

AIR TRAILS

A STREET AND SMITH PUBLICATION



GUEST EDITOR

Kern Dodge

ANNUAL SCHOOL
ISSUE

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Bill Barnes Air Novel

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SEPTEMBER 1938

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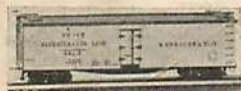
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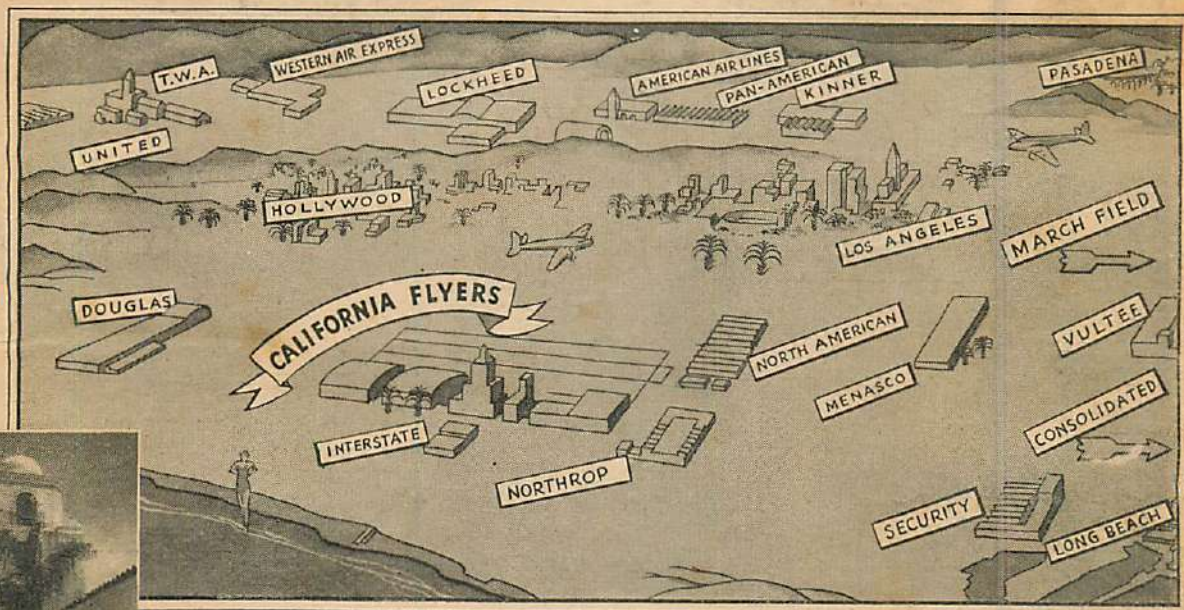
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Above: Line Service Work
Left: Reassembling an overhauled plane

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A.T. SEPT. 1933

ADEQUATE AIR DEFENSE *An Editorial*

THANK God we don't have to teach our children how to wear gas masks!"

Joseph Kennedy, Ambassador to the Court of St. James, recently uttered these words upon his return to this country. They curtly summarize the objectives of the Air Defense League—may we in America never, at any time, have to face the necessity of teaching our children to wear gas masks.

In 1930 a group of former World War officers met in Philadelphia and organized the Air Defense League. Many of the original group remain today officers of the organization. At that time treaties limiting the size of navies were still in effect, international good will reigned, Europe was tranquil and transoceanic flying was still a daring and adventurous achievement. An industrial boom had just ended in this country, our people were prosperous, contented, fully convinced that the world would never see a recurrence of the horrors of the World War and that we were completely protected by our Navy and oceans against any foreign threat. Our Army was the smallest of any major nation and our air force a meager handful of men and planes, operating on antiquated principles under terrific handicaps productive of horrible inefficiency and with little public support.

The men who organized this League had seen men die in France. They had witnessed the great cost of unpreparedness. They had seen the effectiveness of

aircraft in the closing days of the World War. They believed that this new weapon had the capacity, in the years that were to come, to change the map of the world. They believed that the United States was likely to be vulnerable offensively but the greatest benefactor defensively through the use of aircraft. They believed further that public recognition of these facts was necessary to achieve an adequate national defense through proper air development. They were thoroughly convinced that our nation could remain secure only through the maintenance of military forces respected by the world, and that aviation had become, and would increasingly become, the foundation of any modern defense structure.

Of all the conditions enumerated above as existing when the League was formed only one remains today—our Army is the smallest regular Army of any major nation in the world. Disarmament treaties have been scrapped, international good will has disappeared, might has replaced right, two powerful nations have openly expounded policies of aggression through force. Two other nations have been conquered and absorbed through the power of aviation. Transoceanic flying has become commonplace, aviation has become the foundation of the military strength of every major nation except the United States. Children in all European nations train regularly against theoretical air raids and two great wars are at present raging in the world.

ABOUT KERN DODGE

KERN DODGE was born in Chicago in 1880, the son of James Mapes Dodge and Josephine Kern Dodge.

From his forebears he inherited many unusual characteristics, for his father was one of the most prolific inventors of his time, having over one hundred practical inventions listed in the Patent Office at the time of his death, and Kern Dodge's grandmother was the author of several books, one of which, "Hans Brincker and the Silver Skates," is still a classic of children's literature.

A few years after Kern Dodge was born the family moved to Philadelphia. There he attended school at the Germantown Academy, graduating in 1899, next going to Drexel Institute in the Department of Mechanic Arts, from which he graduated in 1901 as an engineer, the profession which he has followed since that time.

