amused by the antics of a child. Then he began to laugh. He threw back his head and choked and bellowed curses until his face and ears were a fiery red.

Then he reached up and snatched the trembling pistol out of Mann's hand and threw it in a corner. "You might pull the trigger from fright," he said, getting to his feet. "You come with me. My men are down on the dunes. You'll come with me while we bury the

gold. How many men have you with you?"

"Three," Mann said. "With my horses."

"Round them up and have them keep Jeremiah Smithers and his scullery boy and blacks in sight until we come back," Meech ordered.

Twenty minutes later Captain Meech saw the faint flicker of his mate's lantern through the pines. The six iron-bound chests of gold were on the edge of the pit the pirate crew had finished digging in the sand.

"Lower 'em, my hearties!" Meech bawled. He was in a good humor again, and his men strained and sweated to edge the heavy chests into the hole.

"All yours and mine, Mann," he said, gouging the governor in the ribs with his thumb.

"Have you made a chart?" Mann asked.

"That's another thing I did this afternoon," Meech chuckled.

He waited until all the chests had





been placed in the pit. Then he ordered his-men into the hole to straighten them out to suit him. While they were there he held a quick, whispered conversation with his mate. They both moved back to the edge of the hole.

When the first of the men started to scramble out of the pit, Meech whipped one of the pistols from its holster at the end of the shoulder belt, cocked it and blew the man back into the pit with a bullet through his head. His bellowing laughter rang out intermingled with filth and curses as he served the others each in turn as they screamed for their lives.

Governor Anthony Mann was trembling like one with ague as he watched the lifeless bodies roll back on top of the chests.

"Dammy!" Meech roared. "They'll never tell tales."

Anthony Mann could remember afterward how Meech's eyes glittered in the moonlight when he turned his gaze on him.

"They'll never try to steal the gold

from under my nose, Mann," Meech growled. "That's how I handle those things. I don't need to be afraid they'll come back to get it when I'm not here. Do you understand how I handle those things, Mann?"

"I understand," Mann said, his voice trembling.

"Here's your chart, governor," Meech said. "But don't ever use it unless you're sure I'm dead, or I'm with you. You'll be careful about that, won't you, Mann?"

"I'll—I'll be careful about that."

Anthony Mann looked behind him where the lights glowed dimly in the windows of the Port of Missing Men Tavern. The moss on the trees swayed slightly in the breeze from off the inlet and cast weird shadows on the glittering sand. He began to edge away from the pit Captain Meech's mate was filling with sand.

"I had better go reassure my men about those shots," he said.

"Yes," Meech chuckled. "You'll hear from me by post."

Governor Mann fled through the trees, and his feet made a slithering noise through the sand because he could hardly lift them.

Captain Francis Meech helped his mate launch the long-boat, then both climbed over the gunwale.

Far out in the inlet the *Sea Wolf*, Meech's brig, swung at her anchor. No lights were visible aboard her as they came alongside. As the mate stood up to catch a line Meech rose beside him.

Drawing the last unfired pistol from its holster, the pirate captain placed it against the mate's belly and pulled the trigger. The man was still screaming as he toppled over the side and his mouth filled with water.

"A curse on him that touches Meech's gold!" Meech growled deep in his belly, starting up the ladder.

## II—SANDY'S NEW HOBBY

BILL BARNES walked slowly along the blue gravel path that led from the Administration Building on Barnes



His victim gasped for breath—sailed backward across the floor—



Field, Long Island, to his comfortable bungalow. He was walking slowly because he was absorbed in a new book on aerial tactics and strategy by the chief of the French army air corps. The book had arrived in the morning mail, and as soon as he could get away from the routine duties in his office he had grabbed it and left, anticipating a pleasant afternoon and evening of reading. The book covered a quarter of a century of military aviation by a pilot who had spent a large portion of that time in the cockpit of a fighting plane.

Because it was an unusually hot day Bill was dressed only in a pair of gray flannel slacks, a white shirt open at the neck, and a pair of white buckskin shoes with tan saddles. Occasionally he lifted a hand to run it through his rumpled blond hair and wipe the perspiration from his forehead. Once, he glanced quickly over his shoulder as two of his yellow-and-black-and-scarlet Snorters dropped their amphibian landing gear and came roaring in above his head for a landing.

"Shorty" Hassfurth, Bill's chief of staff, and Eric ("The Red") Gleason, another of his veteran pilots, waved at him as they fishtailed the Snorters in to reduce speed.

Then he forgot about them because his mind was entirely absorbed in his book. He felt for the bungalow steps with his feet because he didn't want to remove his eyes from the page he was reading. He had just gained the little front porch and was groping for the door knob when it happened.

The noise that leaped out of his living room and blasted against his ears startled him so that the book went slithering across the porch. For an instant Bill crouched as though he expected that first blast of noise to be followed by a herd of charging elephants. He braced himself to meet the physical contact that seemed inevitable. It was a noise such as he had never heard before.

"What in the name of Heaven is that?" he asked himself. His mouth hung a little open as he stared into his living room. But it was too dark inside for him to see.

Then he realized that much of the terrific noise was coming from a swing band program on his radio. He could tell that the volume control was wide open, but he couldn't understand the wild, primitive wails that were being interpolated into the music of the band. They were like the screams of a voodoo man working his subjects into a mad frenzy.

"Ippsy dippy, ippsy! Swing, boys, swing!" the voice brayed.

Then it broke off to be followed by the discordant notes of a clarinet, which went up and down the scale out of tune with the music. It struck a high note

followed by one at the bottom of the scale. Then the voice said, "Boo! Boo! Boo!" and in came the screams of the clarinet again.

Bill pushed into the room, shading his eyes with his hands because he was half blinded in the dim light. The terrific noise of the swing band beat against the walls of the room and concentrated on his eardrums as he made out the faint outline of a figure with a clarinet going through contortions that would have done credit to a Houdini.

"Hey!" Bill screamed. "For the love of Moses, will you stop that ungodly noise!"

Young "Sandy" Sanders, the youngest of Bill's famous little squadron of combat pilots, whirled around. He dropped the clarinet into a chair and guiltily twisted the volume-control knob on the radio.

"Why—why—" he said feebly, "I was just having a little music."

"Yeah," Bill said. "It sounded like a little music. What the hell are you doing in here with that radio turned on so loud? You must be trying to give music to the Fiji Islanders!"

"Gosh," Sandy said, "I didn't think you would be over here, Bill. You said you were going to New York."

"I know you didn't think I'd be over here. I didn't go to New York because a book arrived I've been expecting. I didn't go to New York because I wanted to come over here and do a little quiet reading. And what do I find—a madhouse! Good grief! Why don't you get some sense? I thought you were going to take the hangar hook and struts off the Eaglet?"

The Eaglet was a tiny little biplane powered by an 830 h.p. Twin Wasp motor that had been built around young Sandy "like a suit of clothes." It had been designed for the specific job of being carried inside the giant carrier-transport BT-4, from which it took off and made landings with a hook and trapeze arrangement while in flight. Since the destruction of the carrier-transport, Sandy had been trying to figure how to remove the hangar hook and hangar struts.

"I got that all figured out now, Bill," Sandy said. "I—"

"Then why don't you do it?" Bill snapped. "Why are you wasting your time making funny noises on that clarinet?"

"Listen, Bill!" Sandy said. "I only got this clarinet this morning. Just like your book. You were going to go to New York, weren't you? When your book arrived you decided not to go. Well, that's the way I feel about the clarinet. I was just—just—"

"You were just—just!" Bill mimicked. "Get to hell out of here and take that thing with you. I swear, you'll drive me nuts."

"Aw, listen, Bill," Sandy said. "Don't you like swing music? Everyone is going crazy about it. When fellows like Benny Goodman begin to swing it makes me want to climb trees and yell."

"Yeah," Bill said. "I noticed."

"You ought to see some of the kids over at the El Banco do the Big Apple and the Suzy-Q. It's hot stuff."

"I bet," Bill said dryly. "Where's the El Banco?"

"It's a Spanish restaurant down in the Village in New York," Sandy said. "I'm going over there tonight. You better come with me, Bill."

"How long since you've begun running around to night clubs?" Bill asked. "I don't want you to start that stuff, kid."

"I've only been there twice," Sandy said. "Shorty took me there for dinner one night. Then I went once more to hear the swing band again. Boy! Are they hot? They're called the Jamaica



Tony Lamport.

Gingers. I got acquainted with the leader. He's a nice guy, Bill. He's going to give me some pointers on swinging the clarinet. Boy! Would he teach me things if you went along! How about it, Bill?"

Bill was about to answer with a gruff refusal when he caught the expression in Sandy's eyes. Through his mind flashed a lot of things he had never stopped to think about before.

Suddenly it dawned on him that Sandy was really growing up and that he ought to know something besides airplanes. He had kept the kid's nose to the grindstone on Barnes Field for the past four years, ever since he had become Sandy's tutor and guardian. He had never given him much chance to play, except with the thousand and one hobbies the youngster pulled out of his sleeve, one after another. Such as the clarinet.

He saw the expression in Sandy's eyes and swallowed the retort that was on his lips. But he felt that he shouldn't be too enthusiastic or Sandy would be



organizing the whole field into a swing band.

"Where is this place, kid?" he asked.

"Just south of Washington Square," Sandy said eagerly. "You'll like it, Bill."

"Okay. What time do we go?"

Sandy's face lighted in a way Bill had never seen it before. His eyes were dancing with elation.

"We'll leave here about six so we can see the dinner show and hear Mac Macado swing his Jamaica Gingers," Sandy said. "It's swell of you to go, Bill."

"I'll enjoy it," Bill said gruffly. "Now scram. We'll hop over to the downtown skyport and take a taxi up from there."

### III—ENVELOPE WITH A SECRET

AT six o'clock that evening Bill climbed into the streamlined bullet he called the Silver Lancer. He dropped into the bucket seat, being careful not to "muss" the tweed suit he had donned for the occasion. He revved up the tandem Diesel engines that drove the enormous twin props in different directions. For an instant he listened to their full-throated roar.

"They sound sweet!" he shouted at old "Scotty" MacCloskey, major-domo on Barnes Field, who stood beside the big ship.

"They always sound sweet, boy," old Scotty shouted back at him.

Following his regular custom he checked over his ammunition counters and his two .50-caliber machine guns and the radio installation that made conversation possible with his other ships or with Barnes Field while he was in the air.

His eyes ran over the flight instrument panel and he tested the yellow-and-green amphibian gear lights. Then he lifted the infra-red-ray telescope that permitted him to see through fog, clouds or darkness, checked it and let it drop back to its folding recess in the instrument panel.

"Put on your hair net," he said to young Sandy over the inter-cockpit telephone, and blasted the tail around.

The big sesquiplane sped down the center runway at terrific speed, and then Bill eased it into the air. He leveled off at three thousand feet and stuck the nose on the lower tip of Manhattan Island.

Above the Skyport, he circled once until a ferry boat was out of his path, then, fishtailing to reduce his speed, he struck the water in a cloud of spray and roared up to the landing. The floats of the big ship rode halfway up the inclined turntable.

Five minutes later they were in a taxicab weaving in and out of the traffic on lower Broadway.

"You're going to hear something to-

night, Bill," Sandy said, his eyes shining.

"I hope so, kid." But Bill was pretty sure he was in for an extremely dull evening. He hated the smoke and the noise and the idiotic behavior of the people to be found in night clubs.

El Banco was so hot it sizzled when Bill and Sandy went down the front steps, checked their hats and stepped into a room that was crowded with perspiring people.

In one corner was a raised platform on which Mac Macado and his Jamaica Gingers were doing their stuff. Macado was standing on the edge of the platform pumping on a clarinet and leading the band at the same time. His whole body swayed to the quickening tempo of the music as he swung it faster and faster. The drummer in the corner seemed to be a flashing centipede with fifty arms and fifty legs. The violins screamed shrilly at one another, while the cello came in with its deep rumble, and a saxophone ran the gamut of musical emotions.

The faces of the players were streaming with perspiration as they brought the piece to a close with a last wail from the saxophone, a crashing of cymbals, and an eerie run by Mac Macado on his clarinet.

The people at the tables surrounding the dance floor broke into a thunder of applause, which Macado acknowledged with a bobbing head and a wide grin showing his even white teeth.

"Hello, keed," he shouted at Sandy as they were escorted toward a table.

Sandy's grin spread and Bill could not help grinning with him. The spirit of the place was infectious. A girl with flashing eyes gazed up at Bill as he passed, and she was smiling too. She said something in Spanish to the girl beside her. Their eyes followed Bill's broad shoulders to his table.

A moment later Macado was standing beside their table shaking hands with Sandy and Bill.

"You're hot tonight, Mac," Sandy said after he had introduced Bill.

"In more ways than one," the leader acknowledged. "You like our music, Mr. Barnes?"

"It's swell," Bill said.

But he noticed that Macado was not listening to his answer. Instead his black eyes were darting around the room as though they were searching for something. He did not hear a question Sandy asked him.

"Excuse me, please," he said and hurried away as a man who had just entered the place beckoned to him from the doorway.

"Your friend seems a little jumpy," Bill said.

"He's always nervous," Sandy said. "But boy, can he make that clarinet talk."

"I think you mentioned that before."

When Macado came back again he pulled out a chair and sat down with them, but his mind was not on the things they talked about. His glance kept sweeping the room, scarcely acknowledging the many greetings that were thrown at him. He seemed like a man sitting on the edge of a volcano, ready to leap at any moment.

Once he leaned over to Bill and said, "Thees Sandy, he ees a nice keed. Are you not afraad he will keel himself?"

Bill could see that Macado was serious, and when he answered he answered soberly. "He can take care of himself. I don't worry about him. He uses his head."

"That ees good," Macado said. "But it is hard to always know how to use your head. I—I—" He stopped speaking and his eyes fluttered nervously around the room again. Bill could tell that there was fear lurking deep behind his attempted air of nonchalance.

"Do you like this kind of work?" Bill asked him. He was curious about the man, because he seemed out of place leading a swing band in a garish night club. Seated at their table, he seemed to be something out of old Spain, a gallant and a gentleman.

"It ees only a—what you say?—make-sheeft," Macado answered. "I like music. I am forced away from my home because of politics. I must live. So, I organize my own band from among some of my followers who are also exiled."

"You're a South American?" Bill asked.

"No," Macado said. "From a small island off South America. A West Indian. I—"

Suddenly he stopped speaking and the color seemed to drain from his handsome face as his eyes darted to the three men who were coming in the doorway, and to two more who were standing near the band platform.

Their own eyes fastened on Macado, they began to move toward the table, quietly and swiftly. Two of them still wore their hats.

Bill, watching Macado, saw that his face was white, but that he was not afraid. He sat motionless in his chair while the five men converged on him. He swung his chair around a little so they would be in front of him. His right hand was stuck into the side pocket of his dinner jacket, and Bill could tell by the bulge there that he held an automatic.

The approaching men formed a little semi-circle around the table and Bill knew that they too had guns in their pockets. They all had the same facial contours as Macado, the same dark hair and dark, gleaming eyes. They were entirely oblivious of other people about, intent only on their quarry.



"Give me that gun, Macado," one of them said quietly.

Macado hesitated, then slipped the small automatic out of his pocket, trying to conceal it with his hand.

But a girl at a table next to them had seen it. Her eyes grew wide and she began to scream. All five men turned their heads for a brief instant.

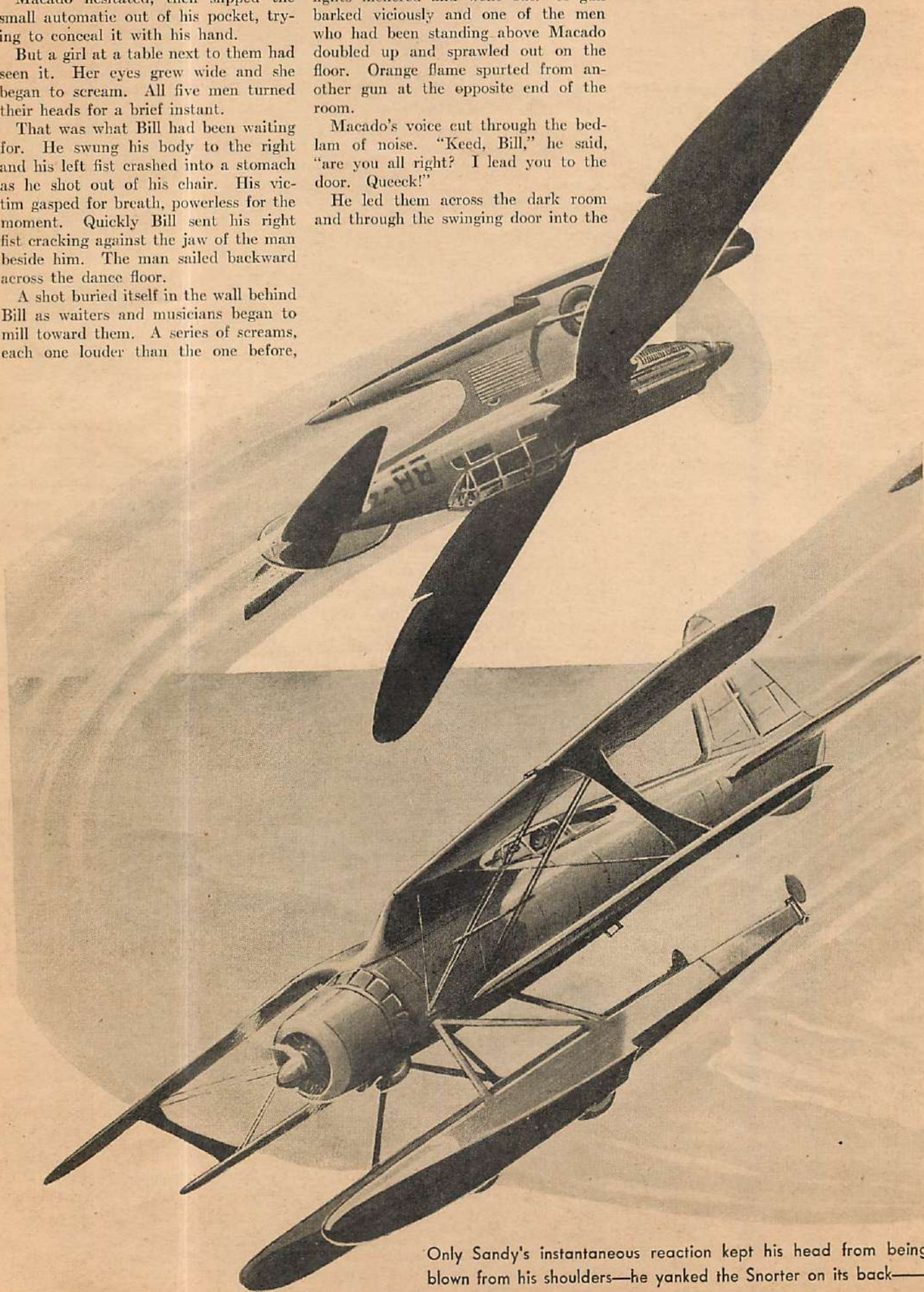
That was what Bill had been waiting for. He swung his body to the right and his left fist crashed into a stomach as he shot out of his chair. His victim gasped for breath, powerless for the moment. Quickly Bill sent his right fist cracking against the jaw of the man beside him. The man sailed backward across the dance floor.

A shot buried itself in the wall behind Bill as waiters and musicians began to mill toward them. A series of screams, each one louder than the one before,

came from the dance floor. People were jumping to their feet. Suddenly the lights flickered and went out. A gun barked viciously and one of the men who had been standing above Macado doubled up and sprawled out on the floor. Orange flame spurted from another gun at the opposite end of the room.

Macado's voice cut through the bedlam of noise. "Keed, Bill," he said, "are you all right? I lead you to the door. Queeck!"

He led them across the dark room and through the swinging door into the

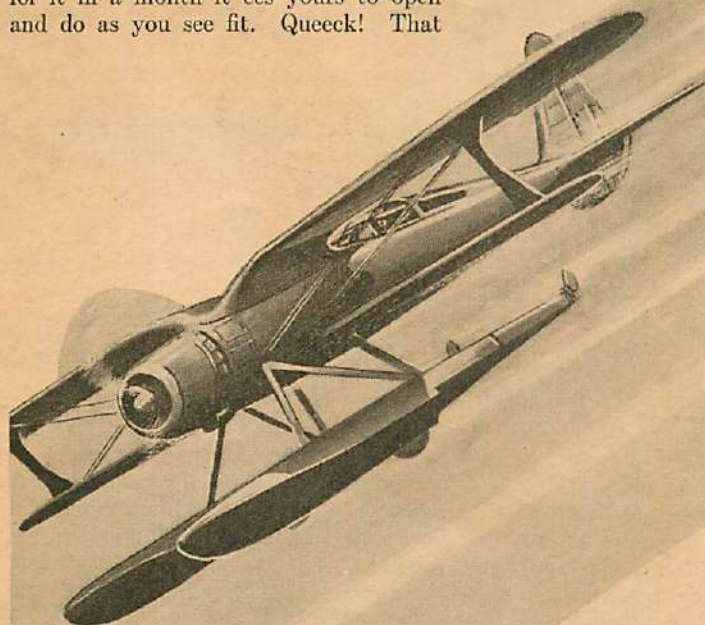


Only Sandy's instantaneous reaction kept his head from being blown from his shoulders—he yanked the Snorter on its back—



kitchen. There he pointed to a door on the far side as he yanked a long white envelope out of his pocket and forced it into Sandy's hands.

"Keep thees for me until I ask you for it," he said. "Eef I do not come for it in a month it ees yours to open and do as you see fit. Queeck! That



#### IV—PIRATE'S VOICE

BILL AND SANDY spent three hours at Police Headquarters explaining what little they knew about the affair at the El Banco. They made no mention of the envelope Macado had given Sandy.

"It's none of their business," Bill told Sandy. "Macado will show up and claim it and you give it to him."

door will take you into an alley. Get away."

"What about you, Mac?" Sandy asked quickly.

"I will be all right," Macado said. "This, she ees is only nothing."

He pushed them into the alleyway outside and closed the door behind them. They could see a street fifty feet away and began to stumble toward it, falling over cans of refuse and broken crates.

Police sirens screamed and whistles shrilled as they slipped around a corner. Sandy was still holding the envelope Macado had given him. He turned it over and looked at the other side.

"Don't you think we ought to stick with him, Bill?" he said.

"No!" Bill snapped. "He seemed to know what it was all about. It was something that isn't any of our business. I don't want to get a lot of publicity and get mixed up in a thing like that. We'll get in touch with Commissioner Barton and tell him what we know and to keep us out of it. Come on. Let's scam!"

Commissioner Barton promised to keep them out of the newspaper accounts of the affair, which later said that Macado had been driven from his island home in the West Indies because he was the son of the former president there. The newspapers laid the whole thing to political upheavals on the island of Trujillo. Macado's father had been forced to flee for his life a few months before, and Macado had left at the same time to become a swing band leader in the United States.

After the first day the affair crept back to the tenth page of the newspapers and in a week it was forgotten.

By everyone but Sandy Sanders. Each day Sandy took out the envelope Macado had given him and speculated as to what was inside.

He had heard nothing from Macado since that night. Macado had disappeared completely. The newspapers reported that he was in hiding from dangerous political foes. That was all Sandy knew.

At the end of three weeks Sandy gave the envelope to Bill to put away in the secret, bomb-proof vault underneath the

Administration Building. It was shortly after the month was up that he remembered it again and asked Bill to get it out for him.

Bill laughed and said, "It's probably filled with tickets on a Cuban lottery."

They opened it together in Bill's private office. Inside the outer envelope was another envelope that was yellowed with age. Sandy's eyes were the size of saucers as Bill took a single sheet of parchment paper from the second envelope and spread it on his desk.

It was cracked and faded but the India ink was still plain on the face of it. They studied it in puzzled wonderment for a few moments. Then Sandy's breath exploded and his eyes were in danger of popping out of his head.

"Bill!" he said. "It's an old chart to a buried treasure!"

"Nuts," Bill said, but he bent over the map and studied it more closely.

At the top was a little sketch showing a place called Pogue Inlet between Cape Lookout and Cape Fear on the Carolina coast. Below it read: "Latitude 77° 50', Longitude 34° 50'."

And below that, printed in faded old English, was the legend:

Take your long-boat through the inlet and into the mouth of the White Oak River. Beach boat where pines are close to the dunes. Follow the shadows. The October sun is the key.

At one o'clock follow the shadow of the sun from the old white oak that is the largest. Where the shadow ends set a sapling. It will be 400 paces east of the Port of Missing Men Tavern.

At two o'clock follow the shadow cast by the sapling twenty paces and set another sapling.

At sunset, measure five paces along the direction of the shadow cast by the last sapling and set a spade deep in the muck. Follow the shadow of the spade ten paces; then due north ten paces. Four feet below the surface will be found the six iron-bound chests.

A curse on him that touches Meech's gold. F. M.



That was all.

But it was enough for Sandy. He tried to speak. But his words only tangled up in his mouth to choke him.

"Take it easy, kid," Bill laughed, "or you'll have a stroke."

"It's a map to show where to find a buried treasure!" Sandy managed to say. "Where—where do you suppose it is?"

"It's the bunk, Sandy," Bill said. But he went across the room and pulled a book of charts and maps from a shelf and began to flip the pages.

"My gosh! It may be a fortune!" Sandy said. "When shall we start, Bill?"

"Start where?"

"To look for it!"

"I don't want any part of it," Bill snapped. "There has been a hundred times as much money spent on hunting for buried treasure than there ever was treasure."

"It's mine!" Sandy said. "Mac told me to hold it for a month and if he didn't claim it to do as I saw fit. I'm going to look for it."

"You're going to do nothing of the sort," Bill said. "There is something very screwy about the whole thing, kid. You don't want to get mixed up in it."

"Look, Bill!" Sandy said. "Those men who came after Macado that night knew he had this chart with him. They knew about it and were trying to get it."

"Listen," Bill said patiently. "Those birds were political opponents of Macado's father on the island of Trujillo. They were after Mac because he has been in this country to raise funds to help his father. It's one of those banana revolutions. You want to keep your nose out of it or you'll get your throat cut."

Bill reached for the piece of parchment and compared it with a chart of the North Carolina coast.

Young Sandy, leaning over his shoulder, exclaimed, "There! There, Bill! That little map on the parchment will fit right into that place called Pogue Inlet and into the mouth of the White Oak River."

Bill studied the two maps for a moment without answering. Then he put the book of charts away and selected another book from the shelf. It had to do with early Colonial history and piracy.

"You see, Bill," Sandy went on excitedly, "it was because of this map that those men were after Mac that night. They knew he had it. You say he was here trying to raise funds to help his father. He was going to use that map to dig up that treasure. He knows it's there or he wouldn't have given it to me to keep for him. They got him that night and have been trying to make him tell what he did with it."



"Oh, shut up!" Bill said. "I'm trying to concentrate."

He might as well have been talking to himself because Sandy kept right on jabbering. In a moment he looked up from the book and there was a curious expression in his eyes.

"Listen, kid," he said. "Meech—Francis Meech—was a pirate who took all flags, that is, the ships of all nations, about 1700. He and about two thousand other pirates terrorized the coasts of Virginia and Carolina. He was supposed to be under the protection of Governor Anthony Mann of North Carolina, in league with him. The merchants and planters of North Carolina went to the Governor of Virginia for help because they didn't trust Mann. It was about the time of the Tuscarora Indian massacres in that part of the country. The people inland were threatened by the Indians and the people on the coast by pirates. It was a ruthless and picturesque period in our history."

"What has that to do with this chart?" Sandy asked.

"Nothing except that it is initialed by F. M., who was Francis Meech," Bill said. "He was one of the most blood-thirsty of them all. He was also known as Bluebeard. The place named on the map—Pogue's Inlet—was a rendezvous for pirates in those days."

"See!" Sandy said. "The whole thing fits."

"It all fits," Bill said, "except that no one is trying to get money out of us. The usual procedure is for someone like Macado to produce a chart such as this one—on which the aging is done artificially. He gets hold of some sucker with adventurous leanings, like yourself, and sells it to him for a nice little bit of money. Then they set out to find the treasure and dig a lot of holes in the sand and find nothing. It's an old set-up, kid. And one I refuse to bite on."

"But Macado gets nothing out of this," Sandy said.

"He will," Bill said. "He's just waiting for us to make a move. He wants us to get well warmed up and excited about it. When we start to look for

the treasure he'll step in and demand a price for the chart. It's an old come-on game."

"I don't believe it," Sandy said stoutly. "Mac was on the square."

"So was Francis Meech," Bill said. "Here. Take your treasure chart and go sleep on it. I don't want any part of it."

Sandy put the yellow parchment back in its envelope and started to leave.

As he hesitated at the door Bill said, "I'll be seeing you in the morning, kid."

"Okay," Sandy answered. "Good night."

A moment later he was back in Bill's office, and Bill knew what he was going to say before he spoke.

"I forgot to ask you," Sandy said, "if you would mind if I take a Snorter for a while tomorrow?"

It was on the tip of Bill's tongue to ask him why he wanted it. But he caught himself in time. He looked at Sandy steadily for a moment, then answered, "Okay, kid. But remember, you're growing up. Don't forget to be your age."

"Thanks, Bill," Sandy said. "Good night."

## V—ABOVE CAPE LOOKOUT

WHEN young Sandy stuck his head in the traffic-control office on Barnes Field the next morning shortly before dawn, the ceiling was almost down to zero. He heard the roar of a Barnes Diesel overhead and saw the electric eye automatically switch on the shadowless, sodium-vapor lights.

"Go ahead! . . . Go ahead!" Tony Lamport, chief radio operator on Barnes Field, chanted into his microphone.

"Goat head! Goat head!" Sandy mimicked. "What are you doing on duty at this time in the morning?"

"That's Bev Bates coming in," Tony said. "I'm here to see he doesn't stick his nose in the ground. What's the matter with you—did your bed catch on fire?"

"I'm taking a Snorter out in a few minutes," Sandy said importantly.

"Do you have an order from Scotty? There's practically no ceiling," Tony said.

"Bill gave me permission last night," Sandy said. "I'll make a ceiling."

Ten minutes later he wandered into the hangar where the Snorters were kept and nodded to the half-dozen mechanics and grease monkeys who were on night duty. He was dressed in light, white overalls, flying boots and a light helmet.

"Roll out a Snorter and warm her up!" he snapped in his best imitation of Bill.

The mechanic in charge looked at him doubtfully, while the grease monkeys grinned at one another. "Do you



have an order from Scotty?" the mechanic asked. "There's no ceiling."

"Listen," Sandy said, examining his wrist watch, "I'm in a hurry. Let's get rolling!"

Fifteen minutes later he stowed a bag in the gunner's cockpit and opened the emergency locker in the tail to check its contents. There was a small tent, a folding rubber boat, a sub-caliber machine gun, a Springfield rifle with a telescopic sight, a small outboard motor, an ax, a pick and a short shovel. He nodded his head, closed the locker and climbed into the forward cockpit.

Then he took the Snorter into what was now rain, with a verve and precision that would have done credit to Bill Barnes himself. At five thousand feet he leveled off and listened to the steady drone of the twin Diesels, checked his two .50-caliber machine guns and his ammunition counters, and took his bearings.

The rain was beating furiously against his windshield as he pulled out the map rack and plotted his course. After five minutes of flying he noticed that the storm was abating and the fog clearing. He checked his position and his drift and his airspeed against the chronometer, and grinned with satisfaction.

At the same instant Sandy lifted the nose of his Snorter off the runway, Tony Lamport put in a telephone call to Bill's bedroom. Bill shook his head angrily at the buzz of the bell, then reached for the phone.

"Sandy just left, Bill," Tony said in his ear. "I tried to hold him back because there's no ceiling and it's raining cats and dogs."

"What a chance," Bill said. "Tell Scotty to warm up the Lancer and have it ready on the line. Let me know when you hear from Sandy. Tell Charlie to bring some orange juice and toast and coffee over to my bungalow."

"Okay, Bill," Tony said and cut off.

Young Sandy checked his bearings again over the city of Philadelphia. It was daylight now and the fog had cleared away completely. He laid his course along the regular air lines as far south as Raleigh, North Carolina, then pulled from an inside pocket the yellow parchment Bill and he had been looking at the night before. Checking both the parchment and his regular map, he plotted a course from Raleigh to take him over Goldsboro, Newbern, and from there out over Cape Lookout and down the coast over Pogue Sound until he came to Pogue Inlet and the mouth of the White Oak River.

He was singing at the top of his voice, from sheer exultation, when the ancient town of Beaufort flashed under his wings. Perhaps that was why he did not hear the motors of the two ships



that were riding just above him. Perhaps it was carelessness.

As he left Beaufort the two blood-red biplanes above him stuck their noses down. Fire and death sprayed out of their machine-gun ports and the curling smoke of tracers lined the air between the tail of Sandy's Snorter and two plunging ships.

Only Sandy's instantaneous reaction as he heard their yammering guns kept his head from being blown from his shoulders. He yanked the Snorter over on its back as the two ships plunged under him, then rolled it right side up in a flashing Immelmann turn. As he saw them pull out of their dives and hang their powerful little ships on their props, he knew they had been waiting for him, waiting to get possession of the parchment in his pocket. For an instant he hesitated. Then reached for his radio switch.

"Calling BBX. . . . Calling BBX. . . . Calling BBX!" he shouted into his microphone, while he poured soup into his engines and kept an eye on his airspeed indicator.

In a moment Tony Lamport's voice came back to him.

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

"Tony! Sandy calling," he said. "Sandy calling BBX. I've stuck my nose in a jam, Tony. Tell Bill. Two biplanes are trying to shoot my buttons off. I—"

"Where are you, kid? Quick!" Tony said. "Bill's standing by."

"Just off Cape Lookout," Sandy said. "I—"

"Hold it, kid," Tony said. "I'll be back in a minute."

Sandy side-slipped the Snorter out of range as the two blood-red biplanes came down on his tail again. Suddenly he realized that the two biplanes had almost as much speed as his Snorter and that their pilots were masters at their craft. He could feel goose flesh creeping all over his body as he got a glimpse of the cold, black waters of the Atlantic below him. Then Tony's voice sounded in his ears again and gave him courage.

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

"Go ahead. . . . Go ahead!" Sandy shrilled.