Upon his graduation from Drexel Institute he formed an association with Charles Day, and a few years later John H. Zimmerman was taken into the group to form the engineering firm of Dodge, Day and Zimmerman.

This engineering firm continued until 1912 when Mr. Dodge sold out his interest to his partners and established his own engineering practice. The firm at that time and since has been noted as one of the outstanding engineering organizations in the United States.

Mr. Dodge has for many years been interested in public affairs and in civic affairs connected with his own community. He made a comprehensive study of traffic problems and approaches for the Delaware River Bridge before it was constructed, and this was considered of sufficient importance to justify a resolution amending the Constitution of Pennsylvania, which was passed by the Legislature. He has for many years been a member of the Executive Committee of the Committee of 70 in Philadelphia, which is a civic organization interested solely in the establishment and maintenance of principles of good government.

For the past thirty years Mr. Dodge has had an active and real interest in aviation. He flew with many of the

by KERN DODGE *Air Trails* Guest Editor



Kern Dodge, President of the Air Defense League

Further, the people of the United States do now believe *it can happen here!* They are *beginning* to realize an adequate air force can prevent it.

The members of the Air Defense League do believe this—to the point of giving time and funds, as citizens, to achieve this end. We fought for the Congressional investigation of 1934 which exposed horrible conditions existing in the Air Corps. We championed the creation of G. H. Q. Air Force, we have consistently battled for adequate appropriations for aviation, we have opposed domination of air by ground officers. We have fought for proper personnel and planes, for modern organization procedure, for sufficient production facilities in private industry—a few of the things needed to give aviation strength commensurate with our nation's requirements. We believe that only through air supremacy will we effectively achieve national security, and further, this can only ultimately be done by completely freeing aviation from ground officer and General Staff control through the establishment of a completely independent aviation arm in our national defense structure.

We are American citizens. We believe our families and homes will be best protected through an efficient and adequate air force. We belong to the Air Defense League because we have found the organization effective in driving toward this objective. We feel now, as never before, that those people similarly minded should *act*—not talk!

Compiled by Tracy Richardson

pioneers of the industry in the earliest models of Wright planes, his first flight being in April, 1912, in a Wright model #9 at Dayton, Ohio. He was also, in the early days, a member of the Aero Club of America, membership starting in 1909, and the Dodge family was the first in the United States in which three members were listed as licensed pilots—Kern Dodge, his daughter Jane, and his son Jack.

During the World War Kern Dodge was actively engaged in special work in the office of Naval Intelligence.

Since the World War his interest in aviation matters has continued, he having had a very definite part in the development of aviation in the City of Philadelphia and the State of Pennsylvania.

Kern Dodge was one of the group that helped organize the Air Defense League, to provide a medium through which civilian interest could be developed so as to support a sound air program in this country and thus add to the adequacy of our national defense. He has testified

before many committees in Congress in connection with aviation. He has been a governor for Pennsylvania for the National Aeronautic Association, is the past President of the Aero Club of Pennsylvania, and is well known throughout the aeronautical industry.

He is at the present time a Director of the Link Belt Company, Keystone Automobile Club of Philadelphia, Committee of 70, Aero Club of Pennsylvania; and is a member of the American Society of Mechanical Engineers, American Institute of Electrical Engineers, Franklin Institute of Philadelphia, New York Electrical Society, New England Society of Pennsylvania, and the Union League of Philadelphia.

His prominent identification with civic matters in Philadelphia led to his appointment in January, 1932, as Director of Public Safety by Mayor J. Hampton Moore, and for two years Mr. Dodge served in this capacity. He has since then continued to take an active part in all civic and national matters requiring citizen interest.

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Be sure and read all contest rules, instructions and suggestions for HOME SCREEN TEST contestants in the current issue of PICTURE PLAY.

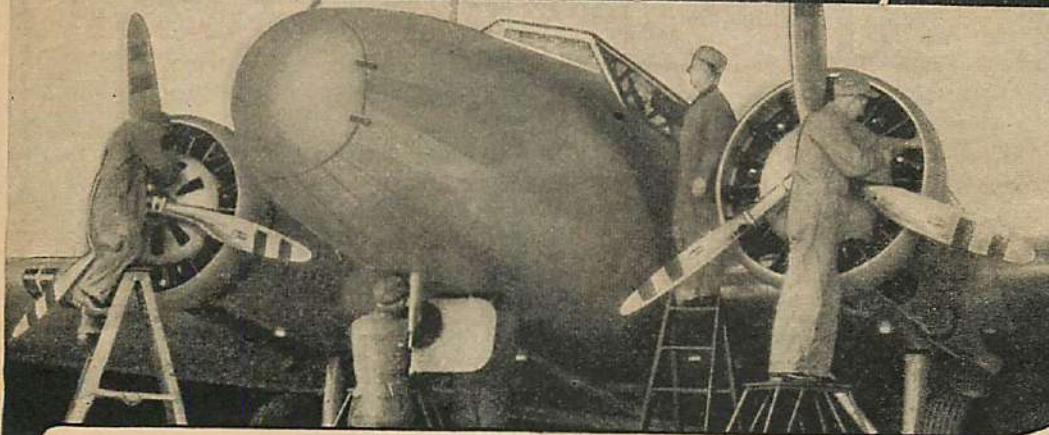
A completely informative booklet has been prepared especially for you. It tells you how to act before a camera, how to use and apply stage cosmetics, the art of dress and camera technique. This booklet is yours for the asking. Fill in the entry blank below and send it with a self-addressed, stamped envelope to PICTURE PLAY MAGAZINE, 79 Seventh Avenue, New York, N. Y., and this booklet will be sent to you immediately, absolutely free. Contest closes Aug. 30th.

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THIS WINGED WORLD



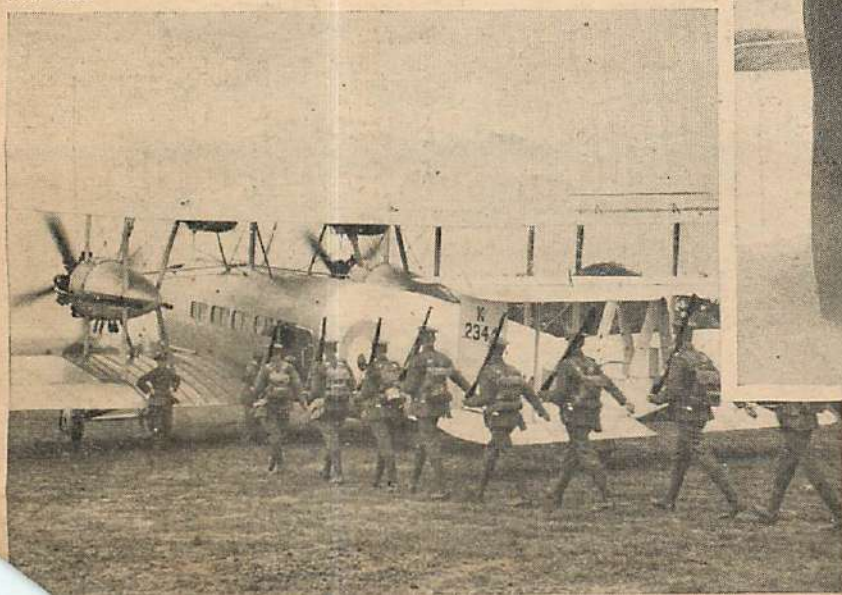
International

Above—Seemingly towering over the terminal buildings in the background a giant Sky-sleeper awaits the signal for the engines to start. Passengers and crew hurry to board the giant, emblematic of modern night aerial travel.

Right—Flying fish beware! A charter plane of the Institute of Tourism of Puerto Rico prepares to carry two fair anglers to Mona Island being developed as a big game and big fish resort. These anglers seem well supplied with lures.



Wide World

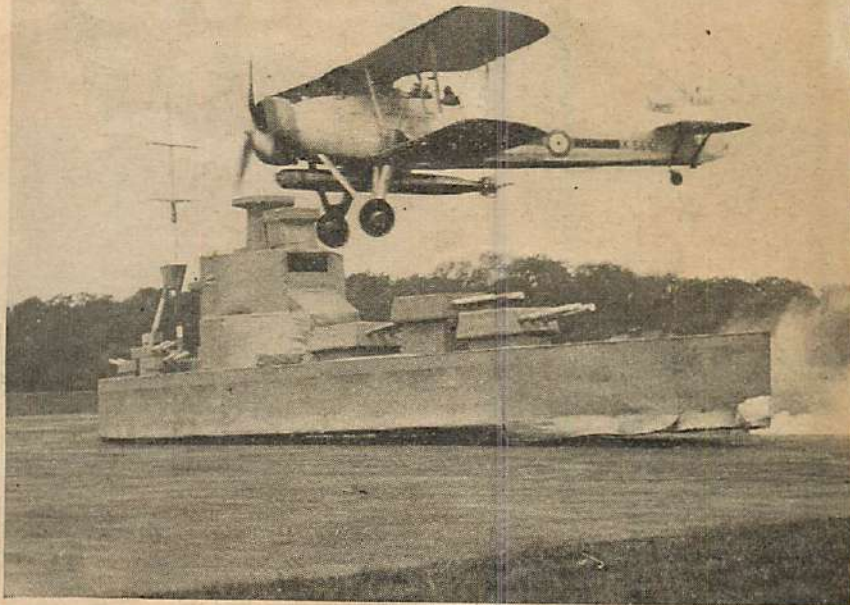
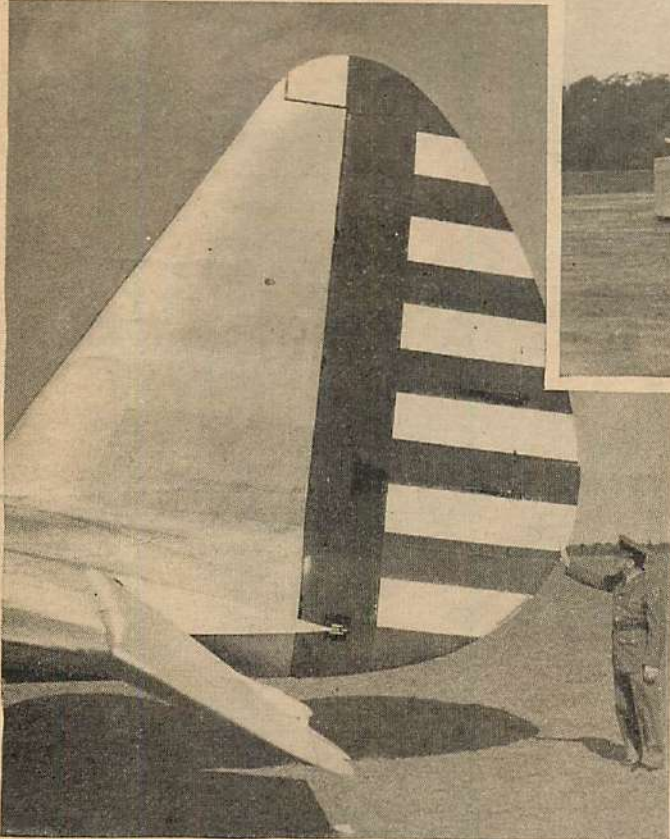


Left—England's soldiers sprout wings. Soldiers of the 1st Battalion, Coldstream Guards, embark at Odiham, England, to be flown to Caterick as part of training exercises. The ship is a Vickers "Victoria" troop-transport.

the news of the aeronautical world presented in pictures

Right—Sinking a dryland battleship. This dummy ship built around a tractor and maneuvered about the Gosport airdrome offers torpedoing practice to the pilots of torpedo planes. A Fairey Swordfish attacks.