"Bill says to lay a course across Pamlico and Albemarle Sounds with your nose on Norfolk," Tony said. "Run away from 'em if you can. If you can't make a running fight of it. He is just taking the Lancer off the south end of the field. Hold everything until he gets there, kid."

"I'll hold it if I can!" Sandy panted, and threw his switch.

He stuck the nose of his Snorter down and roared at one of the biplanes as it eased out of its dive and came around in a climbing turn. Three fingers and his thumb were wrapped around the grip on the end of the stick, and his forefinger rested lightly on his gun trips. For an instant the biplane came under his telescopic sights, and then his forefinger pressed hard on both electric trips. The two synchronized Brownings on either side of him roared into action. He could see his tracers lacing the air with their white smoke.

The pilot of the red ship slipped the biplane down to the right, inside Sandy's range of fire, and escaped. Sandy almost tore the wings off his Snorter as he yanked the stick back to bring it out of its dive. He knew that he was overcontrolling, but he couldn't help it. He brought the Snorter up and around in a flashing chandelle and went back to the attack.

He could see the ship that had just slipped away, going back upstairs as fast as it could get there. But for the moment the other one had disappeared. He started to swing his eyes in a circle, when the *tat-tat-tat* of a machine gun sounded almost in his ear. He threw one quick glance upward and backward as his hand tightened convulsively around the control column.

The first biplane was again diving on him from above. He could see the tracers darting at him and he could feel the impact as a sheet of death drove through his Snorter. For an instant his heart stopped beating. Then he kicked his rudder and threw his stick to bring the ship up and around in a fast climbing turn. As his engines almost stalled he stuck the nose down and leveled off.

A moment later he knew that he had made a sickening tactical error. The ship that had dived below him had come out of its dive as Sandy began his climbing turn. It came up and around with him and was riding just below his tail. The other one was flying directly above him. He tried desperately to outmaneuver them and get into the clear, where he could use his guns. But they were too smart to permit that, and were forcing him lower and lower as they fired burst after burst of fire through his tail.



Suddenly, one of them dived straight across his sights to lure him lower. As Sandy plummeted toward him the other one came down on his tail and forced him even lower. He knew the game they were playing, but he couldn't do anything about it. They had every trick of the combat pilot and they seemed to anticipate his every move.

He was aware they were trying to force him to land without injuring him. And he was aware that he had got himself in such a jam because he had not followed Tony Lampert's instructions. Instead of making a running fight of it he had tried to shoot them both out of the air. He threw his radio switch and chanted Bill's call letters into the microphone.

"Sandy calling BB. . . . Sandy calling BB!" he shouted desperately.

"BB answering. . . . BB answering. . . . Go ahead, kid. . . . Go ahead," came back to him.

"Gosh, Bill," Sandy said. "They're pinning my ears back. I—"

"What the hell is the matter with you!" Bill roared. "They can't be any faster than your Snorter. Are you doing what Tony told you? I'll be at Norfolk before you are."

"They have me in a cross-fire, Bill," Sandy said, "and they're forcing me down."

"Get upstairs!" Bill bellowed. "Hang your Snorter on her props and get through 'em. Lay your nose right on one of them and open her wide. He'll get out of the way. Where are your guts, kid? Get above 'em and lay your nose on Norfolk. Do what I told you to!"

"Okay!" Sandy snapped back. He was mad now and he was dangerously tired. The idea that Bill questioned his courage made him forget his exhaustion.

He rammed the throttles of the Snorter open wide and hung it on its props. The ship above him started to nose down with its guns yammering. But Sandy had moved too fast for the enemy pilot to anticipate what he was going to do this time. He went through that hail of lead and was up and away before the pilot could get him under his sights again. He took his Snorter upstairs like a bolt of light with the two red biplanes strung out behind him.

"I guess I'll always be a sucker!" he said to himself, tears of anger in his eyes. He looked back and down and saw that the two blood-red biplanes were at least six hundred yards behind as he leveled off at fifteen thousand feet and checked his bearings.

As he sped above the waters of Pamlico Sound he began to laugh aloud. The two biplanes had peeled off and were nowhere in sight. He was laughing because their attack had proved one thing to him. Not even Bill could ig-

nore the fact that someone had been waiting and watching for them to make a flight toward the spot designated on the yellowed parchment. Their attack could mean only one thing—that Macado had been trying to hide the treasure map from someone else who knew of its existence. And it followed that both Macado and his enemies believed in the hidden treasure.

Sandy held the nose of the Snorter hard on Norfolk as he made contact with Bill again and told him the two biplanes had peeled off.

"Okay, kid," Bill said. "I suppose you're satisfied now."

"What do you mean, Bill?" Sandy asked innocently.

"Don't tell me you're so dumb you don't know the meaning of that attack," Bill snorted.

"Sure, I know," Sandy said in a jubilant voice. "It means—"

"Is your Snorter all shot to hell?" Bill snapped.

"No, it's all right. A few holes, but nothing vital."

"Then swing around and lay your nose on Raleigh. I'll meet you there at the airport."

"Okay, Toots!" Sandy said.

He knew that meant Bill was going to help him look for the buried treasure.

## VI—TEN PACES NORTH—

BILL went over Sandy's Snorter with a fine tooth comb at the municipal airport at Raleigh. When he had finished he shook his head in pretended disgust and said again, "Why in hell didn't you do what I told you to do?"

"Gosh, Bill," Sandy said. "I—I—"

"I," Bill cut in. "I'll have to send for Shorty and Red and Bev to come down and help me. You'll have to take that crate back to the field and get it patched up. It's too bad you couldn't follow instructions. If we find any buried treasure you'll be wrestling with that Snorter while we're doing it."

"Holy smoke, Bill!" Sandy said, and his face was aghast at the idea. "You wouldn't do that to me, would you? Why, you wouldn't know anything about that map if it wasn't for me. You wouldn't be that kind of a heel, would you, Bill?"

"When I give you orders will you obey them in the future?" Bill asked. His face was a thundercloud, but the twinkle in his eyes belied the tone of his voice.

"Listen, Bill," Sandy pleaded. "In the future if you order me to kiss a baboon, I'll kiss it. But don't send me back to Barnes Field. I'll do anything you say if—"

"All right, kid," Bill said. "Just remember that I don't give you orders for the sake of giving them. I'm no dic-



tator. I just don't want you to get your fool head shot off. We'll have Shorty and Red and Bev meet us at Pogue Inlet. You can take Bev's Snorter and he will fly yours back to the field."

"Do you think we're going to need Shorty and Red?" Sandy asked. The idea of having those two battle-scarred veterans around to kid him if they found no treasure, or even if they did, made him nervous. They spent about half of their time thinking up ways and means of making Sandy miserable.

"If we find any gold," Bill said, "we've got to have some way to transport it. And judging by that attack on you we may need a lot of protection. Let's see that map again."

After reading the instructions on the parchment, Bill glanced at his wrist watch, then referred back to the first paragraph.

"It says the October sun is the key and we must catch it at just one o'clock. We'll have two hours to locate the place and figure out the difference in shadows between October and this month. I'll lay the course and when I locate the place you follow me in for a landing."

"Are you going to keep the map?" Sandy asked as Bill stuck it in his pocket.

"Yes!" Bill roared at him. "What's the matter? Are you afraid I'll steal it!"

"No! No!" Sandy said hastily. He started on a run for the forward cockpit of his Snorter. An instant later his engines blasted. He kicked the ship around into the wind and took it off in a long, low climb.

Bill followed him into the air immediately. They leveled off side by side at five thousand feet while Bill plotted his course from the yellowed parchment and the chart on his map rack. A half hour later they were circling above the inlet that afforded an entrance from the Atlantic Ocean into Pogue Sound and the mouth of the White Oak River.

Below them was a desolate expanse of pines and cedars and sand dunes, with here and there intertangled patches



of swampland covered with bayberries and sea-grape scrub. Sea gulls and great scrawny-necked vultures squatted on the sands and watched them as they circled lower and lower close to the mouth of the river.

"Keep your altitude," Bill said into his microphone, "and keep your eyes peeled for those biplanes that attacked you. I'm going lower and see what I can see. The whole contour of the mainland may have changed in two hundred and fifty years. It looks to me now, kid, as though we didn't have a chance of locating anything."

"What about that Port of Missing Men Tavern, Bill?" Sandy asked.

"That has been dust for a hundred years," Bill said. "Just a minute."

He circled down until he was only two hundred feet above the water, while Sandy strained his eyes over the side of his ship, hoping against hope that they would locate some clue to give them a beginning.

"Okay, kid," Bill said in a few moments. His voice sounded tense with suppressed excitement. "I think it's that point that comes down farthest on the right-hand side at the mouth of the river. Notice the pines and cedars grow only a little ways from the dunes there. And I see something else that may help us when we get on the ground. Wait until I make a landing, then follow me in. I'm going to taxi in as close as I can and throw out my sea anchor. We'll have to go overboard and wade ashore."

"O-okay, Bill," Sandy said. "Did—did you get in touch with the field and tell Shorty and Red and Bev where to come?"

"Yes," Bill said.

He lowered the single long float from the belly of the Lancer and the smaller wing tip floats from the wings, and set the big ship down on the water in a cloud of spray and spume. A moment later Sandy followed him in. Only thirty feet from the shore they threw out their sea anchors and went over the side into water up to their hips.

"Stick an automatic in your pocket," Bill shouted at Sandy just before they started to wade to shore.

Sandy fell down, completely submerging himself, in his anxiety to reach the shore. But he was holding the automatic above his head as he struggled up out of the water.

"My cripes!" he said to Bill. "I—I'm going to blow up in a minute, Bill!"

On the shore, Bill took the faded

parchment from his pocket and read: "Take your long-boat through the inlet and into the mouth of the White Oak River. Beach boat where the pines are close to the dunes." . . . That's the spot, right there, kid. And there is an old oak that has been shattered by lightning, probably a hundred years ago. If we can find some trace of the ruins of the Port of Missing Men Tavern we'll know we're right. We'll start at the oak and go four hundred paces due west."

"No, Bill," Sandy said, and his finger trembled as he pointed to the second paragraph of the map. "It says to follow the shadow of the sun from the white oak at one o'clock. Where that shadow ends we're supposed to set a sapling. That sapling will be four hundred paces east of the Port of Missing Men Tavern."

"Right, kid," Bill said. "Before we start, go back out and get the axes and spades from the emergency lockers. We'll need 'em to cut saplings and—"

He had started to say: "And dig up the chests." He was burning with the same fever that was absorbing Sandy, but he didn't want to admit it. In the back of his mind he couldn't help believing that they were on a wild goose chase. He, he tried to tell himself, was just helping the kid have a little fun.

"—you're already soaked and can't get any wetter," he finished lamely.

"Right," Sandy said, and tore across the sand to plunge into the inlet again.

"We'll leave this stuff here," Bill told him when he returned, puffing, "and try to figure how much of a shadow the oak will throw at one o'clock in June instead of October."

Bill figured the height of the sun and the duration against the shadows in October from a little chart he took from his pocket. Then he paced off the approximate length and cupped up a pile of sand to mark the spot.

Next he took out a hand compass and located due west.

"Bring that ax along, kid," he said, his voice uncertain. "We'll have to cut through that tangle of brush ahead."

For three hundred and fifty paces there was only a creeping vine clinging to the surface of the clay and sand to bar their passage. At the end of that distance they came up against a solid wall of sea-grape scrub and tangled vines which was almost impenetrable.

"Go back and get the other ax," Bill ordered as he began to cut his way through.

They chopped and hacked and bludgeoned until their hands and faces were a mass of cuts and scratches, and their clothes soaked with perspiration.

"There was never any tavern in here, kid," Bill finally said. "I don't think this land has ever been cleared."

"Have we come another fifty paces?" Sandy panted.

"Close to it," Bill said. He threw his ax on the ground and sat down beside it to wipe his face. He was convinced now that the map was a hoax. And he was sore at himself for having humored Sandy.

Then the thought of those two blood-red biplanes that had attacked Sandy flashed through his mind, and he reached for his ax again.

At just that moment Sandy, who had not stopped working, let out a war-whoop which would have done credit to the Tuscarora Indians who had raided and killed there three hundred years before.

"Here it is, Bill!" he screamed, dropping down on all fours to point at the cellar and foundations of a building that had long since vanished.

Bill crossed the intervening distance in three enormous strides, and he was, suddenly, as excited as Sandy. He was Sandy's age as he pushed back the tangle of vines and peered at the fallen stones of the old foundation.

"By Francis Meech's bones!" he said in an awed whisper. "It's there!"

"It's there!" Sandy echoed, and he looked at the watch on his wrist. "It's just one o'clock now, Bill. Let's pace back four hundred paces due east and set a sapling."

They were no longer tired as they carefully followed their compass four hundred paces due east.

It was nearly two o'clock when they had agreed on the length of the sapling and had set it upright in the sand, not far from where Bill had first made his little mound.

At two o'clock they followed for twenty paces the shadow of the sun cast by the sapling, and set another sapling.

"Now we've got to wait until sunset," Sandy said. "Don't you suppose we could estimate the direction of that shadow and the shadow that will be cast by the spade? I don't think I can wait until sunset."

"We can try it," Bill said. He glanced into the sky, remarking, "It is time Shorty and Red and Bev were here."

Sandy didn't answer. He was busy pacing off five paces along an imaginary

BILL BARNES' NEW SHIP—

## THE "CHARGER"

PLANS AND DESCRIPTION BY FRANK TINSLEY  
IN THE SEPTEMBER ISSUE



shadow. At that point he stuck his spade deep in the sand and followed another imaginary shadow for ten paces. There he took the compass and walked ten paces due north.

He was in a thicket now and the ground beneath him was wet and slimy. Bill was following closely behind him, checking carefully.

They cleared away the tangled underbrush, standing ankle deep in muck, before they took their spades and began to dig feverishly. The soil was brackish and water ran into the hole nearly as fast as they cleared out the earth.

As Bill dug deep with his spade it struck something hard and solid. He shoved his spade beneath it and heaved upward with all his strength. Sandy was watching him with wide eyes as a round object caked with mud rolled off the end of the spade. Bill swished it in the brackish water until the mud began to drop away.

Suddenly, he realized that he was holding a human skull in his hand. He half dropped it but seized it again before it fell back into the hole. Turning it over, he saw the hole where some object had pierced the skull at the temple and had come out at the rear.

"Frizzle my ears!" Sandy said softly, staring at the thing.

"He was shot through the head," Bill said. "That may mean something. Pirates often took their men ashore to bury their treasure and then shot them so no one would know where it was buried but themselves."

"We're hot, Bill!" Sandy grabbed at his spade again and began to dig. He was trying to throw water out of the hole when Bill's voice came to his ears in a way that made him rigid in his tracks.

"Hold it, kid!" Bill snapped. "Don't move!"

Sandy followed Bill's gaze as Bill whipped an automatic out of his pocket and pointed it. Coiled only four feet away from him, with its flat, ugly head angling up to strike, was a dull, dark-chestnut-brown snake, barred with black. Its slimy belly was black, blotched with a yellowish white. Its tongue was darting in and out as it prepared to strike.

Bill's automatic cracked three times in rapid succession, the shots tearing the snake's head off, while Sandy jumped backward, white and shaken.

## VII—"IF YOU ARE BOLD——"

"YOU want to keep your eyes open for those water moccasins," Bill said. "They're a darker species of the copperhead and just as poisonous."

"Thanks, Bill," Sandy gasped. "He'd have got me sure."

A moment later they returned to work, knee-deep in mud now. Their

backs were lame and sore, their faces and hands matted with coagulated blood.

It was Sandy's spade that first struck a solid object, the impact driving the handle back into the pit of his stomach. He choked for a moment as Bill stopped working to watch him.

"A rock, I guess," he gasped.

"Rock, hell!" Bill said. "There aren't any rocks in this muck, kid. That's pay dirt!"

For twenty minutes they worked like two men possessed with endless strength. They cleared the water and muck away from the wood and iron cask that came to light. They were too tired and too exhausted to speak while they got pieces of wood underneath the bottom and heaved it up on end.

"It's too light, Bill," Sandy said, and there were tears in his voice.

"Let's get it out of here and find out what's in it," Bill snapped.

They rolled the cask out into dry sand and looked it over carefully. It seemed to be an ordinary, heavily oiled water cask.

Bill drove in the half-foot bung with one terrific blow from his ax. He knelt and ran his hand around inside the cask.

"There's nothing——" he began, then his face flushed as his fingers found a square object. He pulled it through the hole in the top.

They both gazed with wide eyes at the square, brown bottle he held in his hand.

"There's a paper inside it," Sandy said in a whisper.

They chipped off the sealing wax that held the rotting cork in place and began to fish for the round roll of paper inside. Bill took the bottle from Sandy's trembling hands, and placing it between his knees, began working two twigs inside like a tweezer until he had extracted the paper.

It was rolled and tied with a tiny piece of oiled hemp that crumpled beneath their touch.

"Easy," Bill said, as he unrolled the piece of parchment on the dry, hot sand. The India ink of the writing stood out as though it had been applied the day before. The script was old English, and in the same hand as that of the first parchment. At times the pen had splattered, and twice the quill seemed to have been jabbed into the paper.

They hardly breathed while they scanned the letter:

TO MY GOOD FRIEND THE HON-  
OURABLE ANTHONY MANN,  
GOVERNOR OF NORTH CARO-  
LINA——

You have followed well my directions to find that our gold has flown. Well knowing you would break our trust and

that there is honor only among pirates and sea rogues, I have hastened to remove temptation after placing your receipt in my strong box.

Your share of the gold, and mine, rests deep in the soil of a morne, overlooking the Caribbean Sea on the isle of Trujillo hard beside the Spanish Main.

Knowing it is only just that you should have your share I gladly leave a chart that will help you find it.

Cast your anchor in the little harbour north of Paz where stand the ruins of a Spanish block house, built of stone. Follow straight back of the house to the crest of the morne. Down through a ravine beyond the crest rages a stream when the season is rainy. In other seasons it is as mild as your love for me.

Follow the stream toward the sea until the rocks are so large and the ravine so deep you cannot go further without the aid of scaling ladders and lianas. There the stream disappears beneath an overhanging ledge of rock, but there is no further passage in it unless you are bold.

If you are bold, as I know you are, my good friend, you will dive off the largest boulder into the stream and disappear with it. The water is ten feet deep, deep enough for you to drown.

It will carry you fifty feet toward the Caribbean with rock above you and on your left and only a shaft of light on your right.

When the stream comes to the surface again it plunges into a four-hundred-foot waterfall and into the Caribbean Sea. If you wish to live draw yourself to the right bank before it plunges. The huge roots of a gommier tree that towers high above you will give you an anchorage.

Draw yourself to the edge of the ravine. Due south are two large chatagnier trees twenty paces apart. Exactly ten paces from each of them, three feet below the top growth, you will find the six chests of Arab gold.

And ere you leave the spot, my honourable friend, you will also find death.

I leave a doubloon within this cask to seal the bargain.

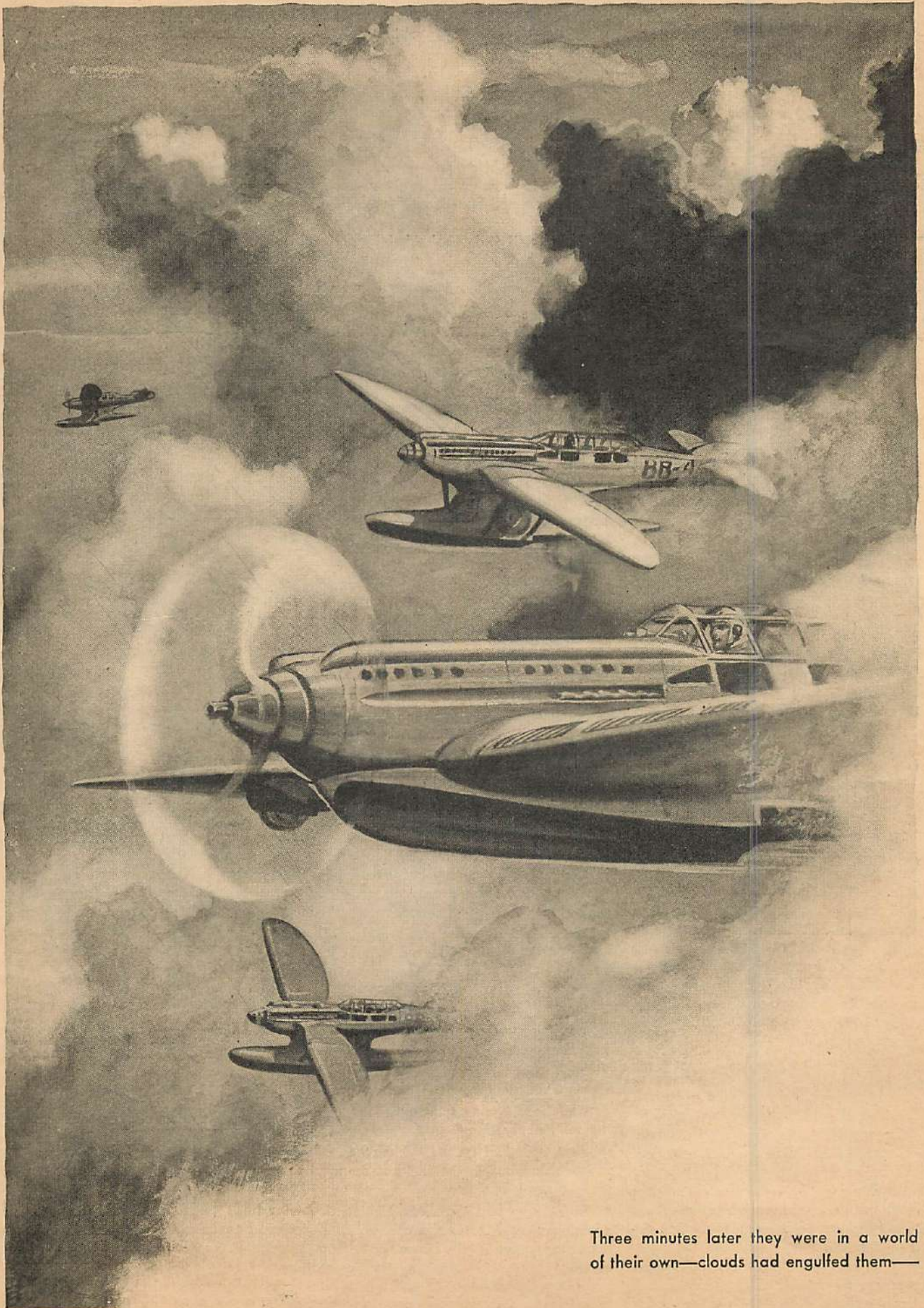
Francis Meech

A long-drawn whistle escaped Sandy's lips as they finished reading. Bill bent over the cask again and ran his hand around inside. When he drew it forth he held a large Spanish coin between his fingers. Sandy stared at the thing like a man in a trance. Then a grin split his blood-marked face.

"No one has ever touched that cask since it was placed there, Bill," he half whispered.

"No one," Bill said. "It all fits, kid. I read some more about Captain Francis Meech and the Governor of North Carolina last night. Everyone believed that Meech and Governor Mann were in league with one another. When Meech was finally boarded and killed by a station-ship of the Royal Navy, they found a lot of papers in his cabin that showed both the governor and his





Three minutes later they were in a world of their own—clouds had engulfed them—



secretary had been aiding Meech. Do you get the idea?"

"I'm afraid I don't, Bill," Sandy said.

"Well, look. Let's reconstruct this thing from these two parchments we have. Suppose Meech had taken a lot of ships and was going to divide his loot with Mann for his protection. They came here and buried the six chests of gold and each of them took a map that told where to find it. They made an agreement that neither of them would touch it unless the other was present.

"Meech, being doubtful of Mann's honor, as he sarcastically points out in the second letter of instructions, went back and got the gold without Mann and took it down in the West Indies to hide it where he was sure Mann would never go for it.

"He took the gold down there and when he came back he was captured and they found the receipt Mann had given him among his papers. I believe Mann killed himself at that time to escape punishment, and Meech was killed when his brig was captured."

"Then you think that gold is still down there on the island of Trujillo?" Sandy asked.

"If it was ever there," Bill said.

"That is Macado's island!" Sandy exclaimed. "The whole thing dovetails, Bill."

"Yes," Bill said. "It's Macado's island. But how did he know anything about the gold? Unless Meech left a duplicate of this note no one ever knew where he buried the gold."

"I wouldn't know about that, Bill," Sandy said. "But we're going to try to find it, aren't we?"

"We're going to try to find it," Bill said decisively. "The island of Trujillo has been Spanish and British and French—each a half dozen different times when the British and French were fighting over the smaller islands down there. I—"

He stopped talking to cock his head to one side and listen as the steady, rhythmic drone of airplane motors sounded overhead. A moment later he pushed his way through the scrub and ran down to the edge of the sand dunes.

"Snorters," he called to Sandy, and began waving his arms.

The Snorter flying at the point of the little "V" formation dipped a wing in acknowledgment as it circled ahead of the other two to come in for a landing.

"Listen, Bill," Sandy hissed, "you're not going to let those lugs, Shorty and Red, in on this, are you? They'll gum the whole thing."

Bill turned around and fastened his eyes on Sandy until the other's face became crimson.

"Remember, kid," he said, "that pair of lugs, as you call them, have pulled your chestnuts out of the fire at least a thousand times. You wouldn't be stand-

ing there with a dirty face right now if it weren't for them."

"Gosh, I'm sorry, Bill. I didn't mean that the way it sounded. You know they could have my shirt."

"That's better," Bill said. "We may need them badly before we get through with this thing."

The three Snorters raced in for a landing with their flaps down. Their pilots taxied in toward the shore, threw out sea anchors, and then slid over the sides.

"The Marines have landed," Shorty shouted, "and have the situation well in hand!"

## VIII—"READY FOR ACTION!"

RED GLEASON, Shorty Hassfurther and the brown-eyed Bostonian, Beverly Bates, regarded Bill and Sandy in utter amazement as they approached them on the beach.

"Just a couple of beachcombers," Red Gleason said, staring at the cuts and mud on the pair. "You look as though you'd dropped down here to fight it out on the beach."

"Little boy been making mud pies?" Shorty Hassfurther asked Sandy.

"Nuts to you, Tarzan," Sandy said. "If you'd—"

"All right! All right!" Bill said. "Did you birds happen to see any red, tear-drop biplanes with amphibian landing gear?"

"Yes," Shorty said. "I put a glass on them—there were three elements of three planes, nine in all. I couldn't find any markings on them. They looked as though they mounted machine guns and were fast."

"They didn't bother you?" Bill asked.

"No," Shorty said. "They looked us over and disappeared—going south." He studied Bill's thoughtful face for a moment. "You might give us an idea what this is all about," he added.

Bill dropped on the sand and said, "Sit down and I'll tell you. And the first bird that laughs gets a smack on the nose."

Shorty Hassfurther and Red Gleason began to grin as they glanced at Sandy's serious expression.

"He's got you in trouble again, eh?" Shorty said, nodding at Sandy.

"All right, you scuttle of Dutch cheese!" Sandy flared.

"Shut up!" Bill roared. Then he began to grin himself. "Believe it or not, we're digging for gold."

After they had finished with their wisecracks and astonishment he told them the whole story from beginning to end. Instead of laughing they were intensely interested. Then he asked them about their ships and how much fuel they were carrying.

"We're all full up except for the leg down here," Shorty said. "What's the plan?"

"We hop out of here in a few minutes and make Port-au-Prince tonight," Bill said. "In the morning we shove for that little harbor north of Paz on the island of Trujillo."

"All of us?" Bev Bates asked. "I'm supposed to start on that aerial survey up in Nova Scotia tomorrow."

"That's okay," Bill said. "Give Sandy your Snorter and take his back to the field. It needs a lot of patching. You'll have to keep in touch with Scotty and keep things running until the rest of us get back."

"Let's get rolling," Shorty said, his hard-bitten eyes gleaming in anticipation of what was to come. "It's a thousand miles to Port-au-Prince and I'm hungry now."

"You're always hungry," Sandy said in disgust.

Twenty minutes later Bill spoke into his microphone: "All right, Sandy. Kick your Snorter up to ten thousand. Red next. Then Shorty. We'll take our regular formation and hold it. Three hundred m.p.h. Tony just told me they are running up storm warnings down through the islands. Let her ride, Sandy!"

That evening at dusk the four ships left a gurgling wake behind them as they glided to a landing on the surface of the harbor at Port-au-Prince. The sky became an indigo blue through wisps of clouds as the ball of fire in the west that was the sun plunged into the sea.

At eleven o'clock the next morning, after a sound sleep in hotel beds, the little formation flashed above the last of the Greater Antilles and across the purple passage that separates them from the Virgin Islands. Circling above the harbor at St. Thomas, Bill asked the naval station for reports on the weather. After he had them he contacted his own planes.

"The weather sounds bad ahead," he said. "Shall we lay over here or go on through?"

"Go on through!" Sandy said immediately.

"We might as well, Bill," Shorty seconded.

"Okay," Bill said.

Long shadows played across the hills above the old town of Charlotte Amelia as Bill stuck the nose of the Lancer on St. Croix to the south, after climbing to ten thousand feet. Far off to the east Mt. Misery rose from the sea on the island of St. Kitts. Thunderheads seemed to be rolling up out of the sea behind it as the morning breeze stiffened.

As Bill completed checking his instruments, the light on his radio panel gleamed red. He flipped the switch and



heard Shorty's quick, staccato voice tumbling into his ears.

"Formation of nine amphibians riding on the horizon about fifteen miles off our starboard bow," he said. "I put a glass on them and I think they're the same ships we saw yesterday. They don't seem to be paying any attention to us."

"I see them," Bill said. "Keep an eye on them, all of you. They won't bother us. We'll be in the center of a storm within a few minutes. We might as well ride through it. Keep checking in."

cockpits of the four ships, rising and falling with the force of the wind.

Angry banks of clouds were swishing in all about them. Rain beat against their windshields and overhead hatches as only tropical rain can. The wind lashed at them in sudden bursts of fury, slamming them against their safety straps while their control columns beat a steady tattoo on their legs.

Bill tried to get through to the radio station on Trinidad. A noise like the roar of a train in a tunnel beat on his eardrums. Rain seeped down through his overhead hatch and trickled across

But to Shorty the storm was just another part of his daily work, a part of his job. Storms and bullets and wings that flew off in power dives were all the same to him. He had learned to take them in his stride and let the pieces fall where they might.

Sandy was riding it with a laughing tenacity that was characteristic of him. While he fought his ship he thought about the pirate ships that had ridden out the tropical storms along the Spanish Main three hundred years before. After a bit he tried to check his position. Finally, he gave up with a shrug of his shoulders. He didn't know where he was and he didn't much care. He only wanted the storm to abate so that he could get through to Trujillo.

As Red Gleason rode the storm he sang to it—or with it. It was a habit that drove Shorty crazy. Whenever Red got in a tight spot he began to sing. He sang what he thought was tenor. But he couldn't even carry a tune. He was screaming now at the top of his voice, singing a marching song he had learned in France during the war.

As the force of the wind began to lessen and rain no longer slashed at his windshield, he became aware that the light on his radio panel was gleaming. He threw the key and heard Bill's far-away voice bellowing in his ears.

Bill's breath hissed between his teeth as Shorty, Red and Sandy checked in. He asked them for their positions, checked them against his own, and ordered them back on their original course.

The French islands of Guadeloupe, Dominica and Martinique flashed under their wings as the storm disappeared into the Caribbean. They closed up their formation with Shorty riding on the point of a V, with Red to starboard and Sandy to port. A thousand feet above and a little behind Shorty, Bill rode the Lancer.

Above the Grenadines Bill altered their course to south-southwest as he laid the nose of the Lancer on an invisible Trujillo, far out in the Caribbean.

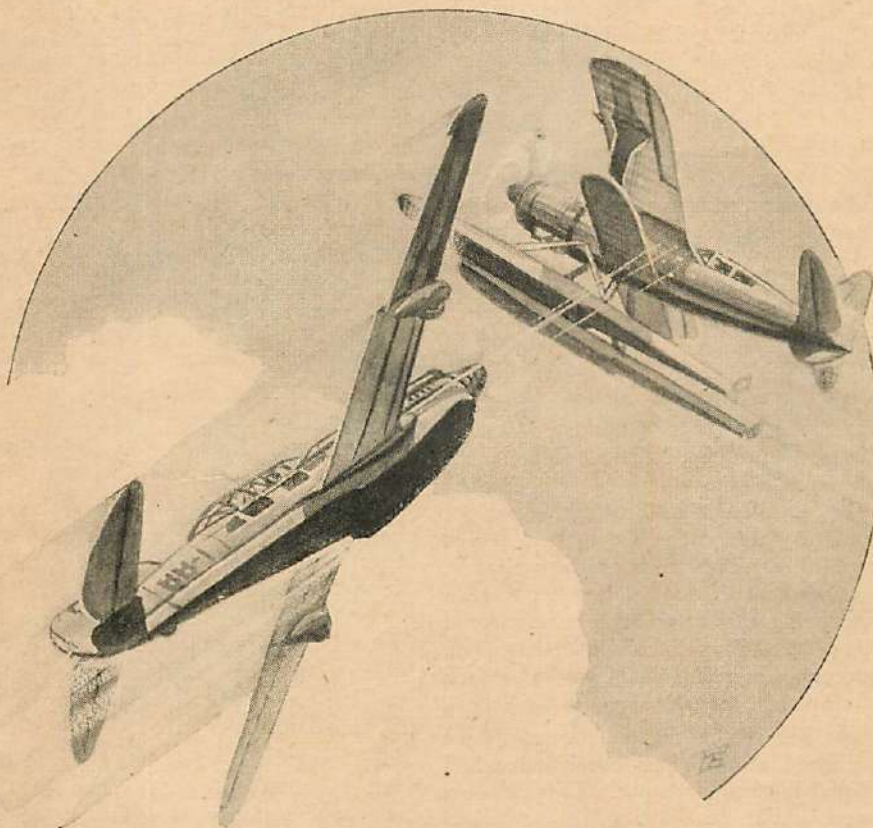
"Ten thousand, three hundred m.p.h.," he finished.

"Oh, Bill!" Sandy said as Bill stopped speaking. "Those same nine amphibians are riding five thousand feet above us. They're riding the sun. They're—"

"Here they come!" Bill barked. "Ready for action!"

## IX—ZOOMING DEATH

BILL surveyed the diving red ships for a split fraction of a second and saw that they were attacking in a manner he knew only too well. They were making their attack in a V formation with the squadron leader at the point and the sub-leader a few hundred feet above



His fingers fastened down hard on the gun trips as a flash of red came under his sights—

Three minutes later they were in a little world of their own. Clouds had suddenly engulfed them. Fog began to lick at the coated windows as they battened their overhead hatches, then came great drops of tropical rain.

An air pocket slapped Sandy's Snorter down several hundred feet and threw him against his crash pad. He grunted a protest and worked like a veteran to regain balance, his eyes anxiously scanning his instrument panel. He stuck his nose upward as the light on his radio panel gleamed scarlet. Bill's voice came through the ether.

"Get up to twenty thousand," he said above the crackling static. "Hold your course. Stick close together. Check in, all of you. Don't forget your oxygen."

The high drone of the supercharged Diesels filtered through the inclosed

the deck at his feet. He checked his position as best he could and tried the radio again. He chanted his men's call letters over and over without an answer.

Shorty Hassfurth further jerked the stick of his Snorter back to bring it out of a dive. His body ached from being thrown against the cowlings. His safety strap was cutting through his stomach and seemed to be stopped only by his backbone.

He nursed his ship out of a flat spin and tried to tighten his hatch. Rain was roaring and raging against it and running down his neck. His Snorter was creaking and groaning like a destroyer in a heavy sea. His radio was useless. At times it seemed his ship would be twisted into a million pieces by the force of the storm.



him. Another sub-leader rode far back of the base of the V.

"Chandelle up and back!" Bill roared into his microphone. "I'll take the sub-leader. Shorty, take the leader. Red, number three to starboard; Sandy, number two on the port side. Watch four and five, Shorty. They'll both dive on you. Hold your fire. Give 'em hell when they're in close!"

The air above the Caribbean became a bellowing, yammering madhouse as the two patrols sped within range, and the deep-throated roar of the .50-caliber Brownings in the three Snorters and the Silver Lancer joined the high-pitched stutter of the amphibians' guns. Bullets tore through fabric and metal and left their passing kiss on the thirteen participants in the battle. But the speed of the two patrols had been too great for accurate shooting in that first clash. They flashed by one another and pulled around as they jockeyed back into formation.

"All right!" Bill bellowed into his microphone. "Come up and back fast in an arrowhead column."

They were above and diving on the nine blood-red ships with the speed and fury of hawks. Their powerful .50-caliber guns belched fire and death as the nine ships formed an echelon and pivoted to their left. But their pivot was started too late. Bullets tore into their tail surfaces and crept forward to their cockpits. A white face popped up in the leading plane as one of the red ships yawed wildly and crashed into the one next to it. The two mangled craft, locked together, began a dizzy descent to the waters of the Caribbean.

The blood was singing through Bill's body as he saw the seven remaining ships close up their formation in answer to the flipping ailerons of their leader. His own arrowhead column was below the enemy now and turning with them to the left. He raised the nose of the Lancer sharply in a swift climb to indicate that his men were to get altitude. He saw Red Gleason holding one hand above his head with the thumb sticking up. As Shorty and Sandy followed suit, he knew they had not been touched in those first two feints.

Then Bill saw the leader of the red ships rock, fishtail his rudder, and rock his ship again. In the air language of all the world, that meant it was to be every man for himself now. As they swung out of formation and stuck their noses down, Bill gave the signal his men had been waiting for. He dove sharply and then zoomed upward.

The Lancer and the three Snorters became four separate bolts of fire and death as they broke their formation and whirled out of the murderous fire of the enemy ships.

Bill's mouth became a firm, hard line

as he whipped the Lancer upward and over on its back. What had been a plane, no faster than the rugged red amphibians, became a streak of silver light.

The seven red planes were concentrating on Bill, at the same time trying to avoid the desperate fire of his men. They were forming a Lufberry circle around him trying to get him in the vortex of their fire. He whipped up and chandelled back with wild fury. They dove and zoomed and skidded to get out of his flaming path. His fingers fastened down hard on his gun trips as a flash of red came under his sights. He carved a ribbon of death on the side of the cockpit and the ship nosed down with a dead man at the controls.

Guns sang their songs of death and hate as the air became choked with slashing, whirling madmen intent on destruction. The loss of three ships only made the six remaining pilots fight more desperately; they showed no sign of turning tail.

Red Gleason and Shorty Hassfurther were fighting the kind of fight for which they were famous. The kind of fight that had allowed them to live through a thousand aerial combats. They were in and out of that tightening Lufberry circle, feinting and then stabbing with streams of crimson fire, never giving the other man a chance to catch his balance and get them under his sights. Attack and retreat was their stock in trade, darting in with a murderous burst, then whirling away before the enemy could get set. They broke up the circle around Bill with their tactics, and then each picked his own man.

As Bill zoomed out of the mad fight he saw that the other four biplanes had closed in around Sandy. Two of them were under his tail. The youngster whipped his Snorter up in a flashing Immelmann turn and tried to run from them, but they stuck to him like a flock of vultures.

Suddenly, Sandy whipped around, did a complete roll to avoid the fire of one of the ships, cut left and pounced on it with his guns chattering. As the biplane veered away he came about in a vertical spiral. He rolled and twisted desperately to get out of range of the guns of the other three planes. They lined up again and began to get him in the vortex of their fire.

As they snared him in a cross-fire Sandy pounced once more. He flew head on at a red biplane. This time his deadly hail of lead drummed true to its mark. As the ship went into a sickening whirl Sandy zoomed upward, but the remaining three were under his tail again, pouring forth lead.

When Bill saw Sandy's ship stagger, he dove. He dove with his guns spewing death. He dove with the mad fury

of a tribesman going into battle. The three ships broke their circle and rolled madly out of his path. Then recovered and were coming back at him with guns yammering. It did not seem possible he could weather such an attack. But weather it he did. He flashed through the sky in a series of maneuvers that gave them no time to line him up under their sights. He knew he was fighting with men who were masters of their craft. Only his speed and precision flying saved him from their deadly skill. He had to give everything he had in his bag of tricks to escape annihilation.

The three ships were still on his tail as he came over on his back in an inverted loop. He centered his controls and then rolled right side up as they went above him. Opening his throttles he stuck the Lancer up in an abrupt climbing turn until it almost stalled. He threw his stick and kicked his rudder to roll the Caribbean out from under him as he dove on the three ships. His fingers were fastened hard on his gun trips. He raked the last rugged biplane as it tried to slip out of range. He saw the pilot pop upward until his safety strap yanked him back, to collapse on the coaming, and the plane started a fluttering descent toward the sea.

Bill gunned his engine again and came over in a normal loop on the tail of another red plane. His tracers curled above the head of the pilot and drove into the engine block. Black smoke that was laced with orange flame licked back along the housing. The pilot sent the ship into a desperate spin to kill the flames.

Bill zoomed upward as Sandy came tearing in to engage the last of the three red biplanes that had attacked Bill. He saw another red biplane fluttering toward the sea, with Shorty circling above it. Red Gleason was following still another as it tried to flee for its life.

With a curse on his lips Bill flipped his radio key and bawled into his microphone: "Let 'em go, Red and Sandy. Get down below and see if you can locate any survivors."

They cruised for twenty minutes above the deep purple waters of the Caribbean. But there were no survivors in the half-surmerged amphibians.

"Get up to ten thousand again," Bill said brusquely. "We've got to make Trujillo and check our ships. Are you all all right?"

"Who do you think they were?" Sandy asked over the radio.

"Trujillo defense planes," Bill said. "We've got to get into Trujillo and out again fast. Our whole chance is in the fact that the spot where we are going



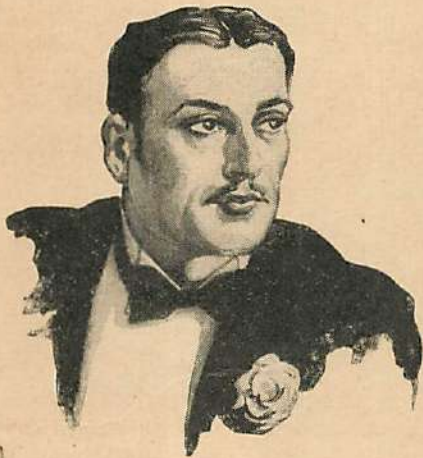
is isolated and the island is one large mass of volcanic mountains and jungle."

"If those were Trujillo army planes," Shorty said, "we've wrecked the whole army. They only have twelve amphibians all told."

## X—THE SECRET OF THE STREAM

TEN minutes later Bill and his squadron saw the high *mornes*, or rounded hills, of Trujillo towering black and menacing against the sky. They circled high above the island while Bill studied it through binoculars.

Through his glasses the irregular mass became lines of hills separated by deep, dark valleys and gorges. The hills were covered with a luxuriant vegeta-



Mac Macado.

tion of green of every hue. The purple of mango and cacao, the golden green of cane and lime mingled with orange and citron. Palms crowned the ridges of the *mornes* and cultivated ground gleamed brown on their slopes.

Down from the wall of mountains great waterfalls dropped to the sea, mere silver threads in the distance. Vapor and steam rose like a rearing serpent from the mouth of a boiling lake, curling upward to mingle with the clouds.

"Okay," Bill snapped. His voice was tense and eager now. "I've located the harbor north of Paz. We'll cut back north and get down to a thousand feet. The mountains will hide us as we slip in. There may be a small native village on the beach, but they won't bother us. We'll have to work fast."

"They've been checking us all the way down here, Bill," Shorty said. "Suppose they have a few squads of machine-gunners back in the bush when we hit the beach?"

"We'll have to gamble on that," Bill said. "Nose 'em down. I'll lead the way. When we're down on the water, Shorty, you and Red taxi your ships up close to the beach so that you can

cover it with your guns. Drop your hooks and stay in your ships. Sandy and I will moor just behind you and go ashore alone. Wear an automatic, kid, and bring a mattock. I'll blow up my boat and we'll paddle in."

"Right, Bill," Sandy said, his voice trembling with eagerness and apprehension.

Low-hanging, fleecy clouds clung to the tops of the *mornes* that surrounded the little harbor on every side. Jasmine, frangipanni and acacia sweetened the hot, humid air as Bill dropped an oblong object into the water alongside the Lancer and pressed the plunger in a nickel cylinder attached to it. The oblong object hissed and took form as compressed air made it into a rubber lifeboat.

A troop of chattering monkeys, disturbed by the roar of their motors, raced away from the banana swamp where they had been feeding as Bill and Sandy propelled the little boat toward shore. Brilliantly colored humming birds darted in and out of the jungle. Large, lizardlike iguanas peered at them from the palm-bordered beach. Little John, parrot fish, fish of every hue swam lazily through the crystal-clear water, their colors standing out against the blue, clay bottom.

Arriving at the beach, Bill and Sandy pulled the boat onto the sand and paused, half expecting the *rat-tat-tat* of machine guns to greet them.

Only the chatter of the monkeys, the whir of birds' wings and the faint sigh of the jungle came to their ears as they gazed upward at the towering *mornes* and searched the jungle beyond the beach for a sign of the Spanish block house they must use as a direction finder.

"There, Bill!" Sandy said breathlessly, pointing. "See the outline of a building under those vines? And there," he pointed farther down the shore to where the beach became a sheer wall of rock towering four hundred feet into the air, "is where the stream plunges into the Caribbean. This is it, Bill!"

Bill's eyes followed Sandy's finger as he pointed from an irregular cone-shaped mass of tangled jungle to the waterfall that plunged out of nowhere into the sea.

"All right, kid," he said after a moment, "let's go!"

They hacked through the jungle growth that had smothered the old block house until they were sure that underneath was a foundation of stone.

Sandy's blood was beating in his temples at a maddening tempo when his mattock struck into the great blocks of stone that had been laid there centuries before.

"This it it, Bill," he repeated, and

they began to cut their way around to the back of the building.

There, they suddenly came into the clear. All about them the jungle had been hacked away to make a trail leading upward into the towering *morne* above them. They stood aghast, not speaking, knowing that someone had cut that trail seeking the same thing which had brought them here. They gazed into the silent, threatening face of the jungle above, wondering what secrets it held within its green bosom.

"Someone has beaten us to it, Bill!" Sandy finally said, tears in his voice.

"It looks that way, kid," Bill answered grimly. "But—"

"This stuff has just been cleared away. If we hurry—"

"And get our heads blown off before we get to the top," Bill said. "Someone is waiting for us, kid. We'd never make it. They're lying low, waiting for us to start up that trail. I—"

"You wouldn't turn back now, would you, Bill?" Sandy's fists were clenched and his face was strained and tense. "You wouldn't let a fellow down when we've come this far?"

"All right, kid," Bill said harshly, "you asked for it. Let's go!"

Something of a wind had sprung up to bring snapping whitecaps racing in to break with an angry boom over the outer reefs of the harbor as they began their trek up that treacherous trail. The jungle was like a huge tomb, humid, silent, terrible.

The horrible, eerie shriek of a parrot came reverberating through the bush, then another and another. Their squawking was like the wail of a hundred banshees. Sandy's blood ran cold in his veins.

Up and up they worked their way, at times forced to fight through where the tangle had not been cut away. Then they were at the top and the trail led straight into a wall of jungle. The sound of rushing water came to their ears, but they could not see it. A hundred feet forward the ground began to dip downward.

The jungle dropped away abruptly and great, giant boulders came into view only a few feet ahead. Then they were standing on the brink of a ravine and thirty feet below them rushed the waters of a mountain stream, impatient and angry in its mad race for the sea. Great boulders, some of them twenty feet in diameter, that had been cut loose from its banks in the rainy season, lay in its bed. On the other side of the stream the *morne* rose up precipitously.

They stood there, panting. The terrible strength of nature's forces and an awesome, lurking menace held them silent as they saw that their trail led into the bed of the racing stream and toward the sea.



"G-g-gosh, Bill," Sandy said, "have we got to follow down that stream?"

Bill looked at Sandy's wide, round eyes, and he began to laugh. He thought of the thousand and one times he had seen the kid risk his neck in the air, braving death. And now he was shaken by this silent threat of nature. His laugh brought Sandy back to reality.

He gave Bill a dirty look and began to scramble down the side of the ravine. "Let's go!" he said as he grabbed at a liana to keep himself from falling.

They fought their way down the stream, clambering over boulders that blocked their path, sometimes having to use one another's body as a bridge to stay out of the crashing, angry stream. Their hands and legs were torn and bleeding as they came to that point where the stream disappeared beneath an overhanging ledge of rock.

In front of them was a wall of jungle again. To go farther they must plunge into the stream where it disappeared from sight.

Bill sat down on the boulder on which they were standing and began to take off his shoes. Sandy finally tore his eyes away from the spot where the stream disappeared and followed Bill's example without a word.

"I'll go first," Bill said. "You come right on my heels. Be ready for anything to happen."

"Do you think we better take the chance, Bill? This was all my idea. Why don't you let me go first while you wait here? Then I'll shout back at you if everything is all right."

"We'll be safer together," Bill said. "So far Meech's map has been right. He wouldn't let us down at this late date. Ready?"

"Ready," Sandy said.

They dove off the boulder one after another. The swift stream carried them under the ledge of rock. There was a clearance of two feet above their heads.

Suddenly, the place became as black as a dungeon. Only the ominous swish of the water along the rocks came to their ears.

"All right, kid?" Bill panted in the darkness.

"Okay," Sandy said, choking on a mouthful of water.

Then a shaft of light appeared in front of them, a doorway to freedom.

As they neared the end of the cavern they swung with the current to the right. They remembered that Meech's note had said they must get up the right side of the stream before it plunged into the sea. For one horrible moment it seemed that they would not be able to fight against the strength of the racing stream as it disappeared between two rows of jungle ahead. Then Bill got one of his powerful hands around the roots at the base of a giant

*gommier* and grabbed at Sandy with his other. An instant they clung there, gasping.

"All right," Bill said. "Let's get out of here. But watch it when we get to the rim of the ravine. If anything is going to happen it will happen now."

They both carried their wet automatics in their right hands as they struggled up the almost perpendicular side of the ravine. They pulled themselves to the top and lay panting on the edge of the jungle when that voice came to their ears.

"You will drop those guns!" it said in English.

Bill Barnes flopped from his back to his stomach. His finger tightened on the trigger of his gun as he laid its nose on the two brown-skinned men who stood there with automatics in their hands, ready to shoot.

Then young Sandy's foot flew out to hit his wrist. The automatic barked once and the bullet went crashing into the jungle.

"It's Mac, Bill!" Sandy screamed.

"Hello, keed!" one of the brown-faced men said.

Bill dropped his weapon and stared. "Macado!" he said in a whisper.

After they were through with their hand-shaking Sandy could restrain himself no longer. "Did you find the gold, Mac?" he asked.

Macado nodded his head. "Six chests!" he said. "It must be nearly a half a million dollars. We find it only yesterday. We are guarding it until my messenger, he gets through to the capital. It will save my father. Money ees what he needed and now he will have it—after you have had your share."

"Listen," Bill said. "Never mind about that. What I want to know is how you got on the trail of Meech's gold."

"It ees a long story," Macado said. "I will make it short. There has been an old, old story on Trujillo among the Carib Indians. The Caribs were never conquered. Their last stand was here on Trujillo where they now have a reservation."

"The story has come down through generation after generation of how a pirate, he came ashore and killed many Indians and buried a treasure. They never dared to touch it, even if they had been able to find it. When I was exiled I thought about that old story and began to study old documents and history in your United States. I send to a friend on Trujillo to send me the old map telling about Meech's cache in North Carolina. It was in the museum in Paz. Where it came from no one seemed to definitely know. But the story ees that it was found among some old papers the Indians found in

a chest that Meech left behind. No one took it seriously when it came to light thirty, forty years ago.

"But the more I studied about Meech the more I thought it might be true, yes. The authorities on Trujillo watched the man who was known to be my friend. When he brought the map to me they followed him. That ees why I gave it to you that night. They were after it and after me."

"But how did you find out about the second map?" Bill asked. "The one that directed you to the treasure here?"

Macado flashed his white teeth in a wide smile.

"That was where I was verree smart," he said. "I studied the history of Meech and Governor Mann of North Carolina for a long time. I find everything I can about it. Then, when I have to disappear again, I come back to Trujillo. I went to my old friend, Jolly John, who is now king of the Caribs that survive. I make him go back into the old tales of the Caribs. I had figured that Meech had dug up the gold and took it some place else. I figured that that was the gold he buried on Trujillo."

"I listened to Jolly John's tales for days and days and try to put them together. Finally, a song that told how the pirates brought *jumbies*—bad spirits—ashore to bury them so they would no longer be cursed with them, gave me a hunch. A week ago we started to play it."

"And you found the gold!" Bill said, slowly shaking his head.

"You will have a share," Macado repeated.

"Listen!" Sandy said. "Never mind the gold. What about those clarinet lessons you were going to give me?"

"I give them to you too, keed," Macado said.

Bill Barnes groaned. He remembered that day he had first heard Sandy trying to play a clarinet.

"Not on Barnes Field!" he said, and his voice was very definite.

The End.





# Pictorial History of Man in the Air



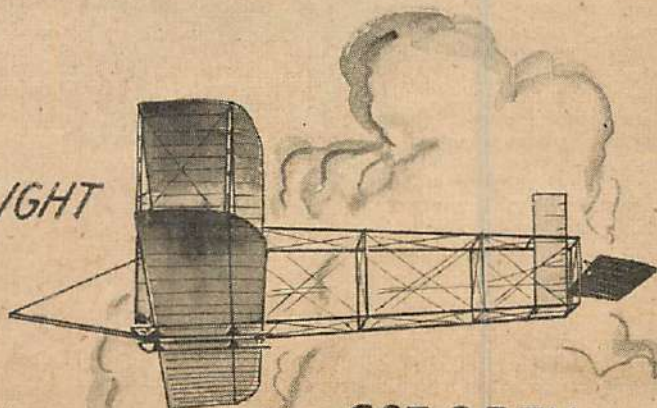
1911-ON SEPT. 9 ENGLAND'S FIRST AIR MAIL WAS FLOWN BY GUSTAVE HAMEL, FROM HENDON TO THE CITY OF WINDSOR, TO PROVE THE PRACTICABILITY OF AIR MAIL.

1911-ON SEPT. 17 TH. C. P. ROGERS STARTED THE FIRST U.S. TRANS-CONTINENTAL FLIGHT FROM NEW YORK. 49 DAYS LATER HE LANDED IN LONG BEACH, CALIFORNIA.



1911-THE FIRST AMERICAN AIR MAIL WAS FLOWN BY PILOT EARL OVINGTON, FROM SHEEPS-HEAD BAY, LONG ISLAND, TO THE JAMAICA POST OFFICE, ON SEPT. 14 TH.

1911-A WORLD'S RECORD FLIGHT FOR GLIDERS OF 10 MIN. 34 SEC. AT 225 FT. ALT. IS MADE BY ORVILLE WRIGHT AT KITTY HAWK, -



OCT. 25 TH.



# MODEL MAKING—

*Air Trails Department of Practical Construction*

## Much Abiding Was He....

*A guest editorial by Edward S. Booth, National Secretary of the Model Aircraft League of Canada.*

The lot of the contest director is often a hapless and thankless one, but he loves it just the same.

He has to be a diplomat, a dynamo, an executive, a chiseler, a laborer, benign enough to listen to everyone's troubles and keep things running smoothly, and hard-shelled enough to accept criticism impassively as part of his reward for taking on the job.

The rest of his reward is the satisfaction of having played a part in making what the contestants describe afterward as "a swell meet."

A decision I was called on to make while assisting in the direction of last year's Canadian National Contest indicates how it is that contest directors are seldom free from headaches. One of the contestants, Geoff Harris, had just made a long flight with his indoor tractor—his first attempt. The timer accidentally clicked his watch back to zero before he had a chance to read the time; he reported he was *sure* the flight had lasted longer than 13 minutes and *thought* it was over 14 minutes.

My decision, right or wrong, gave Harris credit for a time of 13 minutes flat plus the privilege of making three more official flights. The best he could do after that was 13:17, and in the meantime another contestant, Bert Norman, made 13:54. Norman won the event, Harris placed second—and what is more important, Norman won the National Championship by a one-point margin over Harris, which would have been reversed had Harris been credited with 14 minutes.

With model aviation now well out of its childhood, many model builders have graduated into the ranks of leaders, and one of their principal duties is to handle the conduct of contests. This is all to the good of the game, since they can understand the side of the contestant as well as appreciate the limitations of the contest director. As an example, a new regulation was the rule confining timers in outdoor meets within a short radius of the take-off point—a rule swung by a group of leaders most of whom either were or are active model builders.

Every contest represents an unbelievable amount of preliminary arrangement and exacting work on the part of the director. The management is anxious to please us, so let's reciprocate. Let's not kick if a timer isn't handy at the moment we get our ships wound up, or if they pass out cheese sandwiches when we'd rather have ham.

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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 profile or lateral area of a model directly affect the stability characteristics of the design? If so, should the plan be laid out with requirements of profile proportions in mind?

Next month's topic: Thrust-line location.

For October: In designing and constructing a gas model to be entered in contest events, do you believe that the larger gas models offer an advantage over their smaller rivals? Which would you prefer, a  $\frac{7}{8}$ " or  $\frac{5}{8}$ " bore motor? Answers must reach us by July 20th.

For November: In the flying of gas models, do you believe youngsters are necessarily more reckless than their seniors? Do you believe that, to them, the relative value and work involved in building a gas job would insure their responsibility in this phase of model activity? Answers must reach us by August 20th.

# The Discussion Corner

PRO

CON

THE profile of the model affects the spiral stability, and it is important to consider this, especially in the design of a fairly high-speed model such as a gas job. The center of lateral area should always be behind the center of gravity, approximately one-quarter the tail moment arm. It is well to remember that in a turn the air does not strike the model from the side, but rather at a small angle from the axis of the plane. This causes a tall, high-aspect-ratio rudder to affect the model more than a low rudder of the same area.—SHELLY PFEIFFER, Inglewood, Cal.

I have found that the position of the center of projected lateral area affects the stability of a model to a large extent, especially when it is banking under power. For absolute dependability, the C.L.A. should fall on a line passing through the center of gravity and parallel to the line of thrust. This feature should be incorporated in a model while it is still on the drawing board.—RICHARD DUNBAR, Shelton, Wash.

Crashes have taught me to respect good old profile design trends now in use. Gas models are extremely sensitive to properly and improperly designed lateral area designs. It is a good idea to build in sufficient area below the line of thrust on models to help prevent spiral dives or erratic flight characteristics. The most common method is to "belly" the fuselage down below the line of thrust.—EDWIN ELLIOTT, Sacramento, Cal.

Definitely yes! The weight of evidence over the past few years of gas model flying shows clearly that profile area is an essential factor in design. Many builders have come to realize that the disastrous crashes due to insufficient spiral stability could be averted by designing to have the center of profile or lateral area coincident with the center of gravity in a vertical sense and slightly behind it in a longitudinal sense. Failure to observe this requisite results in a job that tends to bank increasingly steep and then to dive, in a tight bank, to earth.—MILTON SHUPE, New York City.

I have found no reason to believe that the projected area of a model directly affects the performance. It has been shown that certain types of fuselage offer less resistance than others. However, the importance of this seems doubtful. After all, don't we get the same results with stick models as we do with built-up fuselages? At contests where almost every conceivable type of fuselage is in evidence, performances vary. But how many modelers credit their good or bad performance to the profile? I will say none. Is it not rather evident to conclude that the profile is an unnecessary subject to consider when designing a model?—ROBERT PEIFER, Chicago, Ill.

Profile shape isn't particularly important. Just as I've finished formulating some high-sounding theories on this subject, I usually have them blown sky-high by models which violate these principles and still turn in perfect performances. And by the time I've amended my theory to accommodate these outstanding exceptions, I find the theory of profile shape to be practically useless. Other than certain fundamentals present in every design, the profile or projected area is not an important design item.—GRANT HAWKINS, Waco, Tex.

In my opinion profile shape is most important from the consideration of appearance rather than stability. Primarily, the model should have pleasing lines. The outlines of the model should tie together certain fundamentals of proportion with attractive lines. It's certainly foolish to distort the shape of the fuselage with a view toward better proportionment of projected area. All necessary stability can be readily incorporated into a beautifully proportioned model—and this should be the first consideration.—VAL TEAGUE, Portland, Me.

Naturally, profile shape is an important design factor, but it's foolish to call it an index to the stability of a model. When considered along with all the other factors influencing stability, profile shape can be constructively used to better stability. Unfortunately, many modelers consider it the only factor affecting stability.—LEONARD BOWMAN, Sioux City, Ia.



# APPLYING RADIO CONTROL

By  
Clinton B.  
DeSoto

## ABOUT CLINTON B. DE SOTO

DeSoto is especially well qualified to handle the difficult problem of radio control for models. He's been active in radio practically all his life and is an authority on the subject. At present he is assistant secretary of the American Radio Relay League.

Fortunately for the model hobby, DeSoto has a young son. The lad wanted a model airplane. His father was elected to build it, since Clinton, Jr., is only 6. The first model refused to fly despite housetop launchings and other persuasive steps. DeSoto accepted this failure as a challenge and continued his model investigation. That was about a year and a half ago. Since then he has become one of the foremost experts on radio-control models. He worked with Ross Hull and R. B. Bourne, two other radio-model enthusiasts, on one of the first successful radio-controlled models in the country—an 18-foot sailplane. Throughout the latter part of 1937 this craft made over a hundred successful flights.

Radio control apparatus is continually being improved. DeSoto modified the original apparatus and incorporated the new control unit in his sailplane. This radio control unit is described in the accompanying article. But DeSoto has gone on to bigger things. At the time of writing he is putting the finishing touches to a large gas model. An improved, four-type control unit will be installed to provide control for every phase of the model's flight.

He lives in West Hartford, Connecticut. A large radio and model experimental ground adjoins his house. An ideal spot for radio-control experiments. With a wealth of radio experience to draw from, and ample modeling skill to carry out ideas, DeSoto will doubtless continue to make radio-control history, provided there is sufficient spare time from his A.R.R.L. duties, just as he has done in the past.

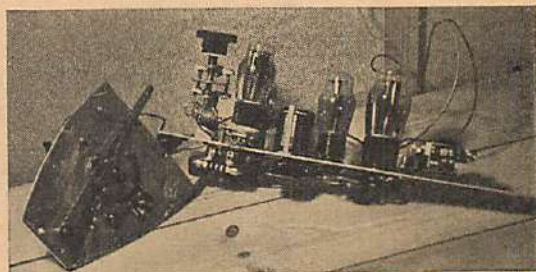
THIS model building is a funny game. As though there weren't enough complications involved in making a successful flyer—with all the fine points of design that must be borne in mind for stability and efficiency—we now find ourselves piling on still more trouble by trying to add radio control.

Not that it's an unreasonable ambition. After all, a large part of the urge to build flying models is the desire to fly oneself. And since it's slightly difficult to climb inside a five-foot gas buggy, the next best thing is to provide some means of remote control. This means radio. It also means trouble—and a whole set of new problems. But that's the sort of diet model builders thrive on, so it looks like radio-controlled soarers and gas jobs are the next big field in model aviation.

First off, though, let us repeat an important word of warning. Unlike ordinary modeling activity, radio transmission is an activity strictly controlled by the federal government. It cannot be engaged in except by those possessing the requisite federal licenses, issued by the Federal Communications Commission. Operation of an unlicensed transmitter makes one liable to such punishment as two years in a federal penitentiary or a fine of \$10,000.

As has been said before in Air Trails, if you do not

*A practical discussion of problems involved, together with details of a proven system.*



The rudder control and escapement mechanism is shown, left, and the four-tube receiver on the right.



The radio-control equipment housed in the sailplane. The removable cowl is in the rear.

possess an amateur ticket yourself, the best thing for you to do is to tie up with some radio "ham" in the vicinity. You'll find them all over—there are some 47,500 in this country—and there'll surely be one sufficiently interested to work with you.

That out of the way, let's talk about the problems of radio control itself.

Any radio control system can be reduced to three essentials: the signal pick-up device, the signal translator, and the motivating controls. Or, look at it from the standpoint of transmitting intelligence. A tennis ball is coming. Your eye—the pick-up, or detector—sees it. Your brain—the translator, or interpreter—figures out what's happening. It in turn instructs your



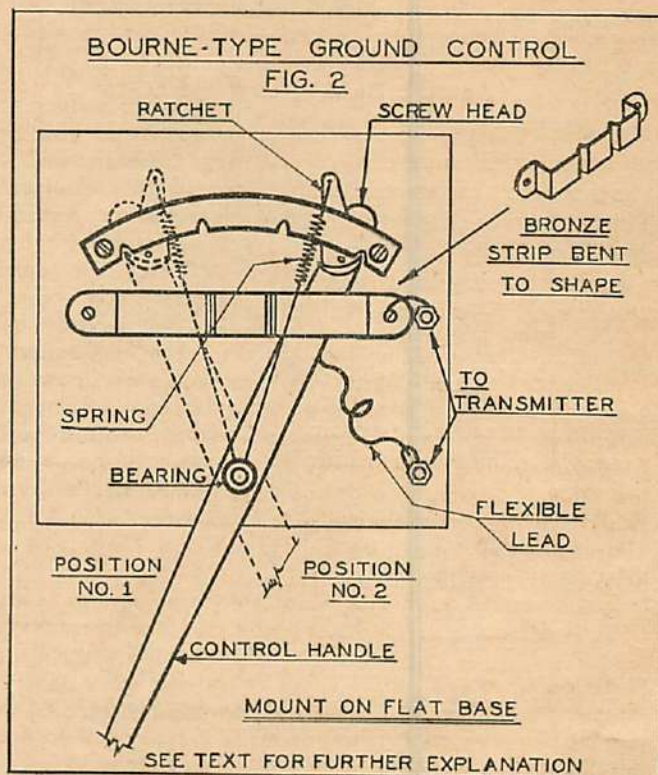
# TO MODEL AIRCRAFT

arm—the control mechanism—which proceeds to swat the ball.

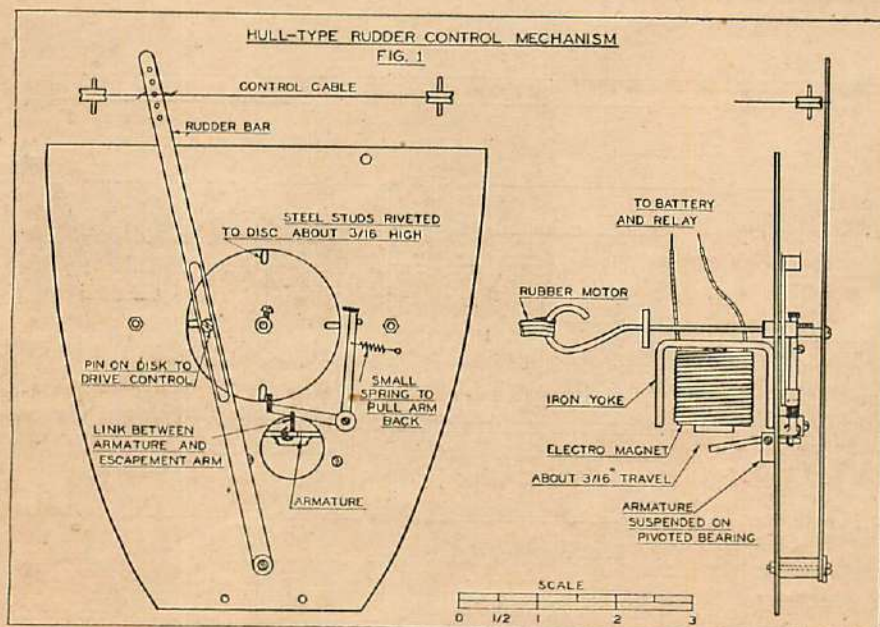
Let's go from the abstract to the specific—backwards. First of all, what sort of control mechanism are we going to find desirable in our radio-controlled plane? Are we going to need elevator, rudder and ailerons, plus throttle control in a power job? In other words, just how tough does this thing have to be made?