Rudy Arnold



Globe

Left—A tail that's hard to believe, but is true nevertheless. The officer gives an idea of the tremendous size of the rudder of the giant YB-15 flying fortress, Boeing's contribution to the Army's fleet of super-super-bombers.

Below—All together now! Members of the Royal Air Force maneuver the Armstrong Whitworth Ensign along the runway. This sky giant weighs over twenty tons and can carry a total of forty passengers plus ship's crew.

Monk Meyer





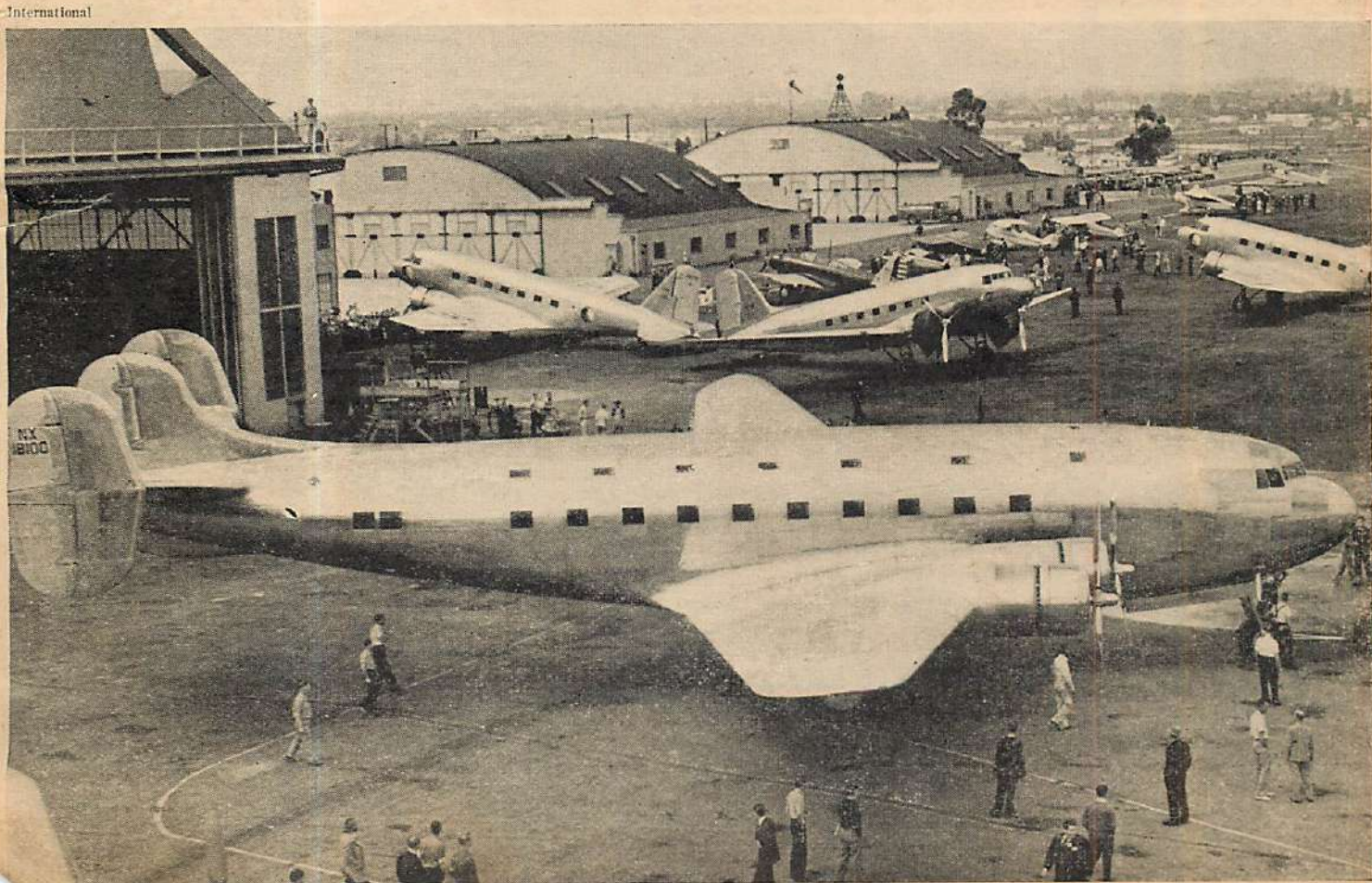
Wide World

Above—The original flying motor boat. This yacht tender, ordered by stranded yachtsman lying off Antwerp, was part of the freight of the first flight of new British Freight Service.

Below—A queen's unveiling. Apparently snubbed by various smaller craft, including several of her smaller sister DC-2s, the giant DC-4 emerges from the great Douglas factories.