The answer is that it seems to be entirely feasible to fly a ship properly if rudder control alone is provided. Consider the ordinary successful model: It possesses sufficient inherent stability to achieve a normal flying attitude under normal conditions and to return to that attitude when any abnormal force momentarily throws it off. It climbs under power, or with lift, and dives without it.

This, obviously, takes care of any requirement except directional control. The rudder provides this—and, in the case of the soarer, the rudder also regulates climb by changing the ship's position with respect to the wind, or lift. In the gas model the gas supply determines the length of the flight; with power off the ship is merely steered to earth. The inclusion of a separate channel will even permit separate throttle control, making available reasonably complete regulation of all the ship's major flying characteristics.



The Bourne-type ground control stick, which moves in one direction and always points in the direction of flight. By pointing in the direction of the turn, confusion is eliminated.



The Hull escapement mechanism which translates pulses from the receiver into rudder motion. The electromagnet (wound with about 300 turns of No. 20 s.c.c. copper wire, resistance approximately 1 ohm) is connected in series with two 1-inch flashlight cells and the sensitive relay in the receiver.

Assuming that the point that rudder control alone is required has been accepted, we move on to the "translator"—the mechanism that tells the rudder what you're trying to say.

There are numerous ways of making this part of the system. None of them is very new. Indeed, a book published in 1916—"Radiodynamics," by Meissner, gives most of the systems known today. Electromag-

nets and electric motors to actuate the rudder are obvious thoughts; a system using a motor in ingenious fashion has been described in Air Trails (See Chester Lanzo's article in the December and January issues). Automatic selector switches for multi-channel systems, methods employing synchronization through matched clockworks—these and many others are within the realm of possibility.



Undoubtedly the simplest and most effective system yet devised is that developed by Ross A. Hull, a prominent radio authority who has also had a long interest in the model field. Several successful installations of this system have been made in model sailplanes of 13- to 18-foot span, and hundreds of flights have been accomplished.

This system relies on the torque of a tightly wound rubber-band motor for power to actuate the rudder—a choice eminently sensible in the eyes of any model builder, who knows that a rubber motor is the lightest and most practical reservoir for energy in small quantities now known.

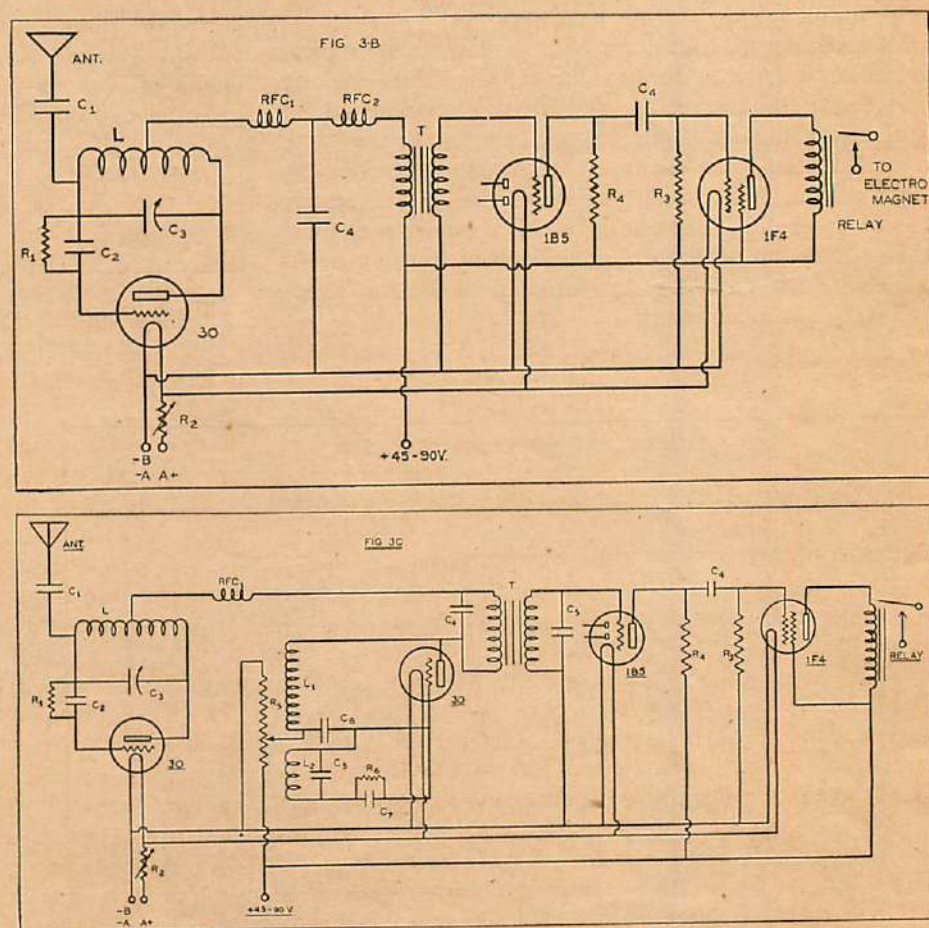
The energy stored in the rubber is released to the rudder by means of a disc and escapement mechanism, shown in Fig. 1. The disc, kept under constant tension by the pressure of the rudder, is held in place by the lower arm of the escapement, which engages the lower stud on the disc. When the electromagnet is energized, however, the escapement is pulled down, and the disc is permitted to revolve one notch (one-quarter revolution) before the upper arm on the escapement catches the same stud on its travel. As the electromagnet is de-energized (by stopping the controlling signal), the escapement returns to its normal position through the pull of the spring, the lower arm engages the next stud, and the cycle is ended.

Fine, you say, but what has all this accomplished? The answer is that, to simplify the train of events, we have omitted mention of the rudder bar. This bar is moved from left to right as the escapement disc rotates by the action of a pin on the disc which passes through a slot in the bar. As the bar moves it carries with it the control cable, which passes over pulleys to the rudder itself.

A little study of the system will reveal that its operation is based on the transmission of a series of pulses. One pulse moves the rudder to left position, another back to neutral, a third to right rudder, etc. The objection may be raised that this continuous cycle complicates and delays the control function. In practice this has not been found in the least objectionable. The whole operation can be performed so rapidly that the ship hardly "wiggles" in flight and loses no apparent flying speed. The problem of keeping the turns straight is

Figs. 3A, 3B and 3C—Five-meter receiver circuits, using 2, 3 and 4 tubes; C1—30-uufd. adjustable mica trimmer condenser (ordinarily used "all out" or even with upper plate bent at right angles); C2—100-uufd. midget mica fixed condenser; C3—20-uufd. (or smaller) midget variable tuning condenser (ceramic insulation, insulated mounting); C4—0.01-uufd. 200-volt tubular paper by-pass condenser; C5—0.002-uufd. midget mica fixed condenser; C6—0.1-uufd. 200-volt tubular paper by-pass condenser; C7—0.001-uufd. midget mica fixed condenser; R1—1 to 5 megohm grid leak ( $\frac{1}{2}$  watt). (Experiment desirable); R2—10-ohm rheostat (adjust to 2.2 volts at filaments); R3—2-megohm  $\frac{1}{2}$ -watt fixed resistor; R4—150,000-ohm  $\frac{1}{2}$ -watt fixed resistor; R5—100,000-ohm potentiometer; R6—50,000-ohm  $\frac{1}{2}$ -watt fixed resistor; RFC1—2.5-uh. pie-wound r.f. choke; RFC2—125-mh. universal-wound r.f. choke (preferably shielded); L—6 to 8 turns No. 14 tinned copper wire,  $\frac{1}{2}$ -inch dia.; spaced wire dia. (Experiment necessary); L1-L2—Quench oscillator coil assembly (preferably shielded); T—Any small high-ratio audio transformer. Relay is the sensitive type, capable of operating on 1 or 2 ma. (adjusted so that vibration, minor jars or tilting will not make it close; this usually requires a 3- to 5-ma. current change) E by ER 12,500 ohms, used.

The "A" battery consists of two 1-inch flashlight cells in series. The "B" battery size will depend on weight requirements; it can range from the 2-oz. Eveready X-180 to the 22-oz. Burgess Z30PX or 20-oz. Eveready 738. Probably the best all-around sizes are the 13-oz. Burgess W30FL and 12-oz. Eveready 733. The circuits shown will operate on 45 volts—one battery—but 90-volt supply is recommended. All insulation in r.f. circuit must be of high-grade ceramic, including tube socket.

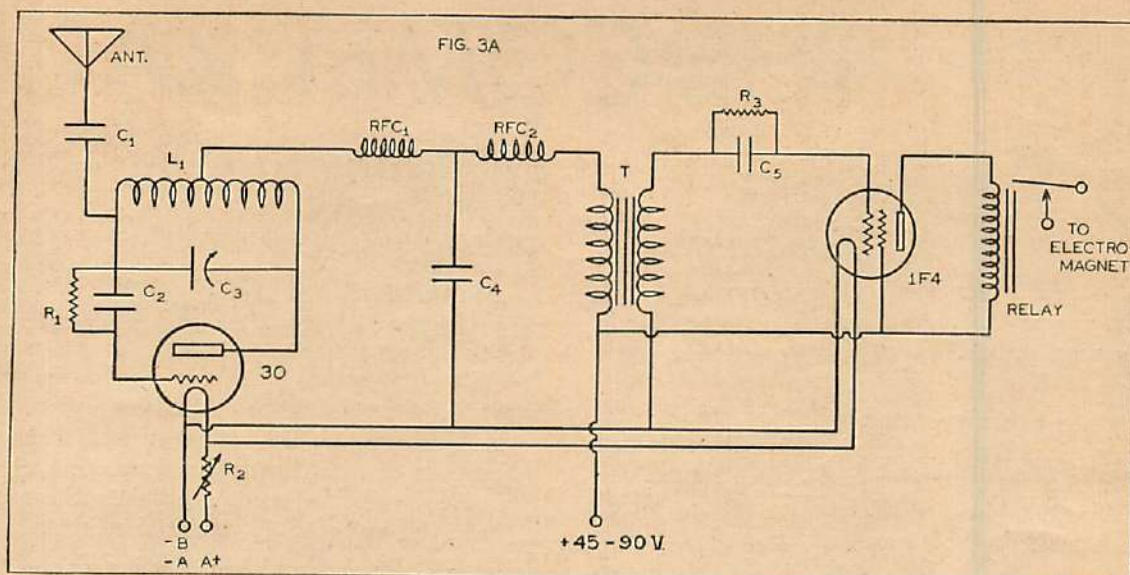


simplified by the use of a control stick as sketched in Fig. 2. The control handle on this device, which was developed by R. B. Bourne, moves in only one direction—the right one to make the next turn right! At the same time, it points in the direction of the turn, eliminating confusion.

So much for the control system. Going on to the radio equipment proper, we run into the toughest headache.

Experience has shown the primary requirement for a successful radio control system to be reliability. Compactness, light weight, economy—these are important, but only after complete reliability has been attained. As





with the model itself, there's nothing in the picture more disheartening than a radio control that won't function on order—that suddenly refuses to control when the ship is diving resolutely for a pond or a wooded hillside, for example.

Reliability is not easily achieved, either. It presupposes, in the first place, adequate sensitivity. But then the probability of overloading when near the transmitter arises. If a heterodyne system is used on the lower frequencies—as in a system recently described in *Air Trails*—the handicap of frequency instability becomes significant (not to mention the good possibility of some “ham” radio amateur a thousand miles away messing up your control with his innocent conversation!) On the ultra-high frequencies, on the other hand—probably the most suitable location—some system of super-regeneration is imperative, and this introduces the complexity of quench leakage and filtration.

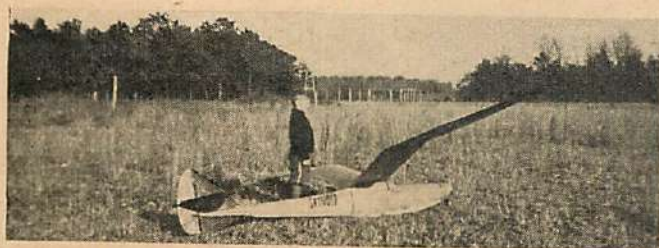
Perhaps a little elaboration on this latter problem is in order. There are two basic ways of using a super-regenerative receiver as a radio-control pick-up actuating a sensitive relay: 1. The receiver may be operated by modulation on a carrier, the rectification of this modulation in an a. f. stage providing the required plate-current change. This system—shown in the two-tube circuit in Fig. 3—is the most sensitive, but imposes the handicap of running the transmitter constantly during a flight. 2. The receiver may be carrier-operated, the operation in this case being somewhat more complicated. Normally, the “rush” noise from the super-regenerative

detector biases the relay tube to minimum plate current. When a carrier comes along this rush ceases and the plate current seeks its static value. The resulting current change operates the relay. This system is used in Fig. 3B.

The trouble with both these systems, but particularly the latter, is that the quench voltage from the super-regenerative tube tends to leak into the a. f. circuits, and, since it is relatively great in value, acts in much the same way as a receiver carrier would. In other words, it cancels the control signal.

Obviously, the cure is to filter out this quench voltage. Like so many “easy” things, however, this is easier said than done. For one thing, a condition which will permit perfectly satisfactory voice reception will be ruinous for control purposes. The radio-control receiver, of course, has no honest ground point; it is all “up in the air.” The stuff simply can't be grounded out. A piece of wire a few inches long provides enough reactance to couple it into the audio system. Moving a battery lead around can mean the difference between success and failure.

All this may not sound particularly helpful, in that it does not pretend to tell you precisely how to cure each and every ailment. (That's a difference you'll discover between radio and model building, by the way; you can see why a model misbehaves, but with radio it's pretty much blind guessing—without oscilloscopes and laboratory gear, at least. But the point we wish to establish is that this difficulty, and others, will (Turn to page 94)

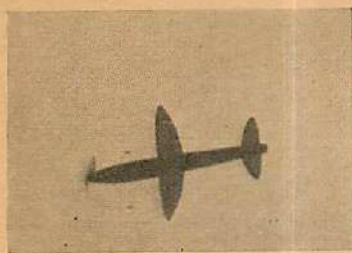


Side view of the 18-foot-span radio-controlled model sailplane. A removable cowl ahead of the wing exposes the radio gear, which fills most of the nose.



The author's sailplane model “Skyrider,” just after launching on a test glide. Several installations of the system described have been made in a number of model sailplanes.





Almost like a real racer the Comet hurtles overhead. Note the tiny wing profile.

# THE COMET RACER

By Don Orman

*The winner of the senior gas model event at the Junior Aviators National Meet designed and flew this racer 91.4 m. p. h. at a club contest.*

THIS model was designed and built for a club contest in Akron. Models of this design have been clocked at 91.4 miles per hour over a 120-foot course. A second model with slight modifications turned in a speed of 96 m.p.h. It averaged 80 m.p.h. for seven flights over the course.

Construction is remarkably simple, and should register well with beginners for this reason. Yet the high speeds it attained make it worthwhile for the more experienced.

Two types of construction have been used in the wing and tail surfaces, solid and built up. The model with the solid balsa construction turned in a slightly higher speed. While the plans have been prepared for the built-up wing and tail construction, either type is readily used. The necessary materials have been listed for both types.

## FUSELAGE

The fuselage is built of  $\frac{1}{16}$ " square hard balsa. First lay out the two side panels—one over the other. Cut the bracing and cement in position. Note that the top and bottom outline of the fuselage is a straight line in the side view from about a third back. Auxiliary  $\frac{1}{16}$ " square braces are cemented in the nose of the model, running alongside the longerons from the fourth cross-brace forward. The purpose of these inside braces is to strengthen the fuselage against the pull of the rubber and rough landings.  $\frac{1}{16}$ " sheet balsa fillets are inserted flush with the outside edges of the longerons. These fillets are added to the front and rear of the fuselage and prevent damage to the fuselage while handling during the winding operation.

## LANDING GEAR

The landing gear is bent from a single piece of wire  $\frac{1}{16}$ " in diameter and 8" long. The actual length of each

strut is 3". Cement and bend the landing gear to a piece of  $\frac{1}{8} \times \frac{1}{8}$ ". Insert in the bottom of the fuselage, notching the ends of the balsa to fit alongside the longerons and inside braces. Cement the joints thoroughly and add balsa triangles of  $\frac{1}{16}$ " flat for further strength. Wheels are cut to streamline shape from  $\frac{1}{8}$ " flat pine. They are cemented to the wire axles to reduce vibration—a helpful feature in getting maximum speed.

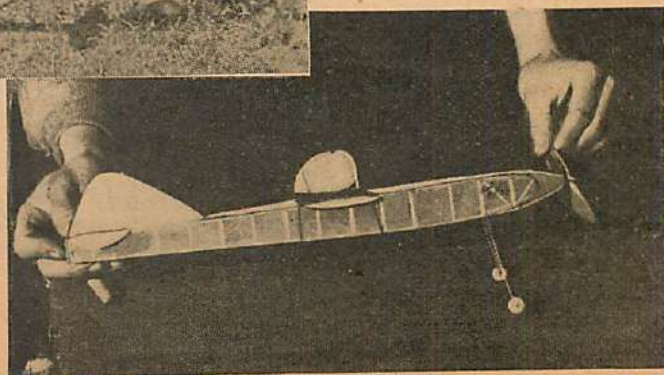
## NOSE AND TAIL PLUGS

These are cut from balsa blocks to fit the ends of the fuselage. The rear plug is built of three thicknesses of balsa (indicated in the drawing and list of materials) cemented cross-grain. A rear hook of  $\frac{1}{16}$ " diameter is inserted and the outside end bent in a loop to fit the hook on your winder. The end of the hook which holds the rubber should be bent so the fitting can be closed to guard against the possibility of the rubber strands slipping off. The hook should be firmly secured with a liberal coating of cement.

$\frac{3}{16}$ " washers are used on both sides of the nose plug to reduce friction and keep the propeller shaft in perfect alignment—a necessary feature for straight flight. An off-centered plug will cause additional drag and reduce speed. A ball-bearing



Don Orman holding the Comet racer. Right—The correct launching method. The model is very simple to build.









ing washer between the propeller and the nose plug will provide smoother running with less friction loss. A clever substitute for this is to stick pins into the nose plug around the  $\frac{3}{16}$ " flat washer. Let the heads of the pins fit over the edge of the washer. Not only does this anchor the washer securely, but it provides smoother running.

The fuselage is covered with tissue. Tighten with water spray and follow with two coats of clear dope.

### WING AND TAIL SURFACES

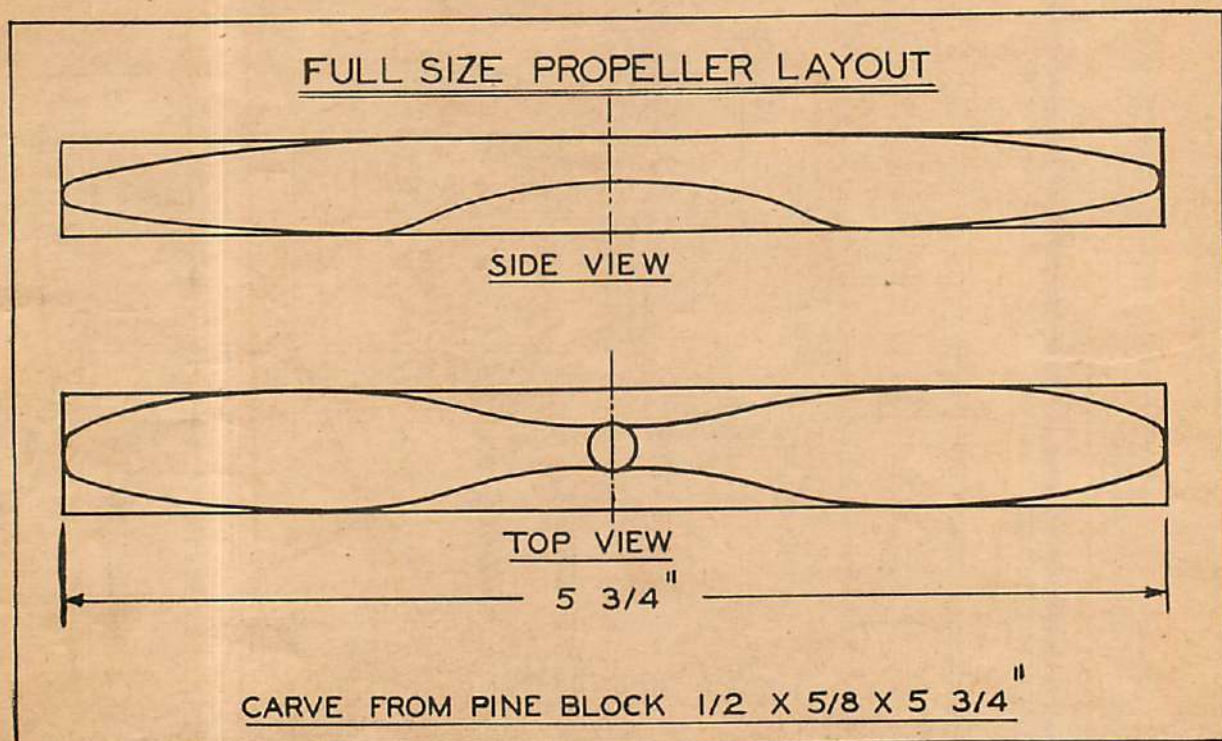
The wing may be built from  $\frac{1}{16}$ " sheet balsa or built up as shown in the drawing. As pointed out earlier, the solid balsa wing and tail surfaces showed slightly higher speed. In using  $\frac{1}{16}$ " sheet balsa, first lay out the plan shape of the wing. Sand to the shape of a wing section. The center portion of the wing which rests atop the fuselage is flat. Thus it is necessary to cut and cement the

### PROPELLER

This is carved from a block of pine or brass wood. The full-size blank layout is included in the article. The blades should be cut to about  $\frac{1}{16}$ " maximum thickness, tapering slightly toward the tips. Balance the propeller carefully. Sand out all the rough spots and apply about a dozen coats of dope. Then polish to a high luster with furniture or automobile polish. Bend a shaft from  $\frac{1}{16}$ " diameter wire and insert through the nose plug. Add several washers (preferably ball-bearing) and insert the shaft through the propeller. Bend a hook in the end of the shaft and cement securely to the front hub of the propeller.

### FLYING

Test flights are accomplished painlessly if you select a field with tall weeds or high grass to provide a cushion for rough landings. The approximate wing position is



wing at two positions.  $\frac{1}{2}$ " dihedral is added to each tip. The wing should be sanded perfectly smooth and given several coats of dope with intermediate sandings.

In making a built-up wing use  $\frac{1}{32}$ " sheet balsa ribs. The spars are  $\frac{1}{16}$ " square and  $\frac{3}{64}$ " square balsa. The trailing edge is a piece of  $\frac{1}{16} \times \frac{3}{16}$ ". First build the center section and then build the two halves. When joining the three pieces of the wing, add balsa corners to strengthen the joint. Take special care to eliminate any warp or twist. Cover the wing with tissue and follow with water spray and two coats of clear dope.

Tail surface construction follows that of the wing. If you used solid balsa construction in the wing, use  $\frac{1}{32}$ " sheet balsa for the elevator and rudder. For built-up construction the method of constructing the elevator and rudder follows closely that of wing. The rib section is flat— $\frac{1}{16}$ " square balsa. The outline of both rudder and elevator is sanded to a sharp edge. Cover and dope the tail surfaces. Notch the rudder to fit over the top of the elevator and cement both to the fuselage. Check their alignment with the thrust line.

having the trailing edge between the eighth and ninth cross braces. Mount the wing flat atop the fuselage and secure with rubber bands.

Measure out 12 strands of  $\frac{3}{16}$ " flat brown rubber. The length of the motor should be an inch or two shorter than the distance between the shaft and the rear hook. A shorter motor provides a more powerful burst of power and consequently higher speeds.

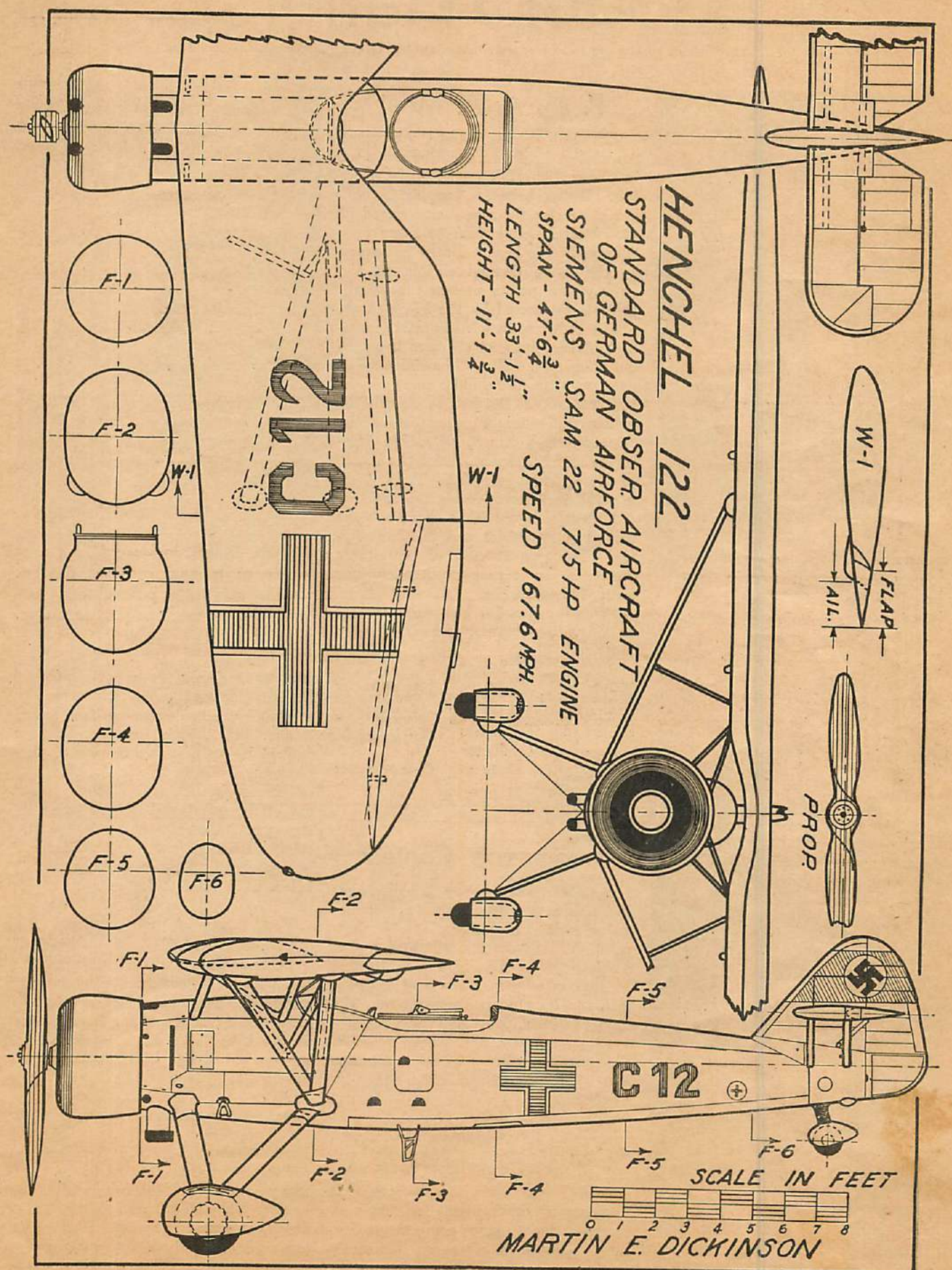
Glides are no index to the adjustment of a speed model. It will be necessary to adjust your model under power. First put approximately fifty turns into the motor and point it up at about an angle of 85 degrees. That is, practically launch the model straight up. If the model dives instead of climbing, move the wing forward. The reverse procedure holds if your model looped immediately after launching.

After several such trials you are ready to give the motor a full wind—about 200 turns. If you are interested in maximum speed, release the model with a quick push. This will help it reach its greatest speed and fly a straight course.

(Turn to page 95)



# THE HENCHEL 122



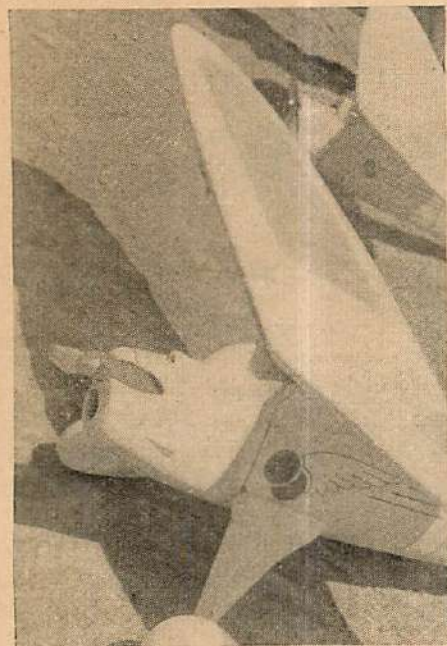


*Flight records  
and contestants  
in competitions.*

# 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.)



Nose details of Bill Effinger's beautiful new design. The ship appeared at the Eastern States contest, where it created a sensation.

## P. M. A. A. Meet

The Philadelphia Model Aeroplane Association held its annual indoor meet in Convention Hall on Saturday, May 7th. Walter Lees, 19, flew his Class C indoor tractor for a new city record of 21 minutes. More than 30 flyers were entered in the meet. Entry is limited to the flyers deemed eligible on the basis of the points won in the weekly contests conducted by the P. M. A. A.

The P. M. A. A. has 600 active members divided into 28 chapters throughout the city. The Convention Hall meet was the last indoor meet of the winter season. Outdoor meets will be held every other Saturday throughout the summer. Victor R. Fritz, field director, is largely responsible for the active program of flying which the P. M. A. A. has always followed so successfully.

Philadelphia modelers have always played an important part in indoor flying. The present crop of contestants seem to be serious contenders for national honors.

Following are the first-place winners in the various events:

### Senior

Walter Lees	21:02.5	Class C tractor
Robert Gimmel	11:07.3	pusher
Robert Lichten	10:52.5	fuselage
Herman Mitchell	10:38.6	R.O.G.
David Call	12:53	R.O.W.

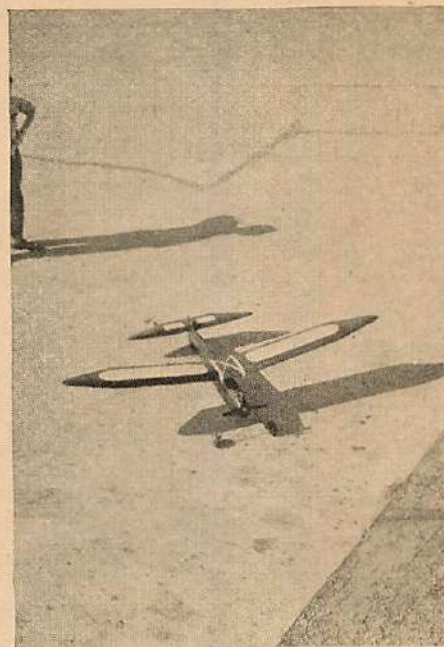
### Junior

Aaron Kirpick	14:07	Class B tractor
Irvin Berlin	10:44.2	pusher
Vincent Foti	7:16.2	R.O.G.
Milton Garber	8:17.8	R.O.W.
Bernard Paul	5:12	fuselage

## Kalamazoo Contest

Pete Dillon of Jackson, Michigan, has just finished test-hopping his new monocoque job. Preliminary tests show great possibilities—fast climb and slow sinking speed. The high wing loading of 14 ounces per square foot actually seems to improve performance over the lighter models.

Dillon recently won second place in the payload event at the Kalamazoo Gas Model Contest. He was flying his Corben Super-Ace—the 1937 duPont Trophy Winner. Last year at Kalamazoo the Corben won first and third and was the only model of this design competing. This year there were six other Corbens. A steady downpour the morning of the contest "washed out" many of the 75 ships competing. Flying weather in the afternoon was nearly perfect. The strongest showing of the



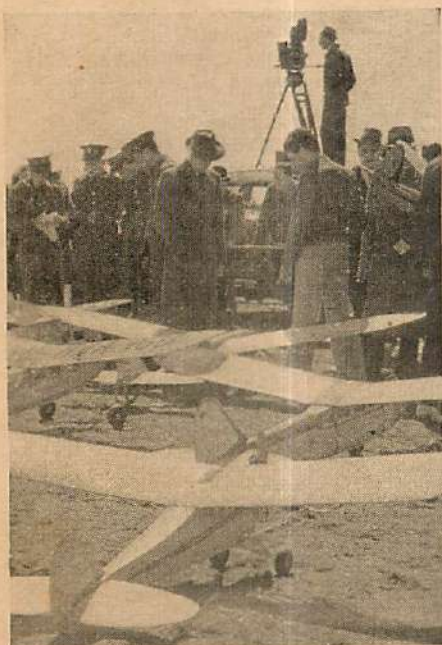
Pete Dillon, Jackson, Mich., produces a new original design. The ship is a parasol and features a monocoque fuselage.

meet was made by the boys from Grand Rapids. Flying Buccaneer type models, they took the lion's share of first prizes.

Mrs. Pete Dillon has taken to gas modeling—her first ship is nearing completion. Probably this is the only way of keeping peace in the family after one of the members has been bitten by the model bug. Husband-and-wife combinations are not new to the model hobby. Like all other sports, modeling holds much interest for everyone.

## A. M. A. Activity

The Academy for Model Aeronautics has scheduled its next official meeting during the National Meet in Detroit. It will be a closed meeting for Academy members. . . . A. M. A. sponsored an indoor trial at Lakehurst on May 28th. Sanctioned by the N. A. A., this gave Eastern modelers a whack at the national records under the splendid indoor flying facilities offered by the large Naval Airship Dock. . . . Small engines revive the problem of wing loading. In many modelers' opinion, small-bore engines of  $\frac{5}{8}$ " or less suffer by the weight rule of 10 ounces per square foot. The question raised was whether the loading requirement should be kept the



A scene at the Eastern States gas model contest held at Seversky Field, Farmingdale. It was this contest that merited a feature in "Life" magazine.



same, lowered to 8 ounces, or a completely new rule drawn up for the midget-motored models. Gas modelers were polled on this question by the A. M. A., and the results will probably be written into the rules governing the National meet. . . . Fred D. Fagg, Jr., recently retired Director of the Bureau of Air Commerce, praised the aims and work of the A. M. A.—“It is my belief that any effort in the development and encouragement of model aircraft activities will be time well spent and that such encouragement will be reflected directly upon the future achievements of those participating in the present activities.”

## Results Of N. Y. U. Events

About 150 high school students of the New York metropolitan area were entered in the fourth annual model contest sponsored by the Daniel Guggenheim School of Aeronautics of New York University. The contest was held Saturday, May 7th. Outdoor flying was done in the morning at Van Cortlandt Park. In the afternoon the scale model contest was judged in the college gymnasium.

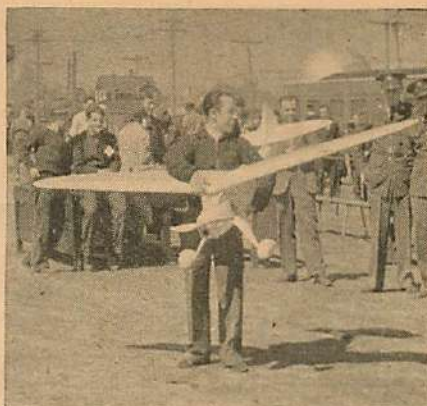
A high wind made flying difficult. Morris Schlackman won the glider event with 3:56.3. Elton Ballas took first in the stick event with 4:25.



George Marvin of Prairie du Chien, Wis., and his interesting 5-foot gas job. In the winter the ice of the Mississippi served as a landing field.



In the Effinger design the landing gear shown is interchangeable with a simpler one for flying.



Fuselage event winner was Albert Sherman with 3:30.4.

Twenty-four models were entered in the scale model event. First was awarded to Carl Baum, Jr., whose model of the Seversky P35 represented ten months' work. Second went to Pelham Burnett's Douglas O-38-B. Third prize was won by Joe Biro. Although scale model entries were limited to replicas of full-size airplanes, Alan Margolies entered an interesting original racing model that attracted favorable attention.

Scale models were judged by Captain Frank Hawks and Captain Alexis Kaminsky, associated with the Seversky aircraft company.

## Canadian Contests

August 29th, 30th and 31st are the dates of the 1938 Canadian National Model Aircraft Contest, conducted by the Model Aircraft League of Canada. The outdoor flying will be done at the airport of the Toronto Flying Club. Indoor events will be held at the Coli-



Joe Walsh, New Bedford, Mass., built this 30-inch endurance model. Its rubber motor provides over a two-minute flight average.

Left—Another view of Bill Effinger's latest. The famed Buccaneer design was originated by him.



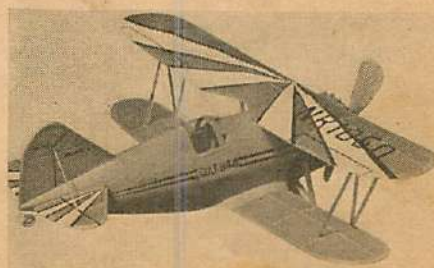
Major Seversky awards the first-place prize, scale event, to Roger Hammer at Farmingdale. The ship was the Taylorcraft job in our April issue.

seum. Seven events are scheduled—indoor: stick, fuselage, flying semi-scale, and exhibition scale; outdoor: stick, Wakefield, and gasoline-powered.

Plans have been made to welcome modelers from all parts of Canada and the United States. Special hotel rates will be available to contestants visiting Toronto. It's interesting to note that contestants from the United States and other countries will be permitted to compete unrestrictedly with Canadian contestants in all events but the exhibition scale model event. (Turn to page 97)



A contestant tuning up the engine of a unique biplane entered at the San Diego contest.



Al Williams' Grumman "Gulfhawk," a kit produced by Megow and priced at ten cents.

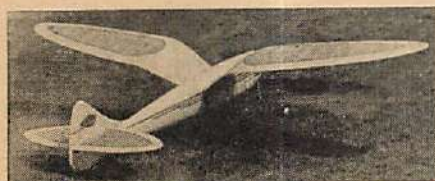




San Diego winners, left to right—L. J. Kading, 3rd, Compton; J. Berg, 2nd, Los Angeles; J. C. Williams, 1st, Los Angeles.



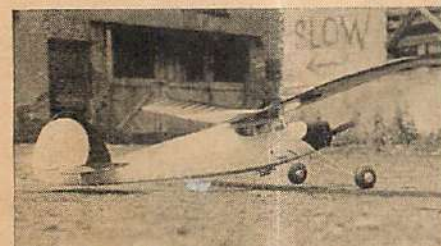
Like its prototype, a neat Beechcraft climbs rapidly at the San Diego meet.



A gull-wing job that, because of its finish, won acclaim at Seversky Field competition.



The job held aloft to display its beautiful lines.



An original design by Carmin A. Castellano, Scranton, Pa. This ship won third place at the Allentown contest with a flight of 6:18.

## Contest Calendar

**READERS AND CLUBS.** Notices should be mailed to the Contest Calendar, Air Trails, 79 7th Ave., New York City, 5 weeks in advance.

**SECOND ANNUAL ANTHRACITE GAS MODEL AIRPLANE MEET.** July 17th, Scranton, Pa. Prizes totaling a value of \$100. Sponsored by Anthracite Gas Model Airplane Club. Complete information from C. A. Castellano, 1010 Jackson St., Scranton, Pa.

**GULF STATES MODEL AIRPLANE MEET.** July 16th and 17th, New Orleans, La. This will be the first meet of its kind and size ever held in this part of the country. Any N.A.A. chapter or individual in good standing is invited to compete. Events will be as follows: flying scale, endurance C and D, gas, and exhibition scale. Entries will be accepted from Gulf states only—Texas, Louisiana, Mississippi, Alabama and Florida. All correspondence should be addressed to Gulf States Model Meet, c/o Delgado Trades School, 610 Park Ave., New Orleans, La.

**FIRST ANNUAL MARYLAND GAS MEET.** July 31st. Sponsored by the Baltimore Gas Model Club. Open to all entrants from surrounding states. N.A.A. rules and regulations. Prizes will be permanent trophies, medals, etc. Full information and entry blanks may be obtained from Meyer Lahn, 20 North Milton Ave., Baltimore, Md.

**WAKEFIELD INTERNATIONAL CONTEST.** July 31st, Caudron-Renault Airport, Guyancourt, France. Competition for the Wakefield Trophy by the representative teams of each nation.

**EASTERN STATES INDOOR MODEL MEET.** During August, at Lakehurst Hangar, Lakewood, N. J. Sponsored by the New York Aeronauts. Trophies will be donated by several model airplane companies. For further particulars write to Roger Hammer, c/o "Jasco," 83 E. 10th St., N. Y. C.

**GAS MODEL CONTEST.** August 7th, Allentown, Pa. Details from Flying Keystone, Y. M. C. A. Building, Allentown, Pa.

**MIDWESTERN STATES GAS MODEL CONTEST.** August 7th, 1938, at Chicago, Ill. Sponsored by The Chicago Gas Model Aeronauts. Information from R. L. Weber, 217 N. Desplaines Street, Chicago, Ill. Contest open to all modelers. One event—limited engine run consistency event.

**ANNUAL GAS MODEL CONTEST,** Miller Field, Staten Island, N. Y. C., sponsored by the Richmond Model Flying Club. Tentative date August 14th; announcements to be made later. For information address Richmond Model Flying Club, 26 Bond St., Staten Island, N. Y. C.

**SIXTH ANNUAL MISSISSIPPI VALLEY TOURNAMENT,** August 13th and 14th. A full list of indoor and outdoor events. Any modeler eligible. Trophies, medals, merchandise, trips, and other attractive prizes. Information from Contest Director, Stix, Baer, and Fuller Model Club, St. Louis, Missouri.

**SECOND ANNUAL TRENTON EASTERN STATES GAS MODEL MEET** sponsored by Trenton Chapter of the N.A.A. Permanent trophies and cash awards for first place winners; numerous awards for other place winners. Date: Sunday, August 21st; place: Mercer Airport. For further information address the Trenton Aero Society, 212 Centre Street, Trenton, N. J.

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

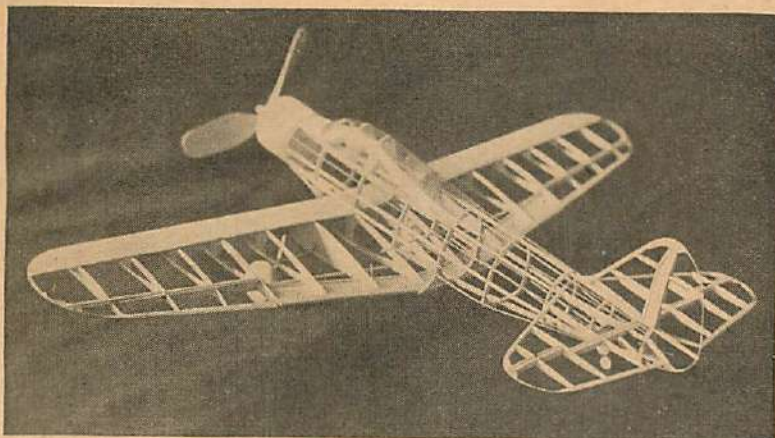
**CANADIAN NATIONALS,** August 29th-31st. An annual feature of the Canadian National Exposition. Indoor and outdoor events open to all modelers. Information from Model Contest Director, Canadian National Exposition, Toronto, Canada.

**SCRIPPS-HOWARD JUNIOR NATIONAL AIR RACES,** Akron, O., August 30th to September 2nd, under the sanction of the N.A.A. Junior, senior and open events. Models must conform to N.A.A. specifications. Entrants are requested to register in advance at headquarters, Cleveland, O. Cash awards in seven events top \$2500. Kits, trophies, and subscriptions also given. For complete information address Ed Clark, National Junior Aviator Editor, Press Building, Cleveland, O.

**INVITATION MEET,** Quaker City Gas Model Club, September 10th and 11th. All modelers invited. Information from William S. Berry, 951 East Price Street, Philadelphia, Pa.



# TORPEDO PLANE



The structure is quite complete; workable flaps and control surfaces are included to make the model unusually interesting.

*Plans for a realistic flying scale model of the formidable Douglas TBD-1*

By

Alan D. Booton

THE TBD-1 is a torpedo-bomber designed for aircraft carrier service. Larger than the scout or pursuit job, the TBD-1 has wings of unique design, folding about midway on each span, conserving space, which is limited on carriers. An exceptionally high speed is obtained from the 850 h.p. Twin Wasp.

The folding wings, flaps, and realistic movable controls have been included in the model without a noticeable increase in weight, and the accurate design has further possibilities where more detail is desired. The simple method of placing the wing eliminates the tedious line-up job.

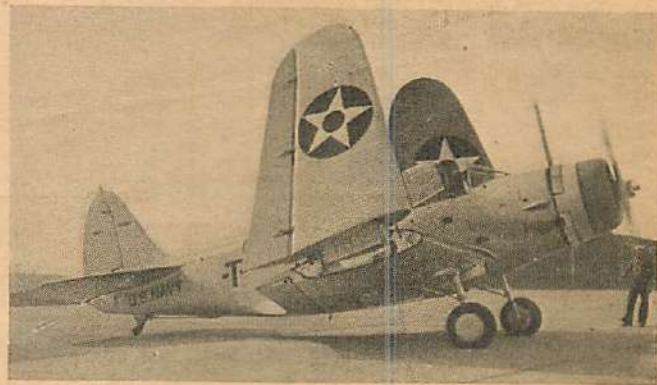
## FUSELAGE

The formers can all be cut from a sheet 4x6" of  $\frac{1}{8}$ " balsa plywood. Use waxed paper between drawing and assemblies.

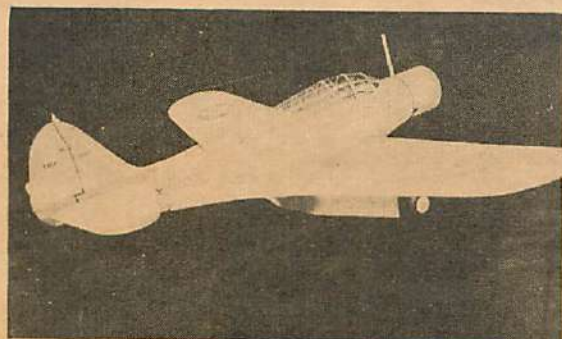
Build the left side of the fuselage on the drawing and then build the right half directly to the left half. Begin by pinning corresponding top and bottom parts to the drawing and then cement the formers to their respective stations. It will be noticed there is nothing to cement to at the top from A to E, so a  $\frac{1}{8}$ " temporary strip is cemented above the former spacers from A to D, then up to E to aid assembly. The plain rib at (Turn to page 83)



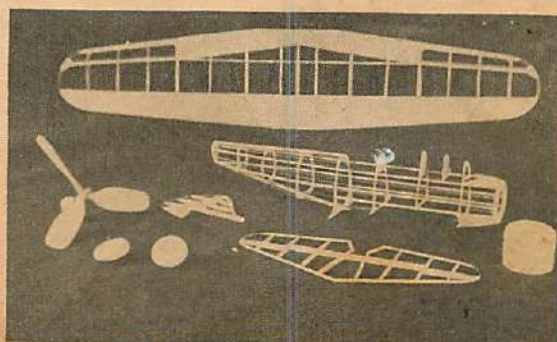
The real ship bedecked in service insignia. Details of the canopy are interesting.



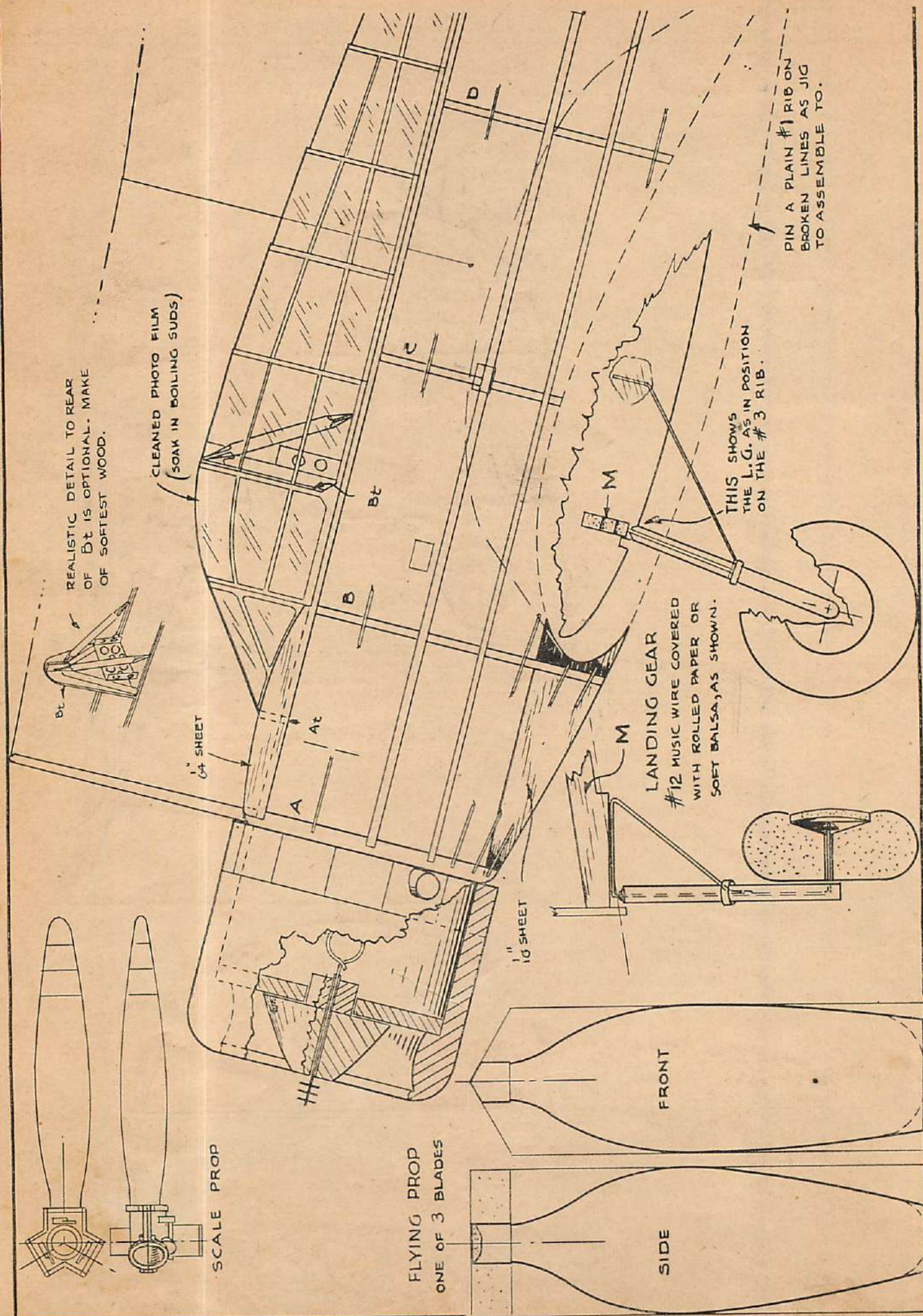
The wings of the TBD-1 fold upward to facilitate stowage aboard aircraft carriers.



Left—The completed model. Note the depressed flaps. Right—The units are easily assembled. Wing is one piece.

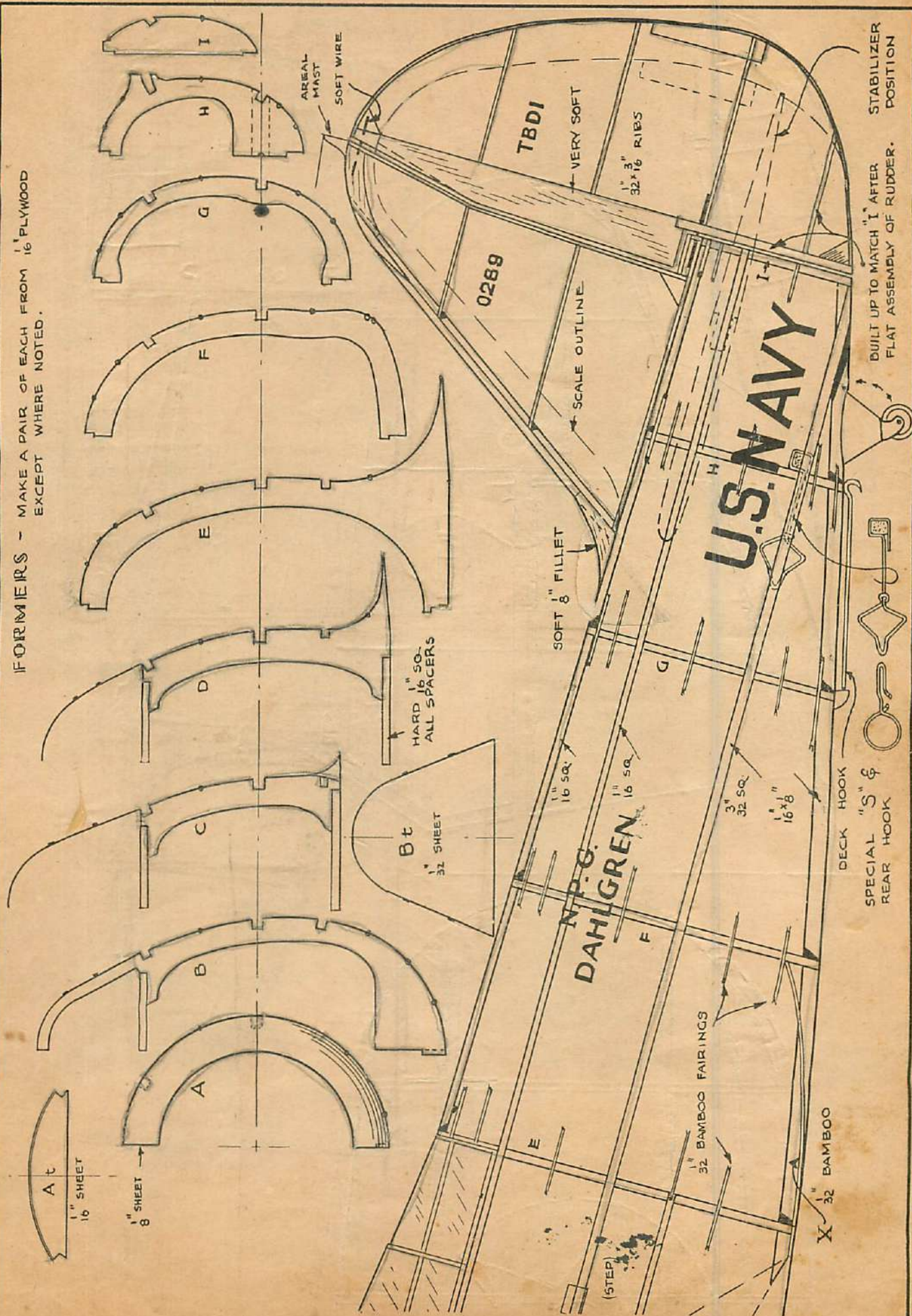




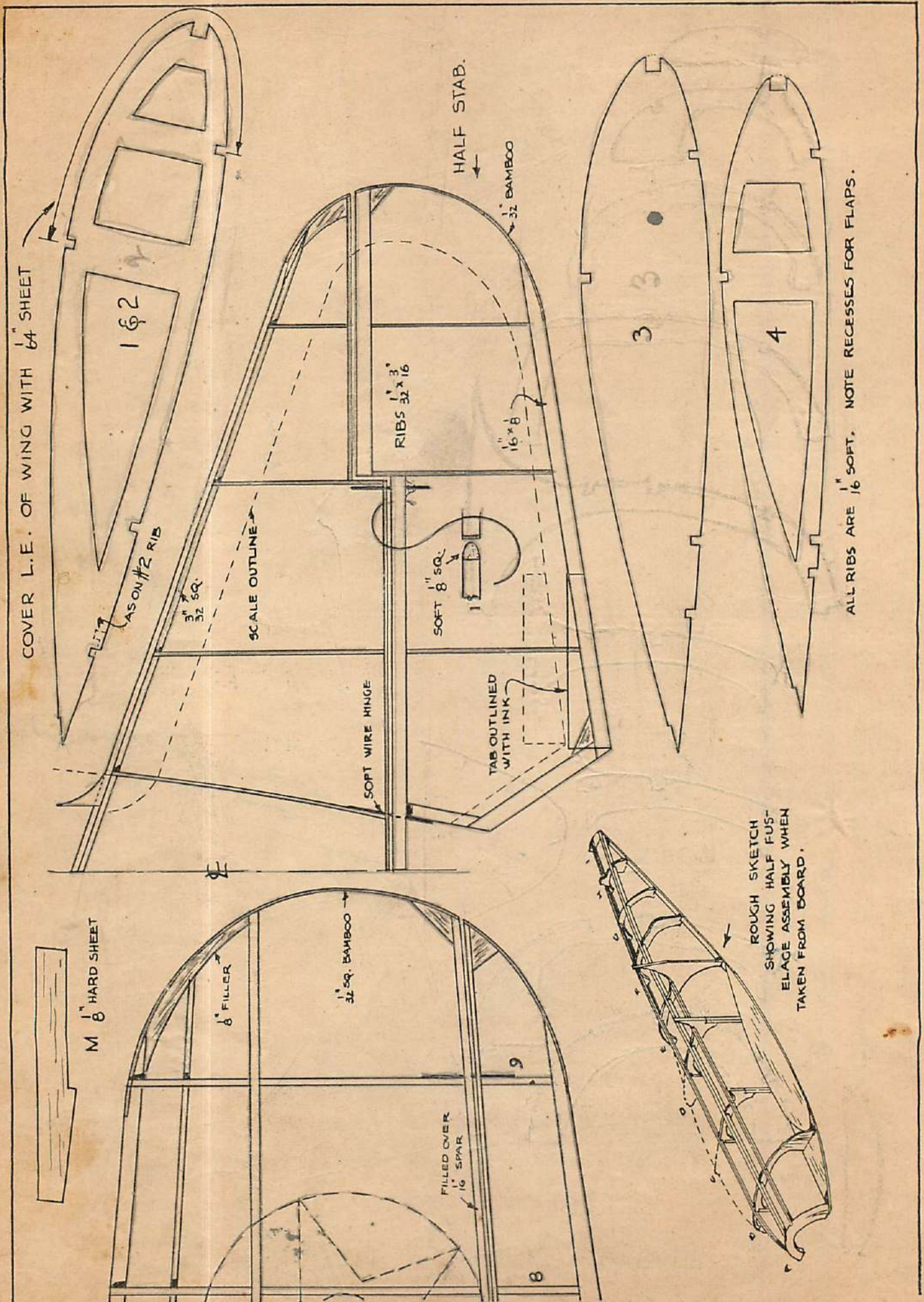




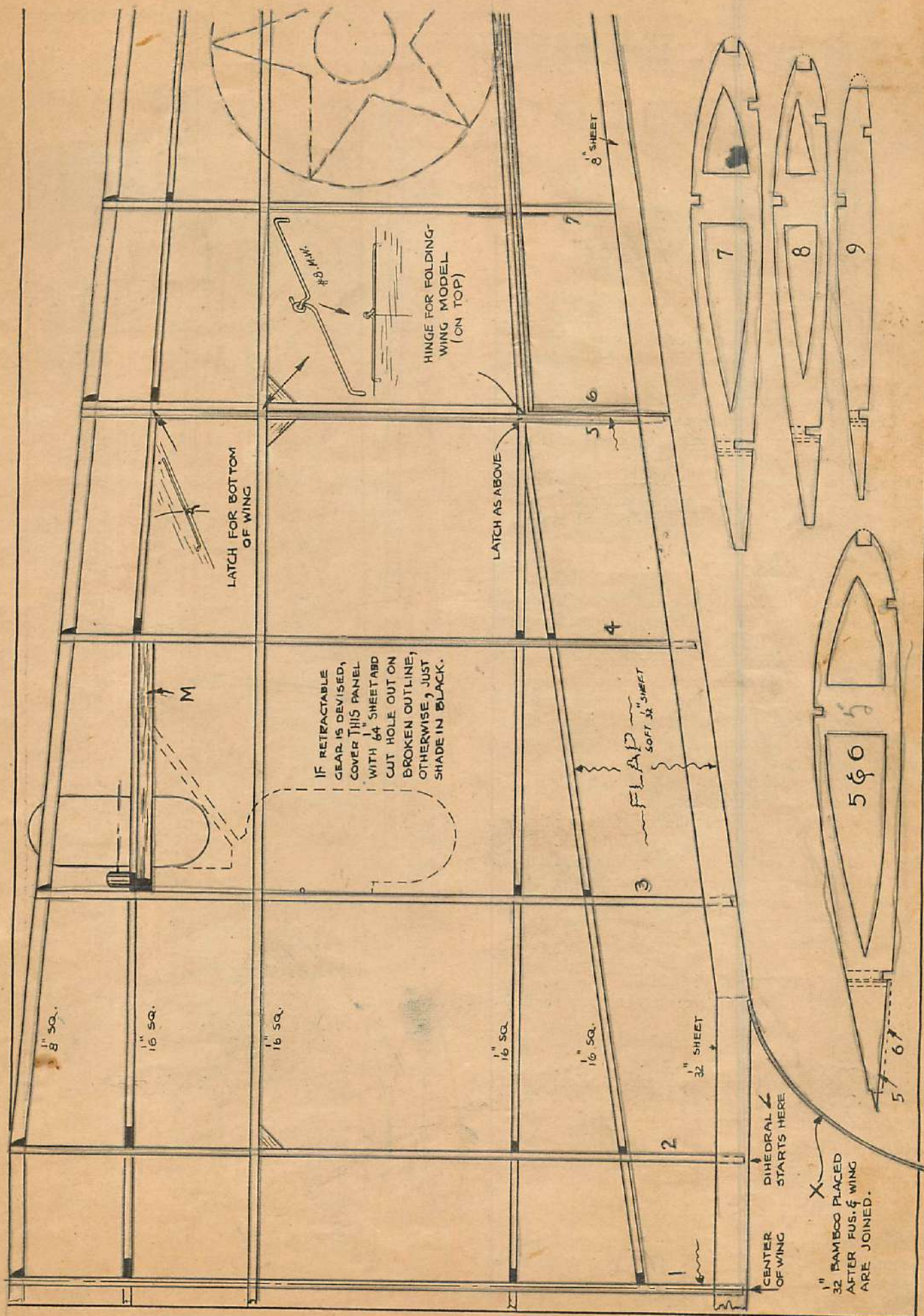
FORMERS - MAKE A PAIR OF EACH FROM 1/8" PLYWOOD EXCEPT WHERE NOTED.













# Great Lakes Dive-Bomber

*Solid model plans of a Marine dive-bomber —  $\frac{1}{4}" = 1'$*

By William Winter

**D**IVE-BOMBING has become the most colorful branch of service aviation. Just a few years ago the pursuit pilot was the idol of air-minded youth. Today, there is something spectacular about dive-bombing that has caught popular fancy.

The picture painted by Lee Gehlbach in his article "9 G's and Pullout" that appeared in the January issue led to numerous requests for plans of the Great Lakes dive-bomber.

This ship is in service for the Marines, where its stamina has made it part and parcel of aviation.

The plans are prepared in the usual  $\frac{1}{4}" = 1'$  scale.

## DIRECTIONS

Square a rectangular block of soft balsa to the outside required dimensions of the fuselage. On its widest side draw the profile of the body and cut away the excess wood.

On the top of the block mark the side contours of the fuselage and again shave away the surplus wood. Shape the partially completed fuselage to the cross-sections shown on the drawings. Sand to a smooth finish. The cockpit cover is shaped from a separate block to be glued in place when finished.

Cut the tail surfaces from  $\frac{5}{32}"$  soft sheet balsa. Shape to a streamlined cross-section and sand.

In the same manner prepare the wings, noting that they taper in thickness. The balsa is  $\frac{5}{16}"$  thick.

Give the units a coat of varnish or clear dope and sand with fine paper when dry. Cement the tail surfaces in position. Mount the wings on struts streamlined from scraps. Likewise, construct the landing gear from scraps.

## FINISHING THE MODEL

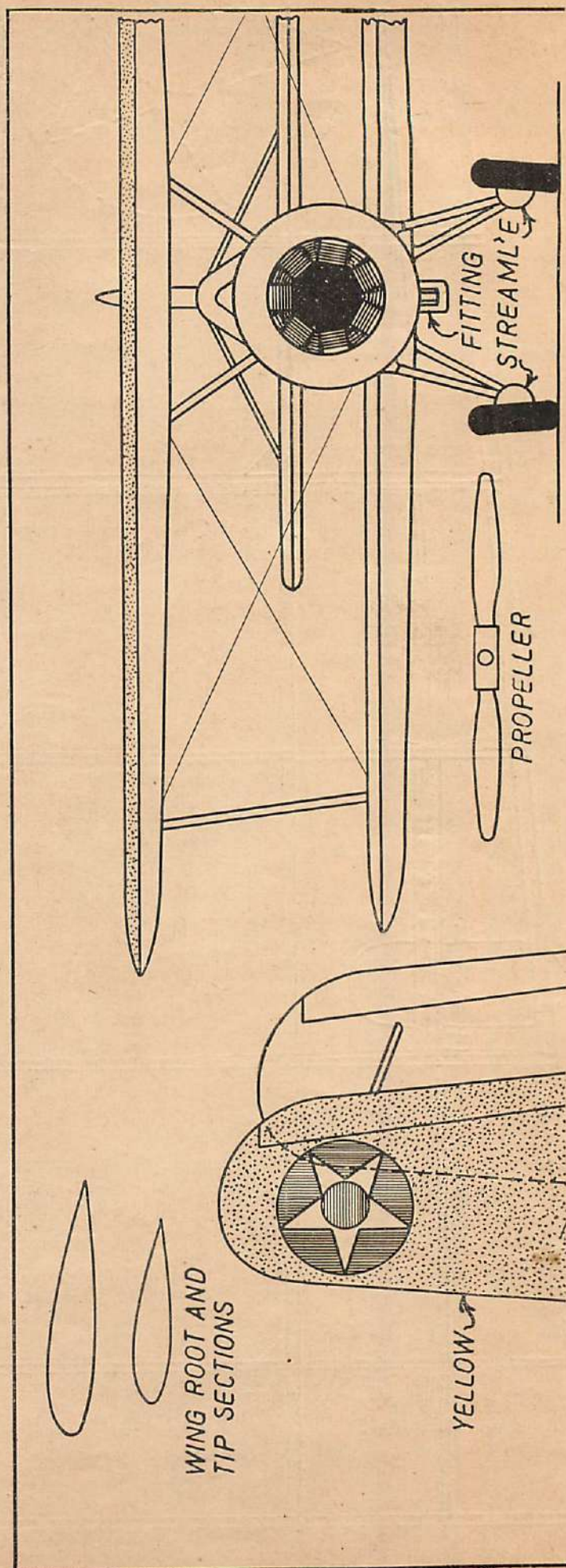
Attach all external constructions, such as bomb racks, tail wheel, etc.

Coat the model with silver or aluminum paint or dope. For an excellent finish a number of coats should be used with intermediate sandings. Note that the top of the upper wing is yellow and that the entire tail is red. Use a rubbing compound to attain a high gloss. The cockpit should be white with black trim.