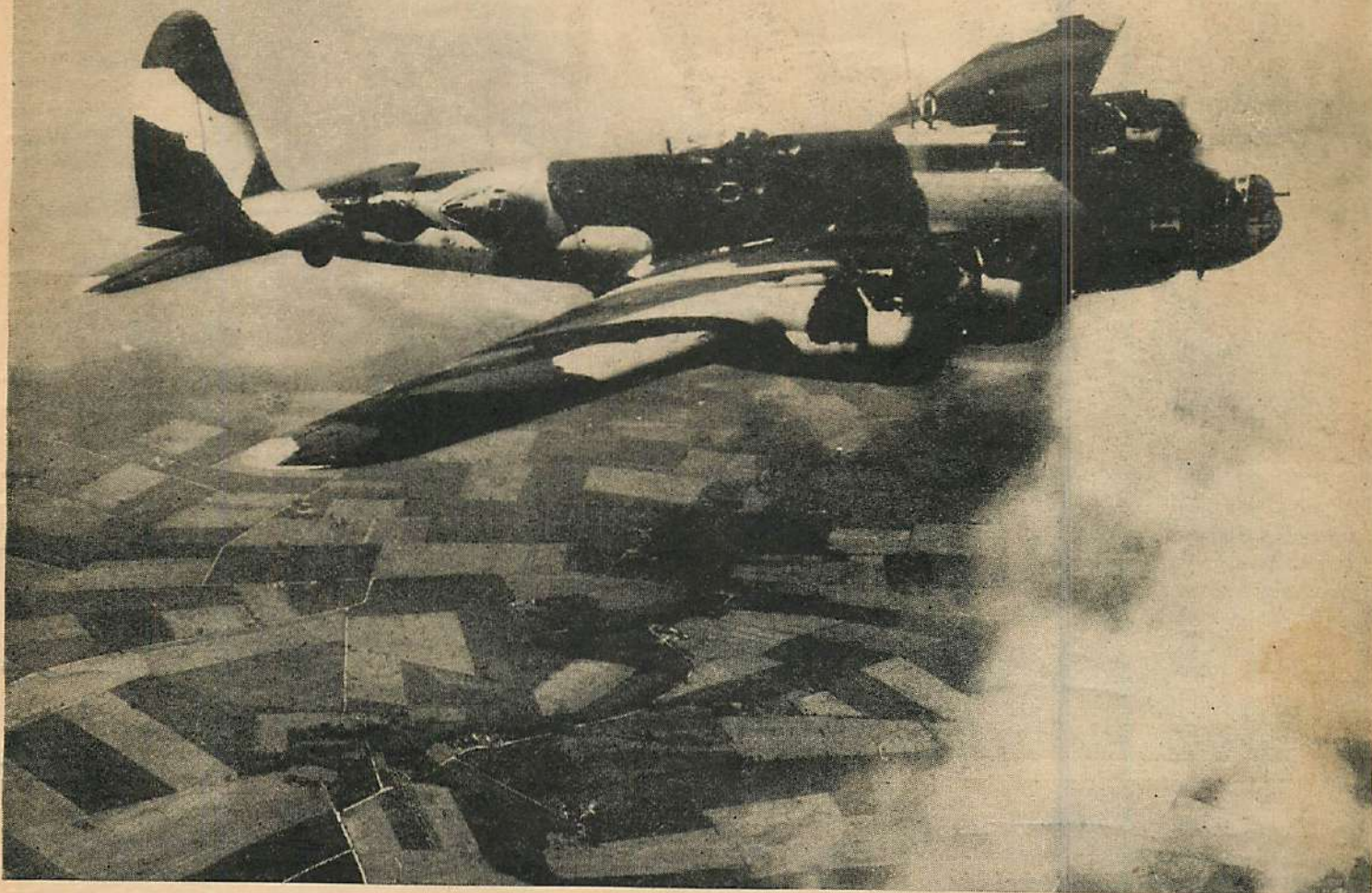
Wide World



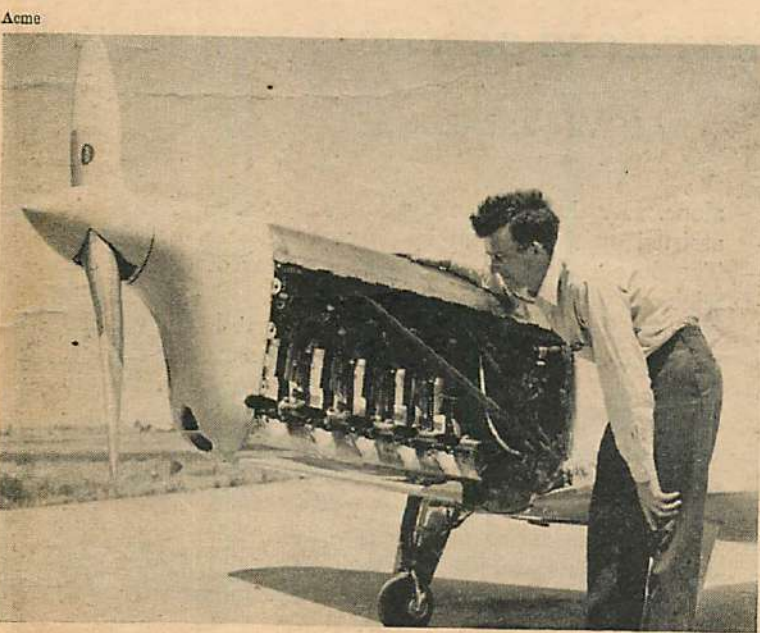
International

Opposite page, top—So bad it's good. This confusing photo shows the bewildering effect, even at close range, of the official air corps camouflage as applied to a "flying fortress." Note how the plane blends into the pattern of the earth.

Below—Not manna, but alfalfa from heaven. Senator Theodore Green, of Rhode Island, first vice-president of the Alfalfa Club, arrives in an autogiro on the estate of John Hines. Well-known autogiro pilot Johnny Miller guides a foot.



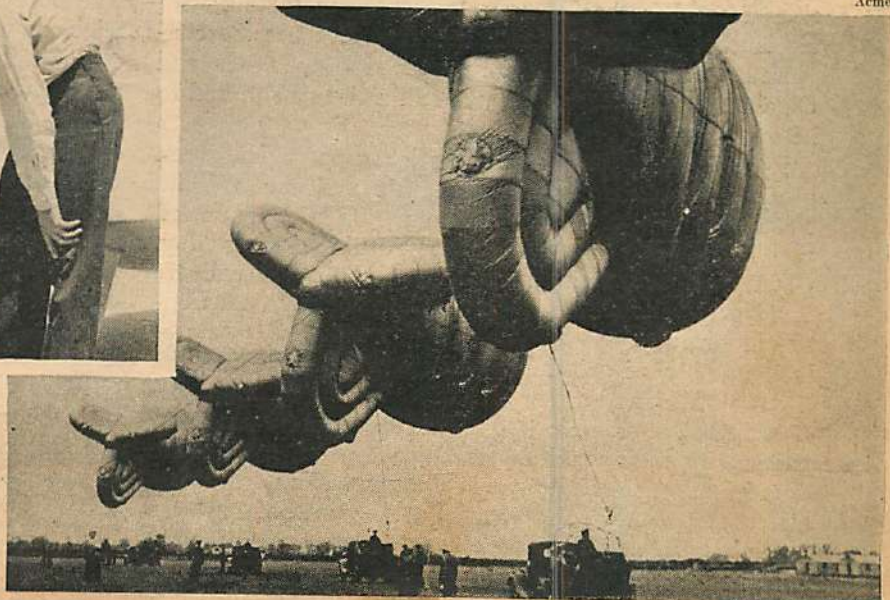
International



Above—Air show sensations. Both Tony Levier and his Schoenfeldt "had what it takes" at the Pacific International Air Races. "Tony and Company" won the 100-mile free-for-all at a speed of 253.46 m.p.h., the 549 cu. in. displacement race at 249.35 m.p.h., and third in the free-for-all specialty race event at conclusion of the show.

Above—A Boeing YB-17 Flying Fortress in warpaint.

Below—Flying Jumbos go aloft to defend England. A group of four of the "Barrage Balloons" designed to carry steel nets to entangle the enemy's planes in the event of a night raid. The balloons can reach an altitude of 25,000 ft.



Acme



More graceful than nature, the Minimoa is launched into Texas skies to prove a long-contested theory of flat-terrain soaring.

The personal account of the expedition to test soaring possibilities in the Southwestern part of the country.

By LEWIN B. BARRINGER

MORE than a year ago I conceived the idea of organizing a small expedition to the south-middle-west to test soaring possibilities over the level plains. After a careful study of prevailing meteorological conditions from Weather Bureau Reports, and talking with airplane pilots familiar with this region, I became convinced that record conditions existed over Texas and Oklahoma. However, this was still a theory and had to be tried out.

By February, sufficient financial support had been obtained from interested individuals and the Wichita Falls Chamber of Commerce to assure a four weeks' expedition. The time chosen was April and early May, when thermal activity should be well started and we could get back in time to prepare for the National Contest in June.

A number of substantial inducements, including the Fiduciary Counsel Prize of \$1,000 for a goal flight between two cities over 200 miles apart, were made to pilots with high-performance ships to join me on the expedition. Two had agreed to do so, but unfortunately had to drop out at the last minute because of business conditions in the East, so I had to tackle the problem

alone. By this I mean the actual flying, as I was ably assisted on the ground by a crew of three, headed by Theodore Bellak, who acted as operator of the duPont winch as well as relief pilot.

The sailplane for this expedition was to have been the all-American Ross R-2 high-performance sailplane. Funds had been raised privately to purchase this ship for the Soaring Society to use in experimental and promotional work on the expedition, but unfortunately its designer and builder, Harland Ross, was unable to complete it in time. To fill the gap, Richard C. duPont, President of the Soaring Society of America, very kindly offered the use of his German Göppingen 3 Minimoa, with which he defended his title of American Soaring Champion at Elmira last year.

After eighteen hundred miles of driving, we arrived at Wichita Falls on April 8th and made a few test flights the following day. On Sunday the 10th, before a crowd of about 4,000 spectators, we officially started operations. Using 4,000 feet of $\frac{3}{8}$ " rope laid diagonally across the airport, I made winch tows up to 1,000 feet and better

into a cloudless sky. Of the eight take-offs made, seven resulted in soaring flights, the shortest 8 and the longest 35 minutes. On the latter I spiraled to an altitude of 2,500 feet.

For the next two days the results were very similar, as I flew in clear air, strong south winds, and under temperature inversions varying from 1,500 to 3,500 feet.

On April 13th, we had a 20-mile SE wind and made two flights to 850 feet before I caught a thermal upcurrent. These were with auto tow, which we used one day to compare maximum heights obtainable by the two methods on a given length of runway. We used 1,500 feet of rope on a 3,500-foot run and found little if any difference in altitude gained by the two methods.

On the third flight I caught a very weak thermal of 1 ft./sec. and rose to 1,000. Flying back upwind I caught a much better one of 7 ft./sec. and climbed it to 2,700. By then I had drifted so far downwind that it was impossible to get back to the field, so I decided to fly cross-country although the conditions did not look very promising.