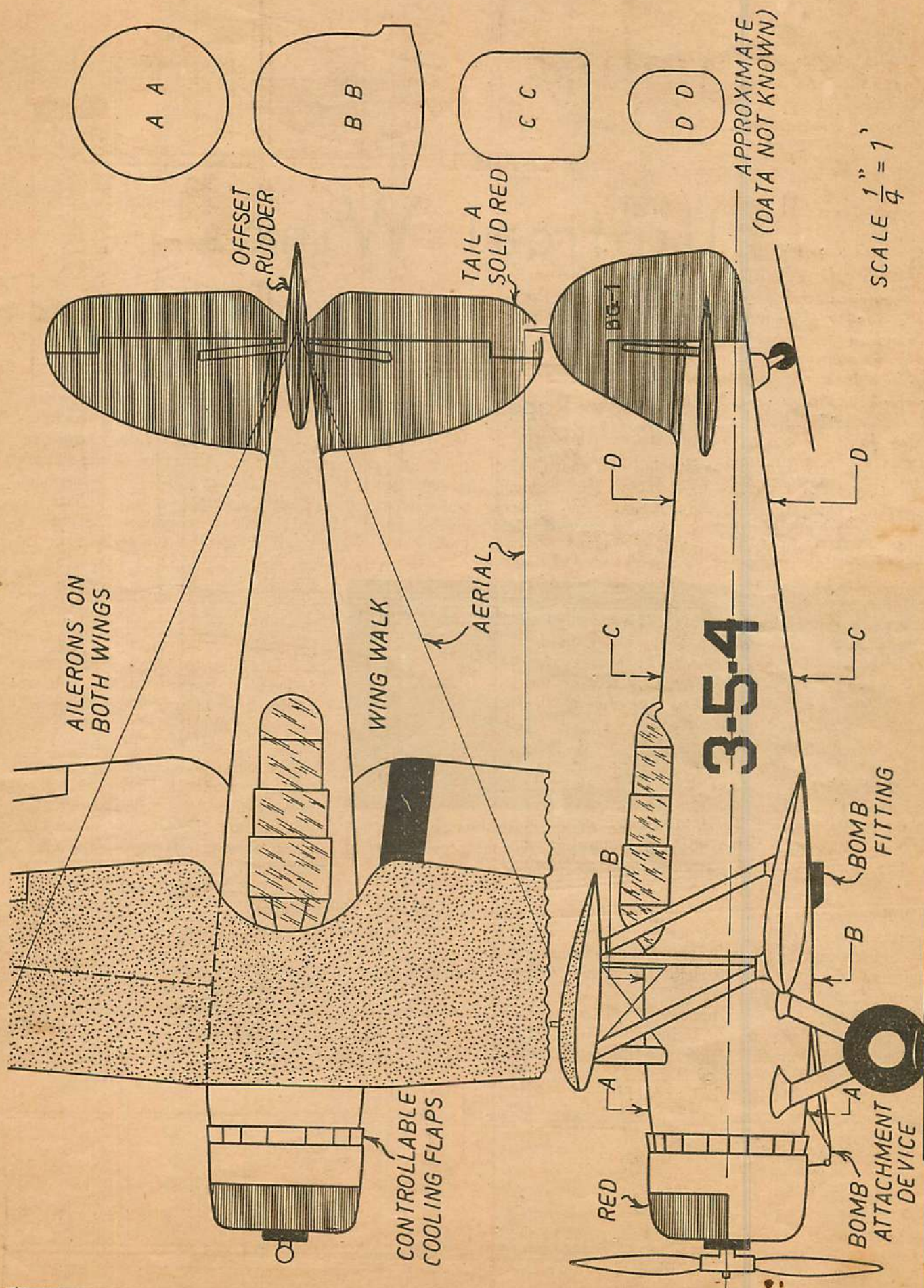
Attach flying wires and mount a propeller made from scraps on a pin free to turn.

## BILL OF MATERIALS

- |  |                                    |
|--|------------------------------------|
| 1 block $7 \times 1\frac{1}{2} \times 1\frac{1}{4}"$ | yellow, silver, red, blue          |
| 1 sheet $\frac{5}{16} \times 2 \times 24"$           | and black coloring as              |
| 1 sheet $\frac{5}{32} \times 2 \times 12"$           | required                           |
| 1 vial cement  | 1 pair wheels $\frac{5}{8}"$ diam. |
| 1 vial clear dope                                    | 1 scrap .014 wire                  |









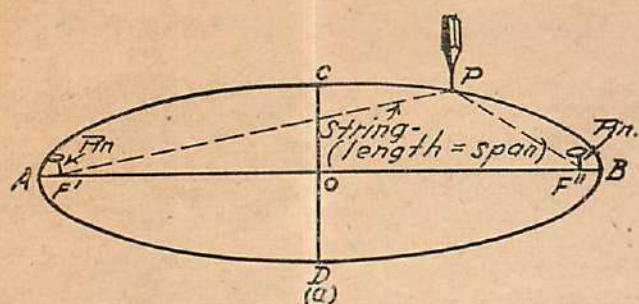
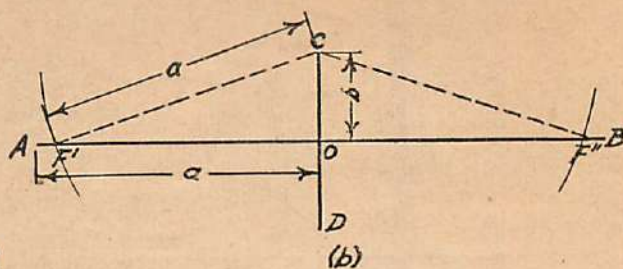


FIG. 1



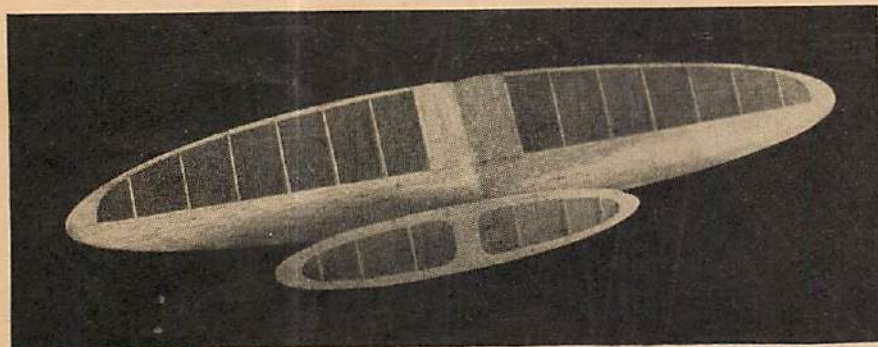
# Elliptical Wings

*The most significant trend in current design—a comprehensive and informative article.*

By Roger F. Parkhill

THE increasing popularity of gasoline models has created a demand for more efficient principles of design and construction of wings and tail surfaces. In obtaining increased efficiency, the plan profile of the wing and tail surfaces should be carefully considered. So far, more or less orthodox designs have prevailed; some builders, for in-

in a plane, the sum of whose distances from two fixed points is constant. Fig. 1a represents an ordinary ellipse. Any point on the ellipse, as represented by P, is such that  $F'P + PF''$  is constant and equal to AB. To find the points (or foci)  $F'$  and  $F''$ , given the span AB and the chord CD of the ellipse, measure the distance OA with dividers and, with C as a center, lay off  $CF'$  and  $CF''$  as shown in Fig. 1b.



The ellipse has been commonplace in indoor design. Such ships as Goldberg's "Valkyrie" and Marquardt's "Riser Rider" are proving the practicability of the ellipse in all phases of modeling.

stance, still prefer the straight wing for its ease of construction, others prefer the tapered cantilever wing for its strength and lightness. But all experienced model engineers will agree that the elliptical plan-form is the most efficient of all wing profiles.

The elliptical shape has proved its efficiency on such well-known airplanes as the Heinkel He-70A and the Supermarine Spitfire I. Also, in model aviation, nearly all the prominent indoor models since 1934 have used the elliptical profile in wings and tail surfaces, thus clearly proving the strength, lightness, and aerodynamic efficiency of the elliptical wing.

Several times I have had other model enthusiasts ask me how to design and lay out an elliptical wing profile. This task, however, is comparatively easy, for several simple methods exist for constructing an ellipse. A model designer may successfully use any one of these methods after he has obtained a general knowledge of the basic properties of the ellipse.

The ellipse is usually defined as the locus of a point

After locating the foci  $F'$  and  $F''$ , the ellipse may be traced mechanically by placing pins or tacks at  $F'$  and  $F''$  and attaching to them a string equal in length to the span AB. Then, by placing a pencil against the string and keeping it taut, the entire ellipse can be easily traced.

For those designers who are keen on accuracy, the following method is recommended. For the purposes of this method, the ellipse is defined as the projection on the original plane of a circle revolved about its diameter as an axis, through an angle less than a right angle. This property of a circle explains why the surface of a circle viewed at an oblique angle always appears to be an ellipse. To construct an ellipse by this method, draw two concentric circles with common center O, and radii equal to  $a$  and  $b$  respectively. Draw a number of radial lines from the center intersecting both

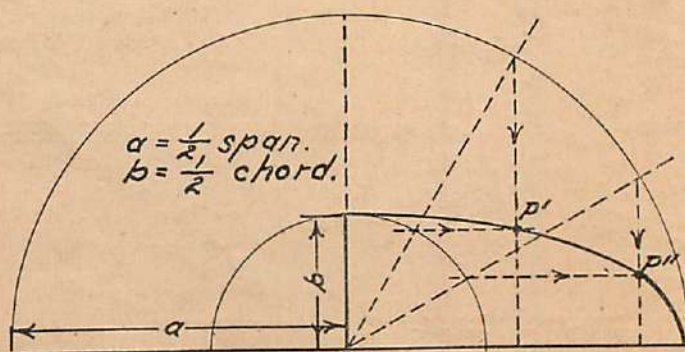


FIG. 2



circles and locate the points of the ellipse by projecting these intersections at right angles as shown in Fig. 2. The points of intersection of the projection lines are the points of the ellipse. A number of points such as P" and P' are located and the ellipse drawn in with a French curve.

For those mathematicians who like to work with ratio, the following method, a little longer than the other two, may be used. Draw the outside circle with radius "a" as in Fig. 2 and erect a number of perpendiculars from the baseline through the center of the circle. Reduce each perpendicular in the ratio b/a and connect the points of division to form the ellipse as in Fig. 3. If desired, horizontal lines parallel to the baseline may be drawn, reduced in the ratio a/b, and the points located to form the ellipse.

A simple symmetrical ellipse will form an efficient wing profile, but a more pleasing appearance will be derived if the wing is composed of two elliptical halves drawn on the maximum ordinate of the wing as a base. The maximum ordinate should pass through a point 32% to 40% from the front of the central or maximum chord, this point being selected in regard to the maximum thick-

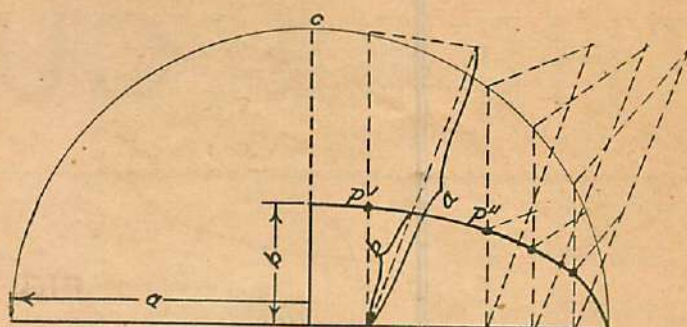


FIG. 3

ness point of the airfoil used. Fig. 4 shows in detail the construction layout of a wing of this type. This layout need not be made full size; it is more convenient to draw it to scale and then enlarge it to the desired size.

In laying out an elliptical wing surface, the following fact is important: The span and maximum chord of the wing must be known beforehand. When substituting an elliptical wing for a straight or tapered wing, use the following formulae:

$$\text{Area} = 0.7854 \times \text{span} \times \text{chord.}$$

$$\text{Aspect Ratio} = (\text{Span})^2 / \text{Area.}$$

The number 0.7854 is a constant for all ellipses and may be used for determining the area of any type of ellipse or combination of ellipses. The use of these formulae greatly lessens the amount of calculation necessary to determine the correct area and proportions for wings and tail surfaces.

Aspect ratios as low as 4 or 5 may be used for an elliptical wing, but for best results it is better to design a wing with an aspect ratio varying from 6 to 8. An elliptical wing with an aspect ratio of 6 will give results in wind tunnel tests comparable to the results obtained from conventional wings of higher aspect ratios.

The wing and stabilizer in the photograph, when substituted for the conventional straight surfaces of equal area on a Gordon Light twin-hydro amphibian, not only gave greatly increased stability, duration and quicker R.O.W. take-offs, but also much enhanced the appearance of the model.

It will be seen from the foregoing design discussions that the elliptical plan form offers a new field for bettering performances that are now considered to be highly efficient. The construction of such surfaces is not difficult. In fact, this development of model construction technique should afford a new stimulus to building. It is hoped that by presenting articles of this type that Air Trails will be able to realize its goal of advancing model building to a new peak of interest and technical achievement.—The Editor.

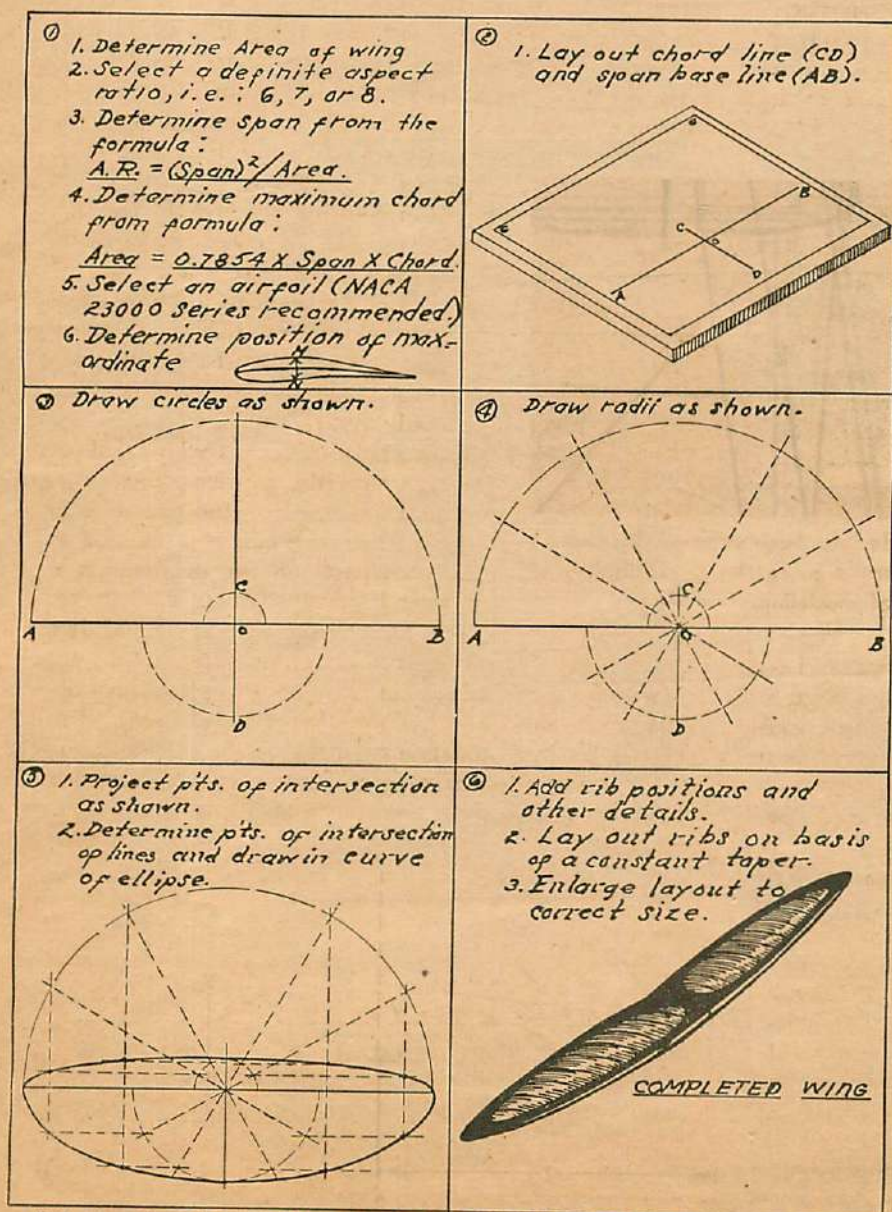
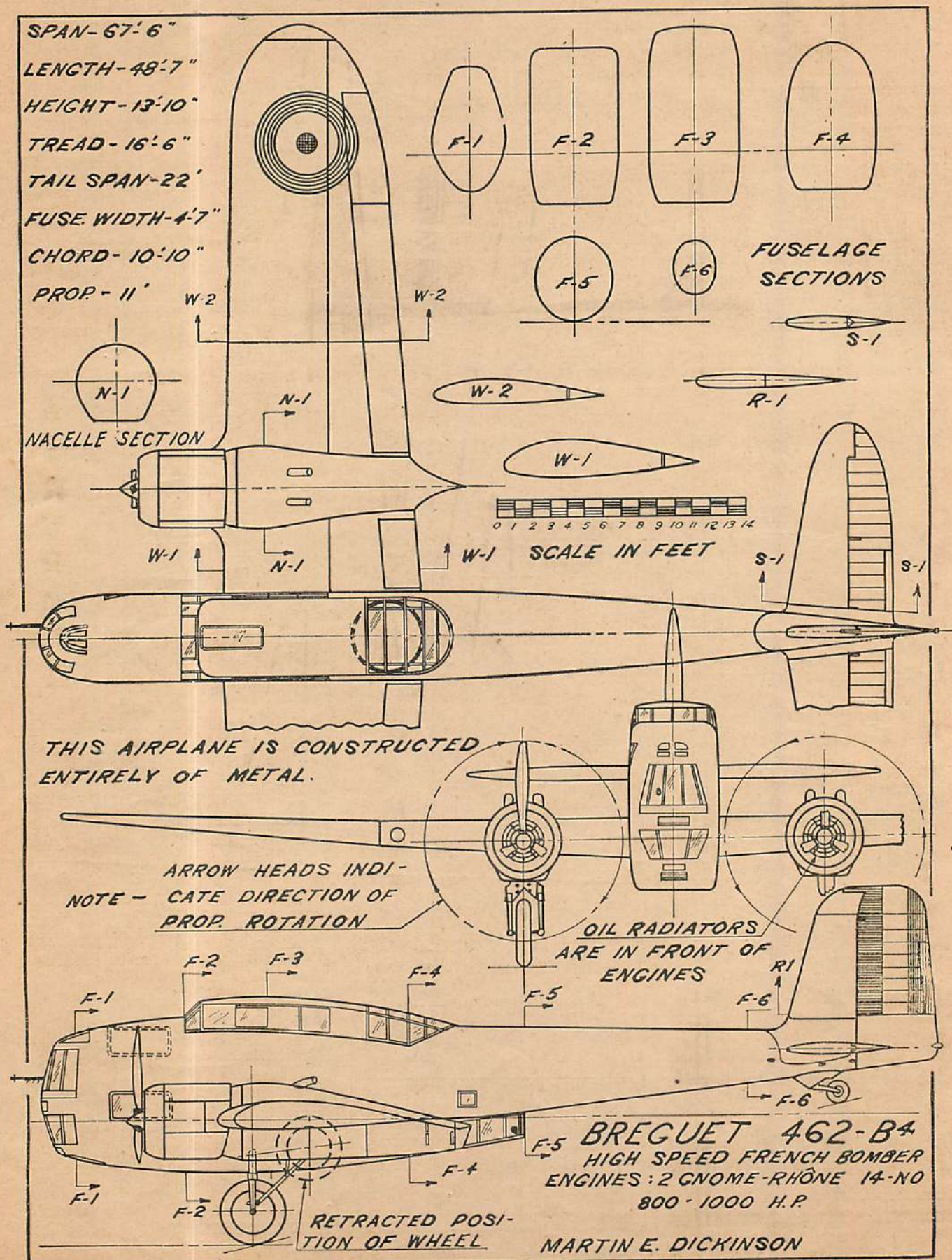


FIG. 4 - STEPS IN LAYING OUT AN ELLIPTICAL WING.

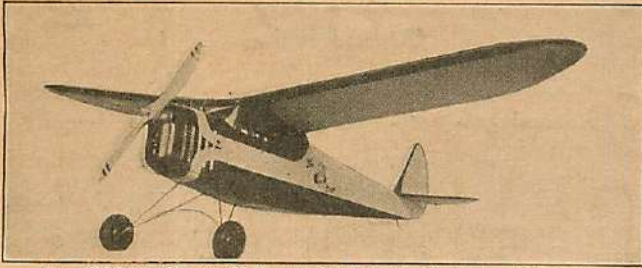


# THE BREGUET 462-B4

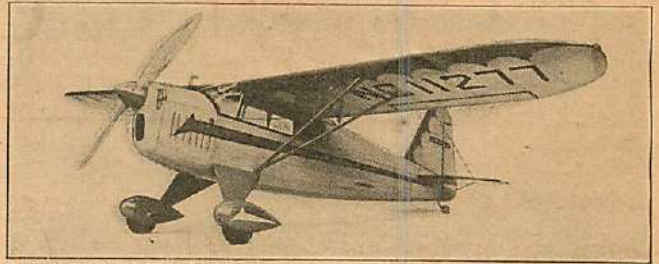




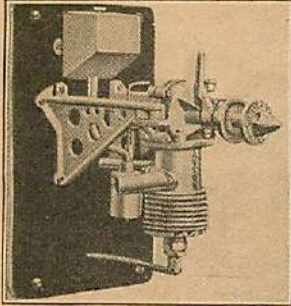
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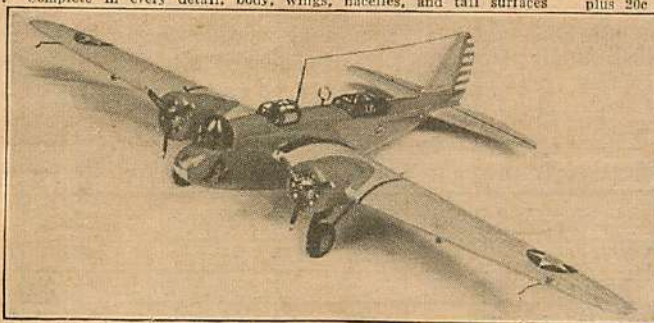
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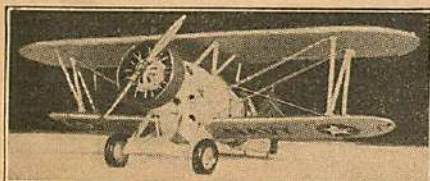
cut to outline shape. Color: Army yellow and blue. Wing span: 17". Price: \$1.00 plus 30c for packing and postage.

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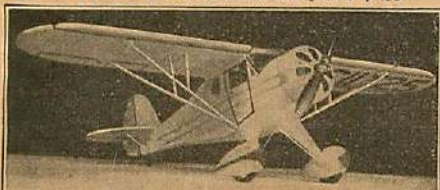


B  
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M  
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E  
R

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FOKKER D7. Colored red wings blue fuselage.



FOKKER D8. Colored red and blue.



SPAD 13. All yellow black detail.



S.E.5. All yellow, black detail.



SOPWITH CAMEL. Colored Blue and Olive.



NIEUPORT 17. Colored yellow and blue.



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# QUESTIONS

(Continued from page 37)

**Question:** What happened to the Gee-Bee racer company? C. H., Tallapoosa, Ga.

**Answer:** The old Granville Aircraft Corporation was disbanded some years ago when it became an aeronautical consultation firm. Z. D. Granville was killed in 1934. The 1932 Gee-Bee put up a world's land-plane record of 294.2 m.p.h. The 1933 model was not so successful.

**Question:** What can you tell me about the British Heston Phoenix? H. McC., Alliance, O.

**Answer:** The Phoenix is a five-passenger high-wing monoplane powered with the 200 h.p. D. H. Gypsy-Six engine. It is manufactured by the Heston Aircraft Works of Middlesex, which was formerly the Comper Aircraft Company. The Phoenix uses a two-spar wing of wood covered with fabric. It comes with a retractable undercarriage, and either a fixed-pitch or a variable-pitch prop. It has a top speed of between 148 and 150 m.p.h., depending on the propeller used.

**Question:** I am interested in building my own light plane. How can I tell whether it will pass the Department of Commerce stress test and how can I assure myself that it will be a licensable ship after it is built? F. L. J., Stanberry, Mo.

**Answer:** You have quite a problem there if you are really sincere in your idea of wanting to build your own plane. If you have a set of plans you might first consult an aeronautical engineer and get him to give you some idea as to whether the plane would pass government tests. If you are not an engineer, as you intimate, I am afraid you would have considerable trouble in working out your own stress tests. If you want a

book on this subject you might try Max M. Munk's "Principles of Aerodynamics," published by the Ronald Press Company, 15 East 26th St., New York City, and priced at three dollars. Or you might write to that firm and get their full catalogue of aviation textbooks and select one yourself.

**Question:** What can you tell me about Colonel Lindbergh's Spirit of St. Louis plane? I am trying to collect data on it. R. C. N., London, Minn.

**Answer:** The Spirit of St. Louis was actually a stock Ryan monoplane built by the Ryan Aviation Company of San Diego. It was specially fitted, of course, for the transatlantic trip. It used the Wright Whirlwind engine of 250 h.p., which gave the plane a sustained speed of about 100 m.p.h. It carried 451 gallons of gasoline and the cockpit was fully enclosed and set under the top of the wing, and the only forward vision obtainable was by means of a periscope arrangement set against the dash. There were two side windows which gave the pilot something of a three-quarter view forward. The ship cost about \$15,000. The general specifications were: span, 42 feet; length, 27 feet, 9 inches; height, 6 feet, 6 inches; chord, 7 feet.

**Question:** Please give me the color scheme of Roscoe Turner's Meteor, the model of which was presented some time ago by William Winter. D. W. C., Buffalo, N. Y.

**Answer:** I have not seen the plane but according to the program of the last National Air Races, the plane was listed as a silver-gray ship, bearing the number R236Y. Beyond that you have only to add the racing number "29" and the advertising emblems as they are shown on the drawing.

**Question:** I have the necessary educational qualifications to enter the Army

Air Corps, but I weigh only 120 pounds and I stand five feet, seven inches, which of course indicates that I am under weight. Do you think that would keep me out of the Air Corps? J. S. V., Detroit, Mich.

**Answer:** This is a question whose answer I would not care to be responsible for. You must understand that I am not a medical man and it is hard for me to pass on questions involving physical conditions. In your case, however, I should think that if you passed the rest of the standards required you might be accepted, under the condition that you agreed to a diet designed to build you up. I would most certainly get a physician's opinion on the matter. You might even write to the Chief Medical Officer of the Army Air Corps, Washington, D. C., and put your case before him.

**Question:** What kind of work is there ahead for girls who want to get into aviation? Will a college education help much? Is there any real opening for a girl who wants to become a pilot? J. S., San Antonio, Tex.

**Answer:** Aviation does not offer such a wide scope for women pilots as it does for men, but there are openings for them in the business. I know some who are flying salesladies for aviation firms and who sell light planes. Others are instructors in amateur flying clubs. A few fly publicity ships. Commercial aviation offers the widest scope both on the ground and in the air. The big air lines hire flying hostesses, traffic representatives and specially trained women in their passenger departments. Some women have very fine positions with air lines making the contacts between the public and the company as lecturers at women's clubs, department stores and other focal points. Yes, there are many openings for a bright girl who is smart, air-minded and keen for the business.

PERFORMANCE CHART FOR "GERMANY FLIES AGAIN."

MANUFACTURER	NO.	TYPE	ENGINE	SPAN	GUNS	SPEED	LENGTH	GRS. WGT.
ARADO	AR-68	FIGHTER	1-750 H.P.	36 FT.	2	205 M.P.H.	31 FT.	4,400 LBS.
"	AR-95	SEAPLANE	1-880	41	?	171	36.5	7,755
MESSERSCHMITT	BF-109	FIGHTER	1-950	?	?	379	?	?
DORNIER	DO-11	BOMBER	2-950	59	?	267	55	?
"	DO-19	"	4-650	104	4	198	83	40,700
"	DO-23	TRANSPORT	2-750	84	3	161	61	20,240
FOCKE-WULF	FW-58	FIGHTER-BOMBER	2-240	68	3	158	46	6,394
HAMBURG	HA-137	DIVE BOMBER	1-680	36.5	4	205	31	5,313
HEINKEL	HE-51	FIGHTER	1-750	36	2	204	27.5	4,180
"	HE-112	"	1-660	30	4	292	29.5	4,906
"	HE-118	DIVE BOMBER	1-910	49	5	249	38	8,888
"	HE-170 K	BOMBER RECONN.	1-910	48	5	264	39	9,086
HENCHEL	HS-122	GENERAL PURPOSE	1-610	47	3	164	33	5,566
"	HS-123	DIVE BOMBER	1-700	34.5	?	?	28	4,884
"	HS-126	LIGHT BOMBER	?	?	3	203	?	6,200
JUNKERS	JU-86 K	BOMBER	2-890	73	3	202	52	12,600

\* Udet recently flew this ship to a new land-plane record of 394 m.p.h.



# TORPEDO PLANE

(Continued from page 71)

the bottom may be lightly cemented to, for the joints are easily separated with a razor blade at the proper time.

Add the balsa side longerons. Pre-bend them to avoid a sprung fuselage. Remove from board and duplicate the first steps right on the assembled half, then add the bamboo stringers, rear hook.

## WING AND LANDING GEAR

Build the wing as a unit. Due to the curve of the ribs, the bottom spars must be blocked up proportionately from root to tips to keep the incidence even. Do not cut the ribs for the ailerons until the wing is assembled, then slice out for the aileron spars and fit the spars in. Remove the top spar between the #2 ribs, then crack all spars at #2 ribs and block the tips up 17/8". Replace the piece of top spar and cement the cracked spars. When dry, remove and install the flaps.

Cement the M pieces between ribs 3 and 4 and install the landing gear, which is explained on the drawing.

## TAIL SURFACES

Build the tail surfaces out of plain unshaped stock, and when complete sand them to the tapered streamlined shapes. This method is much easier and more accurate than pre-cutting all ribs before assembly. The hinges can be copper or soft iron wire. The lower part of the rudder has to be added on to, to conform to the last former. The stabilizer should be made as a unit.

## PROPELLER AND COWL

Carve and hollow the cowl from a soft block and cement in the retainer disc. Make the nose plug to fit snugly in the hole.

Bevel the three propeller blocks as shown on the drawing and prime the bevels copiously with cement. Before the priming has fully dried, add more cement and clamp them together with pins, on a flat surface. After drying several hours, blank and carve each blade in the accepted manner. Dope and sand to a glossy finish. The balance may be obtained by adding a coat of dope to the light blade. Assemble the prop, nose plug, washers, and prop shaft.

## COMPLETING THE MODEL

Cover the leading edge of the wing with 1/64" sheet balsa, and the remainder with silver tissue. Form the celluloid cockpit cover to fit well, then

remove it and cover as much of the fuselage as possible. Cover the tail surfaces with silver tissue. Install the wing in its place under the fuselage. Slice through formers H and I on lines directly over and between the second top longerons. The top of the fuselage can then be raised enough to install the stabilizer. Cement the parts back together and cement the vertical tail on. Check repeatedly to see that the surfaces are in correct alignment. Fashion a dummy tail wheel and deck hook and cement them in place. Fillet the tail surfaces and wing with tissue. Cement the cowling on, the cockpit cover and radio antenna masts. Make the panel frames on the cover by doping on narrow strips of silver tissue.

Spray the tissue lightly with water and when dry, if the model is streaky, coat the surfaces with a thin coat of silver dope. The wheels and inside the cowl are black. The lettering is black. Add any remaining detail that is desired.

Power the model with three loops of 1/8" flat rubber. The loops are tied at both ends, the special "S" hook at the rear. The motor is engaged to the rear hook by "fishing."

With this model, first tests should be made by letting it take off under its own power, making adjustments between flights until a steep left-hand climbing turn is accomplished.

## LIST OF MATERIALS

### Blocks

1 1 3/4 x 2 1/8 x 2 1/8" 1 pr. 1 3/8" air-  
3 1 1/8 x 1 1/8 x 3 1/2" wheels  
2 1/2 x 1 3/8 x 1 3/8 or

### Sheet

1 1/8 x 2 x 12" 4 1/32 x 2 x 18" ✓  
2 1/6 x 2 x 18" 3 1/64 x 2 x 18" ✓

### Strips

2 1/8 sq. x 18" 12 1/16 sq. x 18"  
4 3/32 sq. x 18"

### Miscellaneous

10c tube model air- 2 bamboo sticks  
plane cement 24" #12 music wire  
1 oz. clear dope 6 ft. 1/8" flat rubber  
1/2 oz. silver dope several friction  
2 sheets silver tissue washers  
2 spoiled negatives

(116)

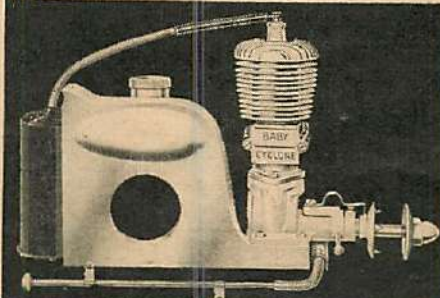
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## N.A.A. NEWS

(Continued from page 25)

by national clubs which are affiliated with the F. A. I., and each club may enter a maximum of twelve models.

### THE COLLIER TROPHY

The Collier Trophy, awarded each year for the greatest achievement in aviation whose value has been demonstrated in actual use during the year preceding, has long been recognized as aviation's premier honor. To decide who merits the coveted trophy for 1937, the National Aeronautic Association has appointed an awards committee of eight aviation leaders, consisting of James H. Doolittle, chairman; Henry B. duPont, S. Paul Johnston, George W. Lewis, William B. Mayo, Leighton Rogers, E. P. Warner, and T. P. Wright.

The committee will follow new rules and procedure for awarding the trophy, since in recent years the number of deserving accomplishments which it is necessary to investigate and study have multiplied manifold.

### MICHIGAN DEPARTMENT ACTIVE

With aviation legislation growing within the states, the trend is toward a closer state-wide organization to further forward-looking laws, oppose those which are undesirable, and in general encourage flying activities.

Typical is the Michigan Department of N. A. A., which has 1,000 air-minded members. This group, under the leadership of Wayne Sheldon, executive secretary, is sponsoring many promotional activities such as the Michigan Air Tour, a light airplane cruise, week-end cruises, air meets, a strong youth program and gliding and soaring meets. In addition, the Department is acting as a clearing house for aviation information in an effort to maintain a cooperative service between airports and operators.

### STANFORD GETS INTERCOLLEGIATE TROPHY

Top intercollegiate flying honors of the year went to the flying club of Leland Stanford University when it was awarded the Loening Trophy at the annual conference of the National Intercollegiate Flying Club in Washington during April. Stanford flew more than 1,600 hours during the school year and competed in and won four inter-club meets and placed second at the National meet at Hicksville, L. I., in June of 1937.

More than thirty delegates from ten schools were in attendance at the conference. Clark Henderson of Kenyon College, son of the pioneer aviation executive, Paul Henderson, was elected

N. I. F. C. president for the coming year.

The Cloudhoppers Club of Akron University were scheduled to be hosts to this year's National Intercollegiate Flying Meet at Akron Municipal Airport on June 25th and 26th, with Kenneth Benson, president of the club, in charge of the arrangements.

One of the important new policies decided at the conference was the divisional arrangement of the N. I. F. C. under regional vice-presidents from the East, Middle West and West, who will further the organization of new clubs in those sections. The N. I. F. C. urges all clubs interested in becoming affiliated with the organization to communicate with the new secretary, Miss Joan King of Stanford. Miss King's address until next fall is Box 208, Bryn Mawr, Pa.

### NATIONAL COORDINATION AGENCY

The twenty-two national organizations which met at the First National Aeronautic Planning Conference, held under the auspices of the N. A. A. at Cleveland early in the year to draft a national aviation program, adopted as one plank the need for a permanent coordination agency.

At a meeting called at Washington in March, the first step was taken toward the formation of such a permanent agency. Among the names considered for the group were Joint Air Board, National Aeronautic Forum, Aeronautic Discussion Council, Joint Coordinating Committee, and National Aeronautic Advisory Council. The organization of the agency became definitely assured when the Aeronautical Chamber of Commerce of America, the National Association of State Aviation Officials, the National Aeronautic Association, the Private Flyers' Association and the Air Reserve Association acted officially to become members of it.

An important policy of the new agency is that no official action will be taken without unanimous agreement. Thus it will advance its purpose, which is to gather united support on aviation needs. The agency will first study the program adopted by the Cleveland conference with a view to revising and adding to it where needed. This program contained fifty-seven resolutions grouped under these typical headings: general governmental organization, coordination, air defense, air transport, airports and seaplane bases, weather reporting, private flying, water flying, gliding and soaring, youth education, manufacture, lighter-than-air craft, rotary wing aircraft, research, safety and insurance, and aeronautical law.

### N.A.A. IN THIRTY-THIRD YEAR

The National Aeronautic Association is the oldest aeronautic body in the

United States and on the Western Hemisphere. It was founded as the Aero Club of America in 1905, just two years after the first airplane flight. As the American representative of the F. A. I., it has as a special responsibility the regulation of air meets, races, and record trials.

Since its inception it has been the mainspring of aeronautic activity and of movements to foster and encourage military and civil aviation in the United States. Organized "to make the friendly interest of the general public a vital force for aeronautic progress," it now has more than 10,000 members in all parts of the country.

### THE NATIONAL CONTEST BOARD

For the active guidance and supervision of the sports activity in the United States, a National Contest Board of qualified leaders from the various phases of aviation is named each year by the N. A. A. In general, the board consists of a directing council plus a series of technical committees each of which deals with a specialized phase of activity. The Board is represented regionally by district contest directors and locally by airport managers with the assistance of specialized officials such as air meet directors, F. A. I. timers, model contest directors, and glider observers.

Today, sporting aviation reaches out on a constantly broadening front.

### MEET "OSHKOSH" WITTMAN!

For masterful exhibitions of pylon polishing, S. J. ("Oshkosh") Wittman, the flying schoolmaster and speed merchant extraordinary from Wisconsin, has no peer. Possessed of a dynamic personality and unusual flying ability, he has bagged an enviable collection of trophies at major American air meets.

At the All-American Air Maneuvers in Miami last December, Wittman, flying his special-built silver-nosed red racer, was an easy winner in the three principal high-speed events, including that for the Glenn H. Curtiss Trophy.

He just missed winning the coveted Thompson Trophy last year by a stroke of ill luck after leading for eighteen laps. And although he missed taking the Thompson, he made a fine showing in other events at the 1937 National Air Races. He won first place in three races, including the James J. Davis Trophy event, and placed second in the Greve Trophy Race.

In 1936, he was among the first six championship racing pilots and, in 1935, flying the "Chief Oshkosh" of his own design, ranked second among the racing pilots of the year.

"Oshkosh," incidentally, is special assistant to the president of the N. A. A.





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for Commercial, Wakefield, Moffett, Seale or Stick Models. Finished, ready for use, with free-wheeling attachment.

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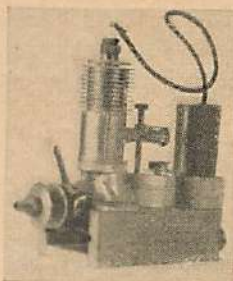


### Just Developed . . . BM GAS MOTOR FUEL

This gas engine fuel is already mixed ready for use. We have taken the finest refined Valvoline SAE 70 oil, mixed it with the finest colorless gas (not ordinary gas from pumps). Sold in 2 mixtures. Red Label for new motors. Yellow Label for motors already broken in. Our mixtures are in perfect accord with every motor manufacturer and are absolutely dependable for utmost in fine fuel performance. Can has easy-to-pour-spout, no funnel necessary.

Yellow or Red Label Pint Cans.....30c P. P.

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They have speed, stamina, finest construction and materials.  $\frac{7}{8}$ " stroke. 1/5 h.p. 1200 to 10,000 R.P.M. Come complete with coil, condenser block tested, and ready to run.



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MODEL "D"  
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Trade in your old motor.  
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**MOTOR REPAIR  
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For \$1.00 we will take  
apart, overhaul, clean and  
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# Beshar MODELS

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"PREMIER MODEL AIRPLANE SHOW ROOM OF AMERICA"

## AIR ADVENTURERS

(Continued from page 35)

At times I sit at my radio and listen to the routine traffic conversations between transport pilots and the dispatchers at the various airports along the East Coast. And as I listen I often feel the urge for a transmitter set to the air-line wave length over which I could say:

"Sure, it's okey-doke with you up there. You've reached your goal. You're in the driver's seat now, but don't forget there are thousands of youngsters who are just as sincere as you, who are hoping that you will never let them down. You've got a transport plane under you and a wheel in your hand. You owe it to more than yourself, more than the passengers behind you, to get her through and put her down safely. You know the rules, you know the air laws. Stick to them, because you are responsible for more than just one transport. You are responsible for Aviation."

What can we Air Adventurers do about it?

You have a Creed to start with. You are pledged to be loyal and to have courage. Don't let these set-backs upset you. Don't let the black headlines rob you of your determination to carry

on. You can talk up aviation and talk down the unbelievers. You can carry the word of safety in aviation wherever you go, and all the crashes in the next ten years will not be able to stop you from reaching your goal—your place in American aviation.

Are we downhearted?

No! But we want further proof of your sincerity. If you are not a member of Air Adventurers, clip the coupon below and inclose a dime to carry the cost of postage, wings and membership certificate. The spark that caused an explosion, the fog that blinded a pilot or the fracture that let a wing drift away can be turned into valuable assets if only Air Adventurers will be loyal to their trusts and refuse to become downhearted.

Are you with us in this great crusade? Sure!

Your Flight Commander,  
ALBERT J. CARLSON.

### CLUB NEWS

And now for the club news, as far as space will allow.

To be perfectly frank, things in this department are running in sweet oil.

You birds are coming through in fine shape and the Editor is smiling. The membership is climbing fast and the staff is kept pretty busy handling all the examination papers and getting out the awards. We're willing to go the limit with you, of course, so keep on gathering new members and encouraging them to climb with you through the examinations and grades. Stay with us and we'll see you through.

The first bird on the mat this month is David Thompson of Orlando, Fla., who has just been awarded an advance in rank for a paper on a required discussion on the merits of Air Trails. Dave came through with a swell three-page, cleanly typed job that gave us a real thrill and won him a mark of 83%.

According to Dave, he buys Air Trails first of all, and if he has any money left he goes for a model-making magazine. He particularly likes our photographs and raves about the news in "Air Progress." He's a bug, evidently, on details of planes, and would have us chuck out gliding and sailplane stuff; which is one man's opinion, of course. But boy, how he goes for William Winter's solid scale models. We have an idea he does not



like fiction, and he doesn't give our indoor models a tumble.

And so it goes. At any rate, Dave has given us a good idea of what he likes, and we certainly appreciate his criticism.

One of the most sincere raves we have ever had is from Robert F. Steuding of Kingston, N. Y. This bird makes life worth while. Steuding has been flying for about six months and has managed to get in about five hours on an Eaglerock, and hopes to have his private ticket soon. He's also out for his Air Adventurers Flight-Lieutenant award.

Here's what Steuding says about Air Trails:

"Air Trails is IT! The article 'Whether or Not We Fly' certainly proved to me that there is much in aviation that needs to be perfected. Clyde Pangborn's 'Europe Preens Her Wings' was very interesting and shows that Pangborn can be of great assistance to the U. S. A. in time of war, and in preparations for defense. I would like to see a department open for advertising on good used planes and parts."

William Myers of Hot Springs, Ark., comes through with the swell suggestion that we run a special feature on all types of aircraft motors, explaining the type, horse power and particular details. He also sends us a snapshot of a Beechcraft taken at his local airport, on which he based his claim for the Photographer's award. Well, the picture was swell and he used an Agfa D6 with an F-11 lens at a twenty-fifth of a second exposure. He used Convira printing paper.

Gene Dowda of Lindale, Ga., a new member, tells us of a debate he got into at school recently. Gene and another lad or two were telling the world at school just what aviation was doing. Someone broke into the gabfest and said airplanes weren't safe. Gene got up on his hind legs and the teacher decided that they had better settle it with a proper discussion and arranged a debate. The subject was "Resolved: Airplanes are as safe as automobiles." Gene was on the affirmative side and did so well they won the debate.

We would like to have sat in on that affair.

Gene appears to be the leader also in model making around Lindale, for his ships manage to capture most of the prizes. He added a nice line or two about the good work Air Adventurers are doing, and a particularly swell boost for your Flight Commander.

We take a modest bow, Gene, and hope we can live up to your fine tribute.

Robert Pfeifer of West Allis, Wis., shoots in a picture of his flying model which has made thirty minutes (minutes, Bob, or seconds?) indoors. He gets his Airplane Mechanic award for

the ship, at any rate. He has also started what he calls the Wright Model Club.

One of the most interesting pictures that has come in in months was taken by Leon Phinney of East Kingston, N. H. We are presenting it with this department. The details in the Beechcraft are particularly clear and show the wheels down, the wheel wells and the shock absorbers. It was taken at the Portland Airport with an Agfa-Ansco 1A Readyset Royal under good lighting conditions. Needless to say, Leon gets his Craftsman award on this one.

Another unusual picture comes through Eugene Linn of Wichita, Kan. We feel we're getting in a quick one on this. It is the new Dal Special made by Wayne Dalrymple and Charles Pfeiffer, of Wichita, we presume. According to Linn, the Dal Special has a top speed of more than 100 m.p.h. and uses a 30 h.p. Aeronca engine. Linn also sends us details of the special Bantam he built from Air Trails plans and which has turned out to be a very consistent flyer. He's another bird who went hard for the Pangborn article on "Europe Preens Her Wings."

"What else can anyone expect of an aviation magazine?" asks Harry Nyeda of Stockton, Cal., in his discussion on Air Trails for his Flight-Lieutenant award. "You have everything, fiction, models, gliding, club news and articles by Clyde Pangborn. I also like Air Trails pictures and the only suggestion I can make would be a series of articles on motors so that the engine mechanics could get some real inside data."

How's the article on Diesel engines in this issue as a starter, Harry?

Samuel Behrens is another Air Adventurer with the motor bug. "I have flown many times," he says, "and I know what a good engine will do and what a 'dead' motor can do." Behrens is from Brooklyn and probably haunts Floyd Bennett Airport. He is a licensed student pilot and we can readily understand his interest in engines.

Gerald Leland of Dayton, O., has all the luck. He not only lives where American flying was actually born, but goes to Florida in the winter and sees all the activity of the P. A. A. at the Miami Airport. He sends us a swell shot of a Sikorsky S-43 being beached there, which we consider one of the best of its kind.

Fred Phillips of Calgary, Alberta, is a new Canadian member who tells us they are building a new military airport near his town. Fred is planning to take a course in aviation, and hopes to pick up a swell lead by tackling some of our examinations. We'd like a line on that airport, Fred.

Right out of Fort Sam Houston,

Tex., comes another bid for a Photographer's award. Rossman Brimberry managed to get into Randolph Field, of all places, and got a swell shot of a BT-9 Basic Trainer while it stood at a pump for fueling. Rossman used an Eastman box-type camera and 120 Verichrome film, and in spite of the cloudy weather managed to catch a pretty fair shot. We sent him his award, too.

All the way from New Zealand comes a photo which, for all we know, may be the last ever taken of the ill-fated Pan-American Clipper flown by Captain Edwin Musick. It was sent to us by Air Adventurer D. J. Sampson of Auckland. Both Musick and Captain Colbertson were friends of Sampson, who again reminds us of the great loss aviation all over the world suffered when Captain Musick "went west."

Martin Rogers of Byfield, Mass., is one reader and Air Adventurer who wants more fiction. He liked our student series of a few months back, but strenuously objects to our putting foreign planes on the cover. Now it's all right to be patriotic, Martin, but there is still plenty to learn from other countries. Besides, America does not turn out enough new planes to keep us busy with home-produced models, and we have to go abroad now and again. You should have obtained enough aircraft factory addresses in our Light Plane Survey to keep you busy for months.

Wallace B. Stephenson of Portland, Ore., has just found out about Air Adventurers. He had ducked the club news before because it, in his opinion, was nothing but another form of an announcement. However, he fell ill a short time ago, he explains, and had a lot of time on his hands, so he got to reading Air Adventurers. We must have something. Wally had his mother dig up all the back numbers, just to read Air Adventurers and find out what he had missed. Well, he's in now, signed and delivered, and he's after all the awards he can get.

A future Navy pilot, John Francis Morgan of Palmyra, Mo., has sent in his application for membership. John Francis has enlisted in the Navy and hopes to reach an aviation rating or possibly get in the aviation ordnance division. For that reason he hopes we of Air Trails can present something new in the way of modern machine and anti-aircraft guns. We might add too that Morgan is something of an amateur airplane designer, for he has put about sixty original models on his drawing board.

Another Photographer award goes to Thomas Bamford of Washington, D. C., for a swell shot of an Aeronca LB, the ship he himself some day hopes to own.



# LUCKY DAY

(Continued from page 23)

shaking his head. "Wouldn't you know it'd be Lucky Day?" he said.

"The perfect chance to be the hero," Kennie said. "And I'm inside playing solitaire."

I didn't see Jim again until two-thirty that afternoon. I'd been laughing up my sleeve at what had happened. This would fix Jim up, I figured. But if I'd expected him to be changed, I was wrong.

He came back into the kitchen still looking as if he needed a shot of bicarb of soda.

"I suppose you think it was unlucky to rescue the young heiress," I said, pouring on the sarcasm.

"No, Pete," he said. "That part's O. K. I like Marj. And she—well, we sort of understand each other. It's not that. It's what Cap Richardson told me."

"What?" I asked.

Jim hesitated. "Well, Cap heard about the smash and called me into his office and shook my hand," Jim said. "Then he told me Coastal's been trying to get Marj's uncle to invest a lot of money in the outfit. They want to expand and take in Ocean. They can't do it unless old McInnis loosens up."

I began to see the light.

"Cap asked me to be very nice to Marj," Jim went on. "He wants me to take her out to dinner and things. He figures Marj may be able to influence her uncle. Cap's given me a free hand and an expense account."

I staggered back and sat down. "Holy Nellie!" I said. "And they're paying him to do it."

He still looked like a funeral director. "You don't understand, Pete," he said. "It's swell. Too swell, don't you see? Red in the morning, sailors take warning."

I reached behind me for the meat cleaver.

"And Marj is a society girl," Jim continued, his voice as cheerful as a dirge. "She's always getting written up in the papers. What if the reporters start on me? You know what they're like. They'll dig around and find my record. Then, they'll publish it, tabulate my crack-ups. That'll be the end."

"Maybe you'd better grow a beard," I said.

Well, the reporters didn't pay any attention. And most of the news I got of Jim, I got second-hand. From all accounts he was really going to town with Marj. Cap Richardson had eased up on Jim's flying schedule and Pat and Kennie had to put in extra time.

When Jim was at the airport, so was Marj. When he took a trip out and



Edgar Laughinghouse

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Give your age, full name and address. State which of the following courses you are interested in—Solo Pilot; Private Pilot; Limited Commercial Pilot; Commercial Pilot; Aircraft Sheet Metal; Master Airplane Mechanic; Master Airplane and Engine Mechanic; Airline Technician; Aircraft Design and Construction; Combination Flight-Mechanic.

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**ROOSEVELT AVIATION SCHOOL**  
AT ROOSEVELT FIELD  
MINEOLA, LONG ISLAND, NEW YORK

there was an extra seat, she went along. In between times they flashed around in her white super-roadster. Or Jim gave Marj flying instruction in Cap's private Beechcraft. She was a pretty fair pilot, too, except for the times when she'd get excited and forget which end of the wind sock was which.

Now you'd think any normal guy would've been riding high with all the blue chips coming his way. But when I finally saw Jim he was still moaning. "It's too, too perfect, Pete," he said.

"When I'm with Marj I forget about the jinx. But when I'm away. . . ."

"Mothballs!" I exploded. And then to change the subject I asked him how old McInnis was coming along.

"Fine," Jim said. "Looks like he's sold on Coastal. Cap tells me I'll be made chief pilot if things work out."

I didn't say anything for a minute. I couldn't. Then I said, "Now isn't that too, too bad? You poor jinxed guy."

The next day, Jim gave me the news. Duncan McInnis had signed up.

I let out a whoop. "And you're chief pilot!"

"Not yet," Jim said. "Not until they reorganize. But I doubt whether I'll ever be. All good things come to an end. I have an awful premonition that something bad is about to happen."

And—by golly—that night it did.

Jim took Trip 18 away at seven-thirty. He had a full load and for once Marj didn't go along. But she was there to wave good-by.

Jim checked in and out of Hartsville and Brooker on time. Then he headed across the mountains for Leamington. Gus, from the dispatcher's office, kept me up to date. Oh, sure, I guess I was a little bit worried in spite of myself.

Around eleven-thirty, Gus came run-

ning into the lunchroom. His face was white. "Lucky's in trouble, Pete," he clipped out. "Over the mountains. Storm. Icing up fast. Beacon receiver gone haywire. Radio reception blah. Snow static."

A cup dropped from my hand. I thought of Jim's premonition. I thought of him up there fighting that storm—lost. Then I thought of his luck. "He'll pull through, Gus," I said.

But they didn't hear another word from him all night. I know. I was in the office.

In the morning Cap Richardson put search parties into action. Ships crisscrossed the mountains and all around. A lot of snow had fallen the night before and they didn't pick up a sign of the transport.

I tried not to let on, but I was in a panic. I served a customer clear water for consommé and put garlic in the rice pudding.

Of course, the papers got hold of the news. But the European crisis had taken a sudden twist and grabbed all the headlines. Which was a break in a way.

Marj? She'd come piling out soon as she'd heard. She stayed mostly in the lunchroom and drank cup after cup of black coffee. I talked a blue streak. "Jim will be O. K., Miss McInnis," I said. "His luck will hold." If I said it once, I said it fifty times. And in between, I tried to make myself believe it.

She was calm enough. But if she'd started letting down her back hair, it might've relieved her strain. I guess I didn't give her a chance. I told her all about how lucky Jim had been in the past. Just to bolster her up. And before I knew it I'd given her a neat play-by-play report of Jim's crash record. I didn't realize that until later.



The business of waiting got pretty bad when night came and still no word. Every guy who walked into the lunchroom tried to act cheerful and make some helpful crack.

The news broke at exactly ten o'clock that night. Gus raced in. "They've found him!" he whooped out. "Lucky's O. K. Nobody's even hurt!"

The whole place went loco-wild, and it was five minutes before I could get the dope straight. It went like this.

Lucky Day had pulled another miracle. He'd taken his ship down through that storm and somehow found a small valley in the mountains no bigger than a minute. He'd waltzed the transport in and landed pretty as a picture. Nobody had been banged up. The ship hadn't been damaged except for maybe scraping the wing-tips from the tight fit.

Lucky? Well you answer that.

Jim had stayed with his ship and passengers and sent Hank Tuttle, his co-pilot, and a couple of the men to find a phone. They'd climbed down the mountain and finally reached a ranch house. The call had just come through.

I told Marj all the details. She just looked at me and listened. Then she quietly took my hand and squeezed it. "Pete," she started, and her eyes filled up. The only thing handy was my apron. So I gave it to her.

The news crowded the European situation onto the back page. The papers dragged out the box-car type. Reporters and photographers were thicker than flies around the place. Of course, they grabbed hold of Marj and got her talking. She said plenty about Jim. She gave it full gun and didn't spare the adjectives. She told them how lucky Jim had always been and went into his record.

It was then that I got wise to what I'd done.

But I felt better when I saw the extras. Jim was a hero. Every paper carried glowing stories of Lucky Day. Sure enough they tabulated his string of crashes and slapped it on the front page, but they made it look like an honor list. Cap Richardson was quoted as saying that Coastal was proud of Jim—that he would soon be their chief pilot. Cap meant every word of it, I knew.

And when they finally got Jim and the others back home, there was a big celebration. Marj just threw her arms around Jim and let the camera boys have a field day. She didn't care.

Jim was in a whirl, what with every one either trying to kiss him or shake his hand or get his autograph. And it was quite a little time until he got a glimpse of the extras.

I was near him when he did. I saw him stiffen when he read the front page.

"The jinx," I heard him whisper.

"Jinx, nothing!" I said. "You're a hero. And a damn lucky one, if you ask me."

Jim just looked at me. "This is what I've been waiting for," he said. "You'll see."

"You're all wet, Jim," I said.

But I found out that I was the one.

Three days later the news leaked out that Jim was going to be fired.

I know that's hard to believe—but it's the cold, sober truth. Cap Richardson hadn't done it. It'd been old Moneybags McInnis.

He was now a power in Coastal and he wasn't sitting back with his arms folded. He'd taken one look at the expense sheet *re* Jim's emergency landing and his Scotch soul had writhed.

But the pay-off came when McInnis saw Jim's record. He hit the ceiling. Jim was a liability. Any pilot who'd had that many crashes was bound to be incompetent. Cap fought McInnis tooth and nail, but it hadn't done any good.

Jim hadn't heard. He was out on his first run since the accident—express and mail, no passengers—and he wasn't due in until five that afternoon.

It was four o'clock when the office grapevine brought me the news. It took me between the eyes. Despite his premonition, I knew it would hit Jim hard, too. There was only one way to soften the blow. I grabbed a phone. I finally located Marj at a friend's house way over in Scarboro. I spilled everything. "Jim's due at five," I said. "Drive here as fast as you can. He's going to need you."

But when I hung up I knew that no matter how fast she drove, she'd never make it.

I guess I paced the lunchroom a hundred times. And with every breath I blasted Duncan McInnis to hell and back. I'd just thought up some new words when who should walk in but old Moneybags.

He sat down and ordered coffee and I had to hold myself from putting rat poison in his cup. While he sipped the stuff I just stood there and glared. Finally, I let go, job or no job.

What I didn't tell that old bird would fit into the eye of a needle. Didn't he know that Jim was one of the smartest pilots ever made? Couldn't he see that any other guy would've washed out the transport and killed everybody? That and a lot more. I was surprised how logical I made it sound. And I'll have to say this for him, he took it. He got a little red, but he listened.

When it was all over, what do you think old Moneybags said? "Senior Pilot Day has been lucky to have gone as long as he has."

"Luck," I said, "is another word for fast thinking."

It was then that I heard the roar of motors overhead. I shot a look at the clock. It was five. I raced out.

It'd been drizzling all afternoon, but now the clouds had really started to empty themselves. I stood down at the end of the marquee and waited. There were a couple of others there and then McInnis came along. I kept my back to him. It was raining so hard you couldn't see a thing. They'd started testing some motors over in the shop and the sound drowned out everything else.

I strained my eyes across the field. I thought I saw Jim's ship coasting down low over the south boundary. Then I was sure of it. His wheels had almost touched. He was coming in fast on Number 2 runway.

Suddenly McInnis yelled something and pointed. I looked and almost died. A small cabin plane was racing in from the north—coming down Number 2 runway—landing *down-wind*!

I knew who it was. It couldn't be anyone else!

I guess I'll always remember those next two minutes. And I guess Duncan McInnis will, too. Jim's transport was on the runway, racing along it, heading north. The small cabin job's wheels had just touched. It was streaking south on the same strip of concrete, its speed held up by the tail wind.

You'll remember I mentioned a little bit about Jim's luck?

Well, listen.

We stood there, frozen, waiting for the collision. Suddenly, I saw the transport veer sharply to the left. It plunged off the runway. It lurched, staggered. The left wing dropped. There was a crash. The transport heaved up on her nose, then fell back.

In that second the cabin plane went streaking past down the runway—clear.

We got Jim into the administration building. He'd been knocked groggy. But he was coming around.

I saw old Moneybags talking to Marj. Yeah, it'd been Marj all right in the cabin job. Soon as she'd got my message she'd grabbed a plane and come fast. She hadn't bothered about a landing clearance or the direction of the wind—or anything.

When Jim opened his eyes Marj was right beside him. He put his arm around her. "I knew it was you," he said.

Then old Moneybags stepped up.

"My boy," he said. "You'll never be fired from Coastal. I didn't realize what a smart pilot you are. What a fast thinker."

Jim looked a little startled. "Oh, I'm just—" He hesitated.

"Lucky," I finished up for him.



## LIGHT PLANES

(Continued from page 31)

And only 217 American planes, comparatively speaking, to stop them.

But wait. There's more. Another force of the Black Entente convoyed by two aircraft carriers, four battleships and about thirty cruisers and destroyers, and ten cargo vessels carrying deck-loads of knocked-down two-engined bombers, is also on its way with 222 more enemy planes.

So what?

If the Army Air Corps can muster only a handful of planes from half of the country, someone had better start putting up flying clubs everywhere. Not that Gilbert Goggle in a Piper Cub equipped with a mosquito gun could do much about the Black Entente, but a lot of Gilbert Goggles, with light plane flying training under their belts, could soon be rammed through a short and intensive course of military training. The Gilbert Goggles of the flying clubs could be instructed in the use of a machine gun within a few hours and stuck in the back seat of a Northrop or a Vultee. They might even find room for a few aboard the "secret list" Flying Fortresses and in the turrets of the Douglas B-18's.

But, you might ask, what does all this have to do with obtaining more planes? What can Gilbert Goggle do about that?

He can't do a thing about it, but since there are approximately 10,450 planes in the United States—of various categories and types—it should be quite obvious that in an emergency a lot of light plane pilots will be grabbed off to "do their bit." At present there are supposed to be 16,344 pilots of all classes in the United States. Within six weeks after the outbreak of war, more than one-third of these will be out of action for various reasons. And soon the Gilbert Goggles will be called upon to help carry the burden of national defense.

You laugh? All right, go back and look at history of not more than twenty-five years ago when "green" youngsters were flying Farman biplanes to glory on the Western Front. It's not the captains who win wars. They just open the game. The Gilbert Goggle substitutes are the birds who go in and finish them.

Of course we need flying clubs. Tell me one good reason why we don't and I'll concede the battle and take up marble contests.

To make progress we must get over the attitude expressed by comparing aviation with the automobile business. We must stop trying to rate the number of pilots with the number of automobile drivers and the number of planes with

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the number of cars. A man buys an automobile to take him from one place to another, or to transport his goods from one place to another. He is not important to the industry except as a consumer of its products.

When a man buys a light plane and learns to fly it, he becomes part of aviation. He is a potential military pilot. He may, since he has shown such intense interest in flying, become a designer, an operator, a manufacturer or a national executive in aviation.

Yes, we must have more flying clubs, if we are to keep American planes in the air. We must have flying clubs if we are to continue constructive interest in commercial aviation. We must have flying clubs if we are to teach the average man to fly.

### FLYING CLUB NEWS

American doctors interested in flying might be surprised to know that Australia maintains five flying-doctor bases at a cost of something like \$100,000 a year. Of this amount \$5,000 comes from the H. V. McKay charitable trust, the Federal Government gives a subsidy of \$25,000, and funds derived from patients and other sources amount to about \$60,000.

Canada is now spending \$75,000 a year on its flying clubs, of which there

are twenty-three. The Honorable C. D. Howe, Minister of Transport, at the recent dinner of the Canadian Flying Clubs Association, congratulated the members for the manner in which they are acquiring their experience and skill in club flying, but intimated that future requirements would demand a more intensive form of training.

It has been pointed out that although trophies, medals, shields, plaques and other forms of recognition are everyday occurrences in military and commercial aviation, there is nothing similar to encourage the light plane enthusiast in this country. In Canada a medal is awarded annually to the pilot who, in the opinion of a representative committee, has done the most for private flying. It may be awarded for the number of hours flown, for a particular flight, for the efficient management of a club, or for the production of a system or device that in any way improves private aviation.

Here's a real chance for one of our light-plane manufacturers to come through with a bang.

One of the most progressive private flying organizations in this country is the Private Flyers Association of America, which has its headquarters at 41 West 10th Street, Eugene, Oregon.



We earnestly recommend anyone owning a ship who is looking for a good organization to join, or those especially interested in the laws governing light plane flying, to contact Yale E. Smith, president of the association.

The organization currently has representatives in seven states, and puts out a regular publication known as the "Fly Paper." Much of the material published appears to be interesting and generally constructive criticism of the laws of the Bureau of Air Commerce as they relate to the light plane flyer.

The Menasco Manufacturing Co. has received a large order from the Rearwin Aircraft Co. of Kansas for their 50's, and one wonders if they are to replace the 90 h.p. Scarabs that have been installed in the Sportster.

The Bennett Air Service of Hightstown, New Jersey, is offering a complete training course and a new 1938 Cub plane for \$1,688. You can get it for as little as \$560 down, or two partners can work on the same plan for \$994 each—\$330 cash and the balance monthly. According to Al Bennett you can earn \$200 a week doing instruction, sales, passenger-hopping and servicing.

In order to meet the increasing demand for more power, a point we brought up in this column some time ago, the Aeronautical Corporation of America is now developing an Aeronca "45" engine which will weigh 125 pounds. It has a 4½ inch bore and a stroke of 4 inches. It will consume 3 gallons of 73 octane fuel per hour at cruising speed and 3½ at full throttle. The new series will be turned out with three different outputs. The power will range from 40 to 45 h.p.

## FEDERAL APPROVAL OF DOMESTIC-BUILT AIRCRAFT

Innumerable private pilots prefer to construct their own airplanes rather than purchase them directly from some commercial firm. The reasons for this are quite obvious. First, there seems to be immense satisfaction in building one's own light plane; and secondly, there is a considerable pecuniary gain realized. Almost invariably an ecstatic feeling of self-confidence is experienced when one says, "I built this," rather than, "I bought it." But the Department of Air Commerce, in an effort to safeguard the rights of others, and at the same time save the necks of novice designers and craftsmen, has established specific regulations regarding home construction.

According to federal regulations only aircraft operating between states are required to obtain certificates. Other aircraft may apply, however, and if

they meet the established requirements, they are granted proper certification. In many states, statutory law prohibits all airplanes not federally certified from operating within their boundaries.

The airworthiness requirements stipulated in the Civil Air Regulations which were enacted November 1st, 1937, are as follows: (a) application, by the original designer, for approval of his airplane for home construction; (b) the submission of exact technical data, including drawings and stress analysis; (c) if the design has received previously an aircraft specification, it is only necessary to offer the drawings and instructions which are to be used by the home builder or the manufacturer of an assembly kit; (d) a completely assembled airplane, built in accordance with the submitted data, and previous to covering, must be inspected by the proper official in the locality of its construction.

The airplane may be covered after it has satisfactorily completed the initial inspection and the required static tests; after which it is subject to final engineering inspection and a flight test is authorized. Ultimately, the design is either endorsed as airworthy by receiving an aircraft specification, or it is rejected because of structural defects. "The aircraft specification specifies the extent to which home building is approved for the particular model and makes all such models eligible for a commercial license, subject to compliance with certain inspection procedure."

The first regulation, application for approval, should state specifically the extent that home fabrication is to be carried out, whether it is to be an assembly of the important structural components included in a prefabricated assembly kit, whether the actual building of the structure is to be from previously cut parts supplied as a construction kit, or whether the home builder is to construct the complete airplane from approved drawings.

The drawings and instructions which are to be supplied to the builder or construction kit manufacturer must compose a complete and regular file drawn with strict adherence to technical details. This file is then submitted for inspection. These drawings must be so complete as to embody definite and extensive information related to exact material specifications, right shop practices, and directions necessary for correct fabrication by the builder.

All drawings pertaining to primary structural parts which call for construction processes necessitating special training (for instance, welding), should stipulate that such processes shall be completed by qualified technicians. The qualifications of the individuals are to be determined by the Bureau accord-

ing to the nature of the fabrication. And in particular instances it is deemed necessary that such qualifications be demonstrated before a Bureau representative and receive his approval.

With allusion to the third regulation, even a slight infraction of the original design may require additional investigation, in the nature of stress analysis or static tests.

The file of drawings and instructions submitted are inspected by the airworthiness section. This examination determines whether the design conforms with the airworthiness requirements, and whether the drawings and details of construction for home assembly are suitable or not. Of course the extent to which prefabrication is to be used in the construction of the airplane, is taken into consideration.

"When the kits are to be partially prefabricated, the manufacturer of such kits demonstrates, through a factory inspection, that he possesses the facilities necessary to insure the production of kits of exact similarity and in exact agreement with the approved drawings. (This corresponds to the requirements for a production certificate for a complete airplane.)"

The home builder is compelled to construct his airplane with strict adherence to the approved drawings. If he is using a construction kit, he is required to use the prefabricated parts and materials supplied therein. When the first request for inspection is made to the Bureau, an affidavit to this effect must be submitted.

Deviations from approved drawings, or substitutions of parts supplied in a kit, are considered as material alterations; thus substantiating technical data is offered to warrant such changes. After the airplane has been completely constructed, previous to covering operations, the local Bureau of Air Commerce representative is summoned and requested to inspect the airplane.