Crossing the Red River into Oklahoma, I turned toward some small cumulus clouds and found a strong lift of 13 ft./sec. which took me up through the clouds at 3,300 feet. Finding no more thermals I glided downwind and landed near Loveland, Oklahoma, having covered 28 miles in 55 minutes.

The next five days I added considerably to my knowledge of level country thermals by numerous local flights around the airport. Some of them lasted an hour and a half. The first really good soaring day came on April 19th when cumulus clouds began forming to the east and south about ten in the morning.

After two trials lasting 7 and 16 minutes respectively, I finally caught, on the third flight at 10:45 a. m., a thermal of 3-5 ft./sec. when down to only 500 feet. This I climbed to 2,000 feet. Looking to the southeast I saw really sizeable cumuli building along the Wichita River, so flew upwind toward them.

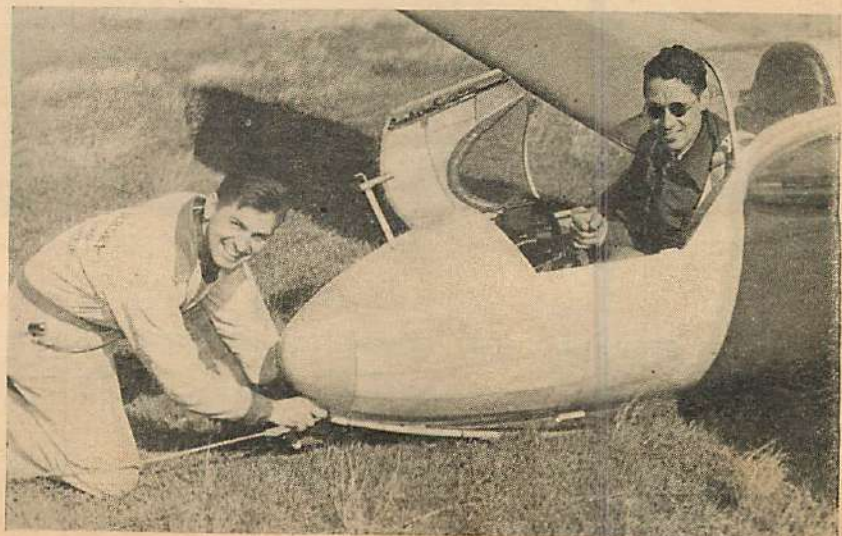
A 11:30 I arrived over the river and soon spiraled up to 2,800 and held this altitude for some time as I flew straight downwind under a line of clouds so close that they were almost touching. As I approached the junction of the Wichita and Red River, however, the clouds thinned out and I lost out steadily. As I neared the U-shaped bend in the Red River west of Waurika, Oklahoma, I was down to 800 feet, and things looked bad. Looking around quickly for possible sources of

thermal lift, I spotted a huge field which I knew to be dry because of the dust blowing from three teams plowing it. Heading over the center of this field I started to circle slowly.

With my altimeter showing barely 500 feet above the ground, the needle of my variometer began to rise as I entered a thermal "bubble" just starting upward. It was quite weak at first but the past few days' experience had taught me that I could make wide, shallow turns at minimum sinking speed because of the size of these level country thermals, so I was soon climbing upward once more. For the next hour it continued to be a real struggle to stay aloft and only occasionally was I able to climb as high as the low cloud base of 3,700 feet. My log shows that I passed west of Waurika at 11:46 and over Ad-dington at 12:05. At that time I again reached the cloud base and flew on through the edge of the cloud at 4,000. All this time the thermals were comparatively weak—3-5 ft./sec. with a few up to 7.

At 12:55 I crossed the Washita River west of Lindsay. I could see from the cloud shadows that (Turn to page 89)

Smiles for the camera and records for the barograph. Left to right, Karl Lange (with barograph), Lewin Barringer, Harland Ross, "Red" Kimbrell, and Ken Findiesen before the take-off.



"Pete" and "Lew" check the towline release and controls before the expedition ship is launched. Note hinged cowl and instrument panel of the Minimoa. Barringer in the cockpit.

AVIATION ALMA MATERS—

In response to numberless requests for information regarding aviation schools, Air Trails takes pleasure in presenting the following chart of U. S. Department of Commerce approved schools. From this you will be able to select the most suitable location, courses, and tuition rate for your particular needs. These figures are as of press time.

IN CONTACTING THESE VARIOUS SCHOOLS PLEASE MENTION "AIR TRAILS."

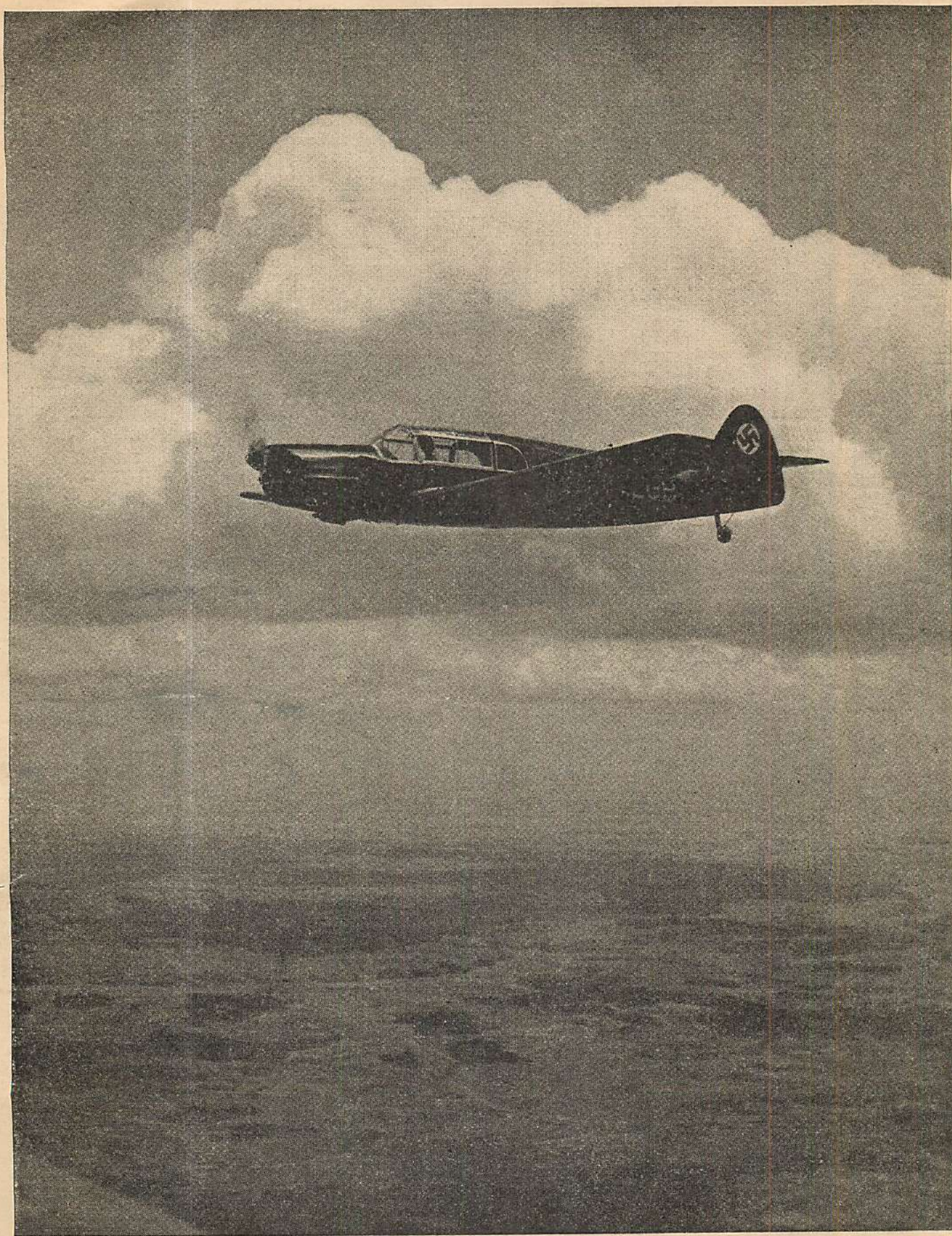
SCHOOLS	CASEY JONES SCHOOL OF AERONAUTICS, INC., 534 BROAD STREET, NEWARK, N. J.	STINSON SCHOOL OF AVIATION, 27-01 BRIDGE PLAZA NORTH, LONG ISLAND CITY, N. Y.	ROOSEVELT AVIATION SCHOOL, INC., ROOSEVELT FIELD NUMBER ONE, MINNEOLA, L. I., N. Y.	SPARTAN SCHOOL OF AERONAUTICS, MUNICIPAL AIRPORT, TULSA, OKLAHOMA.	RISING SUN AIRCRAFT SCHOOL, "H" AND LUZERNE STS., PHILADELPHIA, PA.	STATE OF CONNECTICUT, STATE TRADE SCHOOL, PUTNAM, CONN.	AERONAUTICAL UNIVERSITY, INC., 1338 S. MICHIGAN AVE., CHICAGO, ILL.
COURSES AND RATES	Master Mechanics..\$565 Aeronautical Engineering 990 Terms arranged.	Aircraft Mechanics..\$450 Terms arranged.	Private \$ 675 Solo 365 Limited Com. 1025 Commercial 2800 Master Airplane Mechanic 480 Master Airplane and Engine Mechanic 690 Air Line Technician 720 Aircraft Design and Construction.. 980 Aircraft Sheet Metal 420 Limited Com. Pilot and Master Airplane and Engine Mechanic.. 1500 Commercial Pilot and Master Airplane and Engine Mechanics 3200 Terms available.	Professional Pilot's and Mechanic's Course...\$2945 Master Com. Pilot's and Airplane and Engine Mechanic's Course 2310 Commercial Pilot. 1700 Limited Com. Pilot 720 Private Pilot..... 395 Professional Mechanic..... 870 Airplane and Engine Mechanic.. 570 Regular Mechanic's Course 300 Radio Operator's Course..... 300 Sheet Metal Mechanic..... 210 Special Flight Course..... 1400 Terms available.	Master Airplane and Engine Mechanics\$400 Terms available.	State institution open only to residents of Connecticut. General airplane and engine mechanics.	Aeronautical Engineering. Aviation Mechanics. Administrative.
STUDENT ACCOMMODATIONS	Board and room in supervised homes.	Board and rooms near by.	Accommodations in private homes near field for \$9.00 a week including board.	School barracks and cafe, accommodating 200 students.	Private homes sponsored by school faculty.	Boarding houses available.	Student accommodations approved by the university.
PLACEMENT ARRANGEMENTS	Maintains placement bureau for graduates.	Co-operation with students.	Maintains student placement bureau.	Maintains student placement service	Maintains student placement service.	Student placement arrangements.	Student placement co-operation.
EQUIPMENT	Fully equipped for instruction in these subjects.	Fully equipped for course.	Fully equipped with all shops and types of aircraft.	Two hangars and eight school buildings completely equipped and government approved.	Class rooms, engine test stands, drafting room and all equipment necessary to courses.	Repair shop, hangar, dope shop, engines, training