This official looks over craftsmanship, materials, and conformity to construction details. It is possible that this inspection may call for one or more proof tests. If so, the tests will have been approved or disapproved, as the case may be, upon the first inspection of the construction data. In the event that proof tests are required, a statement to that effect will be definitely stipulated in the instructions supplied to the home builder. A second inspection is performed after the covering operations have been completed.

The airplane is eligible for certification as to airworthiness, only after the satisfactory termination of these inspections, and after the completion of a test flight by a commercial pilot in the presence of an Air Commerce representative.



# AIR PROGRESS

(Continued from page 6)

## AIR FORCES

The war games planned by the General Headquarters Air Force in the defense of the Northeastern States provided some startling and interesting features. In the first place they proved that the G. H. Q. air force as an independent unit was quite capable of directing its own affairs without the assistance of the Army or the Navy. And to many the games indicated that a unified air service may yet be attempted in the United States.

The war games also disclosed that the pursuit squadrons are not as yet ready for night engagements, for all pursuit flying was called off "because it was considered too dangerous," and in addition few airports along the East Coast were large or long enough to accommodate the giant Boeing bombers.

All the publicity given to the British Air Ministry commission which visited this country a short time ago, presumably to place large orders for American fighting planes, has gone up in smoke. The Commission left without purchasing one plane, after a thorough inspection of the plants. It was explained that while some American planes were considered, the firms manufacturing them could not turn them out fast enough for the British demands. The actual facts of the case were that the Commission had no authority for purchasing any planes or even placing orders. They came here mainly to observe and to return to Britain to make a full report on general conditions.

British experts commenting on the matter were of the opinion that Britain would do better purchasing Italian planes, which in a great many instances use British engines. Had a great number of American planes been purchased it would have taken fully six months to train crews in the servicing of unfamiliar engines.

The Canadian National Steel Car Corporation has been awarded manufacturing licenses on the Westland Lysander, Army Cooperation plane. They will be made in great numbers for the Canadian government.

We are now able to state that air cannons are being considered as regular equipment on U. S. Navy Sikorsky and Consolidated flying boats. It is understood that the weapons will be produced by the American Armament Corporation. They will be 37mm. guns. The "cannon" to be mounted in the Bell Airacuda have not as yet been decided upon, but it is believed that a smaller caliber weapon, manufactured by the same company, will eventually be installed. The guns shown in the first

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2x2x1 .....2c  
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**ALUM. TUBING**  
1/16, 3/32, 1/8  
3/16 or 1/2, ft. 10c  
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All col., doz. 19c  
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**GAS MODEL**  
Silk, sq. yard 45  
**CLEAR DOPE**  
OR THINNER  
5c per oz.; large  
bottle, 8c; 1/2 pt.  
30c; 1 pt. 45c  
**COLOR DOPE**  
5c per oz.; large  
bottle, 10c  
**CLEARCEMENT**  
5c per oz.; large  
bottle, 8c; 1/2 pt.  
35c; 1 pt. 55c  
**PROPELLERS**  
Balsa Paul-O  
Mach. Cut Wina  
5" 4c 10c  
6" 5c 15c  
7" 6c 20c  
8" 7c 25c  
9" 8c 30c  
10" 8c 35c  
12" 10c 45c  
14" 13c 55c  
15" 15c 60c  
**RUBBER**  
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**SANDPAPER**  
Doz. sheets 5c

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3/4 .02 .04 .05  
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1 1/2 .07 .10 .15  
1 3/4 .15 .30  
**WASHERS**  
1 doz. 1/4 or 1/2 1c  
1 doz. 3/4 10c  
**THRUST, dz.**  
8m. 10c; 18c. 15c  
**PROP. BLOCKS**  
1/2x 3/4x 5 6-5c  
1/2x 3/4x 6 6-5c  
3/4x1 x 7 4-5c  
3/4x1 x 8 3-5c  
3/4x1 1/2x10 3c ea.  
3/4x1 1/2x12 3c ea.  
1 x1 1/2x12 4c ea.  
1 x1 1/2x15 7c ea.  
**BUSHINGS**  
1/16 .0004x5x1 1/4  
2 sheets 3c  
100s in. 6x6 5c  
100 in. 6x6 6c  
100 in. 6x8 8c  
1/32 in. 6x6 15c  
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24 and stripes 5c

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1/2x1/2 per ft. 15c  
3/4x3/4 per ft. 22c  
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1/2x1/2 ft. 25c

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1/2x1/2 30 for 20c  
3/4x3/4 12 for 20c  
1/2x1/2 10 for 20c  
3/16x3/16 8 for 20c  
3/4x1/2 6 for 20c  
1/2x1/2 3 for 20c  
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pictures of the Airacuda were only wooden dummies.

According to an announcement made by the French Air Ministry, 100 American military planes have been purchased to help build up the lagging French Air Service. Of the 167 machines ordered for 1937, only 87 were completed in that year. French production seems to be held up by the slow movement in the engine factories.

Russia is now building a great number of Vultee V-11's and will start making French Potez-63 bomber-fighters under license. Their building program also includes the manufacture of the French Hanriot 220, the American Boeing YB-17, and the Curtiss A-18 attack ship.

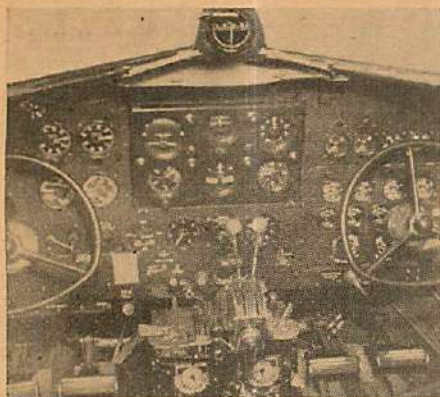
At last some official figures are available on the British Hawker Hurricane as the result of one being placed on public view at the Glasgow Exhibition. According to the details of performance, etc., on the trade plate, its actual top speed is 360 m.p.h., while it lands at 60. The most amazing feature of this sudden "revelation" is contained in the explanation that the Hurricane carries eight fixed Browning guns set in the wings.

The Army Air Corps is seriously considering the autogyro as a war weapon. A group of officers and non-commissioned men gathered at Paterson Field, Fairfield, Ohio, according to the Air Corps News Letter, to take a special course in maintenance and training. It is understood that complete research will be made in the possibility of using the autogyro for artillery observation.

The Fifth Composite Group of Luke Field has had its name changed to the Fifth Bombardment Group. The 75th Service Squadron has been redesignated as the Base Headquarters and 18th Air Base Squadron. It is located at Wheeler Field.

The traveling examining board of the Air Corps, which has been visiting colleges and universities all over the country, has discovered that only one out of five candidates able to pass the educational requirements can get by the physical examination. Traveling in two BT-9's, the board covered about 5,150 miles, examined 746 applicants, out of which only 165 were found qualified and recommended. Of those turned down 48 per cent had eye defects, 35 per cent failed because of defective vascular systems, and the remaining 17 per cent





Panel of a modern transport.

failed because of defective teeth, weight, history, etc.

Aboard one of the Boeing Flying Fortresses engaged in the recent war games along the East Coast was a full set of golf clubs, a tennis racket and a set of civilian clothes, owned by a member of the crew, who decided that the cabin of the bomber was the safest place to store his personal gear. The bomber in question was the one that flew 500 miles out to sea and spotted the liner *Rex*.

#### MISCELLANEOUS

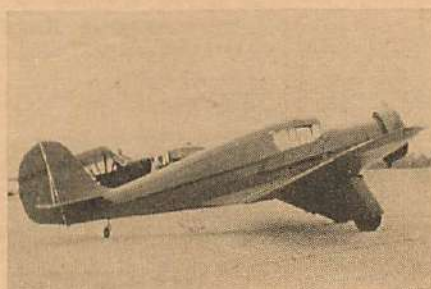
The mystery of a plane which used "sky hooks" and apparently hung motionless over Parsons, Kansas, for a period of forty-five minutes, has been solved. Glen McConnell, the pilot, explained that he was flying a light plane when he encountered a 65-mile-an-hour headwind at 1,500 feet. Throttling the engine down to an equal speed, he had simply sat up there enjoying the scenery.

Twenty-seven undergraduates of Princeton University have formed a flying club and will apply for membership in the National Intercollegiate Flying Club. They plan to get university permission to compete in intercollegiate flying meets and purchase planes of their own.

Two million dollars will be spent on developing an airport and providing

suitable defenses for the Midway Island trans-Pacific station. Both the Army and Navy will cooperate in the work, which will take about two years to complete.

Members of the Waldeck Expedition which arrived at Georgetown, British Guiana, a short time ago, brought out convincing evidence that Paul Redfern, American flyer who has been missing since 1927 when he attempted a non-stop flight from U. S. A. to Rio de Janeiro, died in a crash somewhere in the jungles up the river from Georgetown. Articles of his wearing apparel were brought back and accurate details of the crash were obtained from conversations with the natives.



The Aeronca LC.

The suggestion that Britain and France pool their air forces in case of war in Europe has brought a torrent of denunciation from ex-service men in Britain. "The French made a bad enough mess of the last war," they argue, "and we're not going to let them make us the goats in the next."

What almost turned out to be a tragedy was fortunately restrained to a routine flight with a touch of adventure when Lieutenants R. Antrim, C. Werts, J. McCormick and Ensign Rice set off recently from Lakehurst in a Navy spherical balloon. They were caught in a severe storm near Schenectady and eventually forced down in the Tug Hill woods near Lowville, N. Y. Picking their way out of a swamp, they sat down to dry their clothes and figure out their position. After some hours they found the bed of an abandoned

railroad and trudged twenty miles and finally reached help at Houseville. When medical attention arrived all were found to be suffering from exposure and exhaustion.

Lincoln Ellsworth, American explorer, will start on his fourth trip into the Antarctic on August 13th. He will attempt a 2,000-mile flight across the South Pole from Enderby Land to Little America. He will use a Northrop Delta and will attempt to map the section known as the Enderby Quadrant.

Romeo Vachon, veteran Canadian airman, has been awarded the McKee Trophy for his work in developing the commercial air services along the north shore of the St. Lawrence River. The McKee trophy is Canada's most important aviation award. Vachon is forty years of age.

The British motorship *Greystone Castle* recently left San Pedro for Hong Kong with \$900,000 worth of American military planes headed for the Chinese Air Force.

The House has passed the Lea Bill, under which a three-man authority would be created and have jurisdiction over all civil aviation. The members will be appointed by the President subject to the approval of the Senate.

Eight U. S. Air Service officers have been assigned as technical instructors to the Argentine Air Corps. They will assist in the development of the Argentine forces, which are now using hundreds of American-built planes.



Curtiss Attack Ships.

## SPECIAL ANNOUNCEMENT OF INTEREST TO PROSPECTIVE AVIATION STUDENTS.

The September issue of *Air Trails* will be the Annual School Issue containing information regarding approved schools, available courses, prices, and requirements. Don't miss it!



# THE DIESEL IN AVIATION

(Continued from page 29)

tremendously, as the Diesel automatically creates its own heat by compression for igniting the fuel, and the magneto, spark plugs and wiring of the gasoline engine are unnecessary.

In the four-cycle Diesel engine, as the piston goes down on its suction stroke, clean air fills the cylinder. Then, on the up-stroke, this air is compressed into such a small space between the top of the piston and the cylinder head that its temperature rises to what may be called "red heat." When the fuel is injected just before the piston reaches top dead center, it is immediately ignited by this highly heated air and the gases expand, forcing the piston down on its power stroke. On the up-stroke of the piston, the exhaust gases are expelled through the exhaust valves. The reason the air gets so hot, is that it is compressed to about one-sixteenth part of the volume it originally occupied when the piston was at the bottom of its stroke. This causes its pressure to rise to about 500 pounds per square inch, and its temperature to rise to about 1000° F. In the gasoline engine, the gasoline-and-air mixture is only compressed to about one-sixth of its original volume, for if higher compression were used, the air would heat up and pre-ignite the mixture. The Diesel thus has a compression ratio of 16 to 1, compared with 6 to 1 for the gasoline engine.

The sequence of operations in the four-cycle Diesel is:

1. Intake of air on the down (or suction) stroke.
2. Compression of air and injection of fuel on the up (or compression) stroke.
3. Ignition and expansion of the gases on the down (or power) stroke.
4. Exhaust of burnt gases on the up (or exhaust) stroke.

The four-cycle principle works out quite well in practice—so much so, in fact, that it is used for almost all gasoline engines today. It has its limitations, however, where high-power output and high efficiency are concerned. If an engine has only one power stroke for every two revolutions of the crankshaft, it stands to reason that the pistons are unproductive three-quarters of the time. Not only that, but since they have to be driven by the crankshaft, they absorb power from the engine. An engine with more frequent power impulses and less lost motion is naturally more efficient, and is to be preferred for aviation. That is where the two-cycle engine comes in, with its power stroke for each revolution of the crankshaft.

In a two-cycle engine, things are hap-

pening twice as fast as in a four-cycle engine. Each downward stroke of the piston is a power stroke, and each upward stroke is a compression stroke. There are no separate intake and exhaust strokes, as in the four-cycle engine. The problem, therefore, is to design the engine so that exhaust and scavenging take place in the brief period of time that the piston is near the bottom of its stroke. Small gasoline engines, such as are used for motor-cycles and motorboats, run quite well on the two-cycle principle. To do so, however, they have to partially compress the mixture in the crankcase before admitting it to the cylinder. They use a piston with a "deflector" head which separates the exhaust gases rushing out through the exhaust port, from the incoming mixture entering from a port on the opposite side of the cylinder. Naturally, scavenging is far from complete and pollution of the mixture is bound to occur, but these little engines run at quite high speed and so develop sufficient power for their needs despite their relatively high fuel consumption.

A high-powered, multi-cylinder gasoline engine cannot operate on the two-cycle principle, as crankcase compression is out of the question and its efficiency would be impaired by incomplete scavenging. Compressing the mixture with special pumps and then admitting it to the cylinders is possible, but it would be a most cumbersome and inefficient arrangement. There would still be the difficulty of scavenging the cylinder, for if air were used for this purpose, it would upset the correct gasoline-to-air ratio of the incoming mixture upon which the successful operation of the gasoline engine depends. Air scavenging presents no problem for the Diesel, however, as there is only air in the cylinder prior to the moment of fuel injection. Thus the airplane Diesel has the tremendous advantage of being able to operate on the more efficient two-cycle principle, which is denied to the gasoline engine.

The sequence of operations in the two-cycle Diesel is:

1. Ignition, expansion, exhaust and scavenging on the down (or power) stroke.
2. Compression of air and injection of fuel on the up (or compression) stroke.

The fuel pump is aptly called "the heart of the Diesel." Its function is to meter and deliver to the fuel injector exactly the right amount of fuel at exactly the right time at a pressure greater than that of the air compressed inside the cylinder. The fuel injection

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1/16x3/16 35 for 5c	1/4 .03 .05 .07	.045 ..... 30 ft. 5c
1/16x3/16 18, 5c	1/4 .04 .07 .10	1/16 sq., 18 ft. 5c
1/16x3/4 15 for 5c	1/4 .06 .09 .16	3/16 flat 12 ft. 5c
1/16x3/4 5 for 5c	3/4 .12 .30	1/4 flat 18 ft. 5c
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3/32x3/4 30 for 5c	Balsa Paul-O	Plastic Balsa
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3/32x3/4 10 for 5c	5" 3c 10c	streamlining, etc.
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3/32x3/4 6 for 5c	8" 7c 25c	DUMMY RAD.
3/32x3/4 3 for 5c	9" 8c 30c	ENGINE (Celu.)
3/32x3/4 2 for 5c	10" 8c 35c	1 1/2" dia. .... 15c
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1/16x2, 4 for 5c	Fine TISSUE AA	BEARINGS
3/32x2, 7 for 10c	All col., doz. 19c	1/2 Doz. Small 4c
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1/4x 1/4x 6 6-5c	Wood Veneer	2x18 ..... 2 for 3c
1/4x1 1/2 7 4-5c	20x30" .1 for 15c	3/16x18 ..... 2 for 5c
1/4x1 1/2 8 3-5c	2 for ..... 17c	WIRE
1/4x1 1/2 10 2-5c	11 in. BAMBOO	6-8-10-12-14
1/4x1 1/2 12 3c ea.	1/16x3/4 6 for 5c	..... 2 ft. 1c
1/4x1 1/2 12 6c ea.	Shredded wh. 5c	NOSE PLUGS.
1/4x1 1/2 15 7c ea.	REED	1/2" ..... 1 doz. 5c
NOSE BLOCKS	1/32, 1/16"	1" ..... 1 doz. 10c
1x1x1 ..... 1c	1/4 in. .... 3 ft. 1c	INSIGNIA
2x2x1 ..... 1c	Clear CEMENT	24 and stripes 5c
2x2 1/2x1 ..... 3c	1 oz. .... 5c	Model Pins pkg. 5c
3x3x1 ..... 5c	1/2 pt. .... 27c	PROP. SHAFTS
3x3x2 ..... 8c	DOPE Clear	2" ..... for 1c
3x3x2 ..... 10c	1 oz. 5c 1/2 pt. 30c	SANDPAPER
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system used on airplane Diesels usually consists of an individual cam-operated pump for each cylinder, connected by high-pressure tubing to a fuel injector screwed into the cylinder. Very often, two pumps and two injectors are used for each cylinder, either of which is capable of supplying sufficient fuel should one of them fail.

Another system is to use multi-unit pumps, gear-driven from the engine. In this case, three or more pump units are built into the one casing and are actuated by a small camshaft, each unit being connected to its fuel injector as in the case of the individual pump. This works quite well on aircraft Diesels operating at speeds below 1800 r.p.m., but for the really high-speed engine, which may run up to speeds of 3000 r.p.m., the individual pump system is essential. Fuel injection pressures range as high as 8800 lbs. per square inch on some engines, so the shorter the connection between the pump and the injector, the less will fuel surge back and forth in the fuel line between injections. When the Junkers Jumo 205-D Diesel is running at its maximum speed of 2600 r.p.m., more than 43 fuel injections take place in each cylinder *each second*—that is to say, a fuel injection takes place every 0.023 part of a second!

The operation of a two-cycle airplane Diesel is not particularly complicated, as will be seen from the cut-away view of the Junkers Jumo 205 Diesel. This particular engine has six vertical cylinders, with two pistons in each cylinder

connected to crankshafts at the top and bottom of the crankcase. The combustion chamber is the space between the piston heads when the pistons are at the top of their stroke. Fuel is injected from pumps and injectors arranged along both sides of the cylinders, and is ignited by the air compressed at high temperature between the piston heads. As the gases expand, they force the pistons apart on their power strokes. The upper piston has a 9-degree "lead" over the lower one and when it nears the bottom of its stroke, it uncovers the exhaust ports in the cylinder wall and the exhaust gases rush out. A fraction of a second later, the lower piston uncovers the inlet ports and in rushes a blast of cold air from the blower to scavenge the cylinder. As the pistons come together again, they cover both sets of ports and then compress the clean air in the cylinder ready for the next fuel injection and power stroke.

The Junkers Jumo 205 represents the latest development of the airplane Diesel. It is an extremely compact, well-balanced engine with a bore and stroke of 4.13 inches and 6.30 inches respectively, which give it a displacement of 1014 cubic inches. The Jumo 205-C model, which is used extensively on twin-engined airliners and flying boats in Germany, and on the Deutsche Lufthansa air lines, is rated at 600 h.p. at 2200 r.p.m., and weighs 1140 pounds, or 1.90 pounds per h.p. Another model, the Jumo 205-D, has a rating of 700 h.p. at 2600 r.p.m., with 575 h.p. available

for cruising. Gear-driven blowers or superchargers maintain the rated power of these engines up to an operating altitude of 8000 feet, after which their power falls off in a manner comparable to the gasoline engine. Their fuel consumption is remarkably low, being only 0.36 pounds per h.p. per hour, while their frontal area is only 6½ square feet.

Thus, the most powerful airplane Diesel in production is one of 700 h.p. This is too small for the large planes now coming into use, of course, but the Jumo 206 of 1000 to 1200 h.p. has now been completed and is undergoing its trials in Germany. For the 100-passenger type of airliner envisioned by Capt. Rickenbacker, there is already a 2000 h.p. Diesel under development at the Junkers factory at Dessau. This 2000 h.p. engine will be remarkable for its compactness, and is expected to weigh about 1 pound per h.p. So, you see, Diesel airplane engine development abroad is well up to par, and will probably be ahead of gasoline engine development in the United States within the next two years. If that happens, it will be a calamity—but what can we expect if we continue our present policy of concentrating every effort on the gasoline engine and neglecting to develop the up-to-date Diesel?

*(The second part of this article, to appear next month, will be entitled "The Diesel in the Air." It will describe the remarkable flights of Diesel-engined planes, and will explain the advantages of the Diesel for aviation.)*

## APPLYING RADIO CONTROL

*(Continued from page 63)*

arise, and that they can be cured; and, moreover, that they *must* be cured before a radio-control system can be said to be even remotely successful. To repeat: Reliability is the important thing. It must be the first goal. To date, this fault has been much evident.

But to get back to practical matters. Fig. 3 shows successful circuits that have been made to work. With suitable care in selection of parts, they can be made to weigh—complete with escapement—under 3 pounds. A minimum weight of 2 pounds is not impossible. This should be permissible for even the smaller gas jobs.

In the search for reliability the circuit of Fig. 3C, despite its comparative complexity, has been found worthwhile. The use of a separate quench oscillator tube simplifies the problem of filtering or balancing out the quench voltage, at the same time providing more stable operating conditions. The balance of the circuit is unchanged from Fig. 3B. A direct-coupled audio circuit has been tried, but although sensitive it was

found to be extremely critical to quench influence.

The decision as to which circuit should be used rests largely on the space and weight-carrying ability available. The more radio gear—and batteries—that can be packed into any given installation, the better its probable performance will be.

That, of course, reintroduces the question of weight. Frankly, we attach little importance to it—perhaps too little. The ship in which the installation pictured is used is a sailplane of 18-foot span, easily capable of carrying 10 pounds without exceeding a reasonable flying speed. Four pounds (with heavy batteries) of radio gear is about the minimum that will balance the center of gravity properly, so why use less? And even a 6-foot gas job will carry 3 or 4 pounds without much difficulty. So nothing essential has been spared; the escapement mechanism, for example, is very heavily constructed (again for reliability!) on a rugged aluminum plate, with drill-steel studs set in a

sheet-steel disc, with conical bronze bearings and all the rest. (A beautiful mechanical job, by the way, it is the work of Chauncey T. Mitchell.)

But weight can be pared, if necessary. An escapement weighing only ounces can be made, using thin sheet brass carefully braced and trussed. Lightweight batteries such as are used on meteorological balloons are in order, although it should be remembered that the smaller batteries have higher internal resistance, which often changes the operation of the receiver completely. Bases can be removed from tubes, and so on, ounces pared here and there, until you've gotten down to a pound or two and a little Elf will lift it like a feather. Oh, yes, there's plenty of room for messin' around!

Here are some odds and ends of information that may help to fill out the picture.

Insofar as possible, follow a straight-through plan with the layout. Double-back circuits or leads augment the quench leakage difficulty. The photographs show a satisfactory layout. This receiver was built on an aluminum chassis, in an attempt to maintain a more or less equal ground potential.



Lacking sufficient mechanical strength in itself, it is mounted on a spruce platform in the ship and bolted at several points, to insure rigidity.

Originally the tuned circuit was housed in an aluminum can (National PB-10). This was later removed to enable access for adjustment, but it is still believed a good idea. It serves to eliminate body capacity as well as reaction on tuning by battery leads and other loose wires, not to mention the effect of moving rudder cables running near the antenna.

The antenna, by the way, is just a yard or so of wire run along the fuselage. If the tuned circuit is not shielded no antenna may be necessary.

The audio transformer shown in the picture is rather out of place. It is a special lightweight item—UTC A-12—the only attempt at real weight economy in the whole assembly. Considering that its cost is \$9, an ordinary 79-cent midget transformer (weighing 8 ounces as against 5), would have been more appropriate.

Thin brass wire makes the best control cables. Any kind of cord stretches too much. But wire won't travel around pulleys without friction; fish line or radio dial cord, spliced into the wire, meets that problem.

The proportion of fin to rudder area is a wide variable depending on the design of the ship. It can be compensated by varying the rudder arc, of course—although too much arc means undue drag and strain on the control system. About 25% of the total area seems an average; but up to 40% may not be too much in a slow flyer.

Eight strands of  $\frac{3}{16}$ -inch brown rubber are used to drive the rudder in the large sailplane. Six strands have been found sufficient on smaller ships with lighter mechanisms. It should be re-

membered that in flight the air pressure on the rudder is high.

All gear should be mounted solidly in the ship. "Shock" or flexible suspensions are out; the landing plunge invariably causes havoc. Outside of actual crashes, most structural trouble comes from insecure fastenings.

Microphonic tubes occasionally bother, the slight shock of the electromagnet operating the escapement causing a second pulse which adds a second control cycle. Selection of stable tubes seems the only solution.

A separate set of heavy-duty batteries, with interchangeable plug-and-socket connections, for ground testing, is an obvious aid in extending the life of tiny batteries. The secret of long battery life is intermittent use for very short periods.

Preliminary testing of a receiver is best accomplished by listening to a harmonic of a modulated signal generator, using a pair of headphones clipped across the relay coil terminals. This provides a weak signal, enabling adjustment for maximum sensitivity, and also enables a direct frequency check.

The actual transmitter for control use can be anything capable of being "keyed" in the 56-60 mc. amateur band. Typical rigs which have been used employed 45's or 10's in push-pull as tuned-grid tuned-plate oscillators, and a 6L6 electron-coupled oscillator driving a single 6L6 amplifier. Literally, almost anything will do. For mobile operation the usual Genemotor or Vibrapack supplies are ideal; power capability in excess of 20 or 30 watts is pointless.

If the receiving antenna (if used) is mounted horizontally within the fuselage, the transmitting antenna should be horizontal as well; polarization conflict may be apparent if the ship gets any distance away.

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## THE COMET

(Continued from page 66)

### MATERIAL REQUIRED

(Balsa unless otherwise noted)

#### Fuselage

- 10  $\frac{1}{16} \times \frac{1}{16} \times 15\frac{1}{4}$ " (hard grade) fuselage longerons, struts
- 1  $\frac{9}{16} \times \frac{5}{8} \times 11\frac{1}{16}$ " nose block
- 1  $\frac{1}{16} \times \frac{7}{16} \times \frac{9}{16}$ " nose block
- 1  $\frac{1}{8} \times \frac{3}{4} \times \frac{5}{8}$ " tail plug
- 1  $\frac{1}{16} \times \frac{1}{2} \times \frac{5}{8}$ " tail plug
- 1  $\frac{1}{16} \times \frac{3}{4} \times \frac{5}{8}$ " tail plug
- 1  $\frac{1}{16} \times 1 \times 12$ " front and rear, fuselage fillets
- 1  $\frac{1}{16}$ "-diam. wire, 8" length, landing gear
- 1  $\frac{1}{8} \times \frac{1}{2} \times 1$ " pine wheels
- 1  $\frac{1}{2} \times \frac{5}{8} \times \frac{3}{4}$ " pine propeller block
- 3  $\frac{3}{16}$ "-diam. washers

#### Wing

- 2  $\frac{1}{32} \times \frac{1}{4} \times 12$ " ribs
- 1  $\frac{1}{16} \times \frac{1}{16} \times 9$ " spar
- 1  $\frac{3}{64} \times \frac{3}{64} \times 6$ " spar
- 1  $\frac{1}{8} \times \frac{3}{16} \times 9$ " leading edge
- 1  $\frac{1}{16} \times \frac{3}{16} \times 9$ " trailing edge
- 1  $\frac{1}{16} \times \frac{3}{4} \times 8$ " tips

(Note: substitute a piece of balsa  $\frac{1}{16} \times 2\frac{1}{2} \times 9$ " if solid construction is preferred.)

#### Elevator and Rudder

- 2  $\frac{1}{16} \times \frac{1}{2} \times 5$ " outline
- 3  $\frac{1}{16} \times \frac{1}{16} \times 5$ " spars, ribs
- 1  $\frac{1}{16} \times \frac{1}{2} \times 6$ " outline (rudder)
- 1  $\frac{1}{16} \times \frac{1}{8} \times 4\frac{1}{2}$ " ribs (rudder)
- 1  $\frac{1}{16} \times \frac{1}{16} \times 10$ " ribs (rudder)

(Note: substitute a piece of balsa  $\frac{1}{32} \times 2 \times 8$ " if solid construction is preferred.)

#### Additional Items

- 18 feet  $\frac{3}{16}$ " flat rubber
- 1 sheet tissue
- 1 ounce cement
- 1 ounce dope



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 COLOR OF EYES..... COLOR OF HAIR..... COMPLEXION.....



# MODEL MATTERS

(Continued from page 69)

Attractive prizes have been offered. The Grand Champion of the meet will be awarded a 47-hour flying course leading to a Private Pilot's license, consisting of 17 hours of flying instruction and 30 hours of ground school training. Other prizes are trophies, medals, binoculars, barometers, clocks, traveling sets, and model supplies.

Entry blanks are available from Elwood A. Hughes, General Manager, The Canadian National Exhibition, 6 Adelaide St. East, Toronto. The contest director is Edward S. Booth, director of the Model Aircraft League of Canada.

The Canadian Wakefield Elimination Contest is scheduled for Ottawa, Ontario, July 16th and 17th. Six models will be selected to represent Canada in the 1938 Wakefield International Contest at Paris.

Any modeler living in Canada is eligible regardless of age. Those living near Ottawa are urged to compete in person. Those who cannot do so may send their models, prepaid, to the Model Aircraft League of Canada, 306 Journal Building, Ottawa, Ont. Members appointed by the League will fly such models.

Each entry will be given three flights, the average time being counted. The six highest models will be expressed to France for the finals. Models must conform to the 1938 Wakefield rules, which state briefly that: wing area should be not less than 190 square inches and not more than 210 square inches; stabilizer area not more than 33% of the wing area; weight not less than 8 ounces; area of maximum cross-section shall not be less than  $L^2/100$  square inches where L is the over-all length including the propeller and tail; all models shall be rubber-powered.

All entries should be in Ottawa by July 16th or earlier. Those entering the meet personally, communicate with M. A. L. C. headquarters upon arriving in Ottawa.

## San Diego Aeroneers

The third annual gas model contest of the San Diego Aeroneers was held April 24th at the Navy Practice Field on Camp Kearney Mesa in San Diego. The meet was the most successful ever staged. Over 6000 spectators watched the events. Thousands more

heard a description broadcast over station KFSD.

176 entries were attracted to the meet. Some came as far as 500 miles. 43 were from San Diego, 60 from Los Angeles, and 73 additional from surrounding towns and cities. A complete program of events, giving a full listing of contestants and their type of model, was distributed to the spectators. A public address system was used to keep onlookers familiar with the progress of the meet.

The San Diego Aeroneers allowed a maximum motor run of 35 seconds. There were no restrictions on size or weight of model. Despite the limited motor run, several models were lost.

Following are the winners of the first three places:

- 1st. J. C. Williams, Los Angeles, 8:31. Awarded \$50 cash, \$50 Irvin Aircraft School Instrument course, and Solar Aircraft Trophy.
- 2nd. John Berg, Los Angeles, 8:01. Awarded \$25 cash and Flying Aces Trophy.
- 3rd. Ludwig J. Kading, Compton, 7:10. Awarded \$15 cash and Model Airplane News medal.

## Scale Model Competition

The Fourth Scale Model Aircraft Competition was held under the sponsorship of the Works Progress Administration at the Boys Club of Pittsburgh. A new event this year was the Original Design contest, in which awards were given on the basis of originality and newness. Ruddy Lazan and Robert Barnet won this event.

Other winners were Alex Szwojnowski, Joseph Scuro, and Walter Flynn in the Senior Division; William Engle, Andrew Hasley, and Earl Stehle in the Junior Division.

Harry G. Vogler, Jr., is the director of the Aircraft Division of the Boys Club of Pittsburgh, and deserves much credit for the success of its model activities.

## BESHAR MODELS

The elaborate showrooms of Beshar Models, in New York City, are in charge of three past national champions. These men do woodcutting to order—while you wait—and are the makers of the well-known Beshar Precision Props. The showrooms carry complete motor stocks of all manufacturers, including trade-ins, as well as complete kits and everything in the way of model-building needs.

## NOTICE

The article entitled "World's Record Glider" that appeared in June Air Trails was prepared by Ed Lidgard in collaboration with Wallace Simmers, and not, as erroneously stated, by Wallace Simmers in collaboration with Gordon S. Light.

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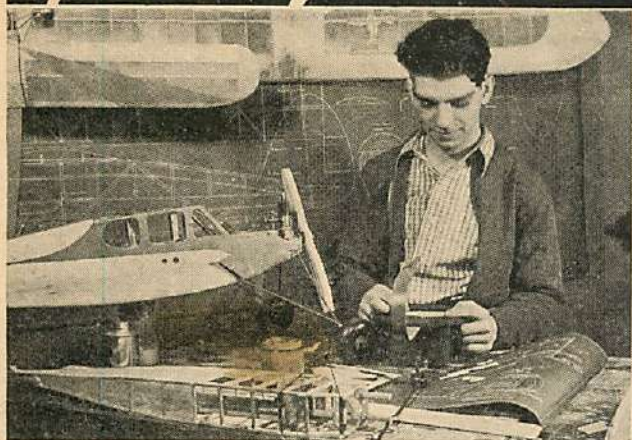
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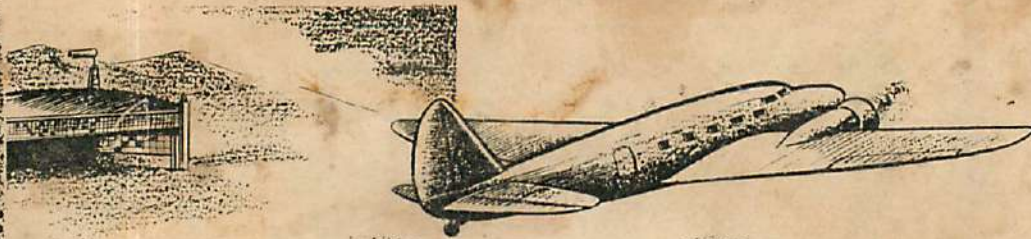
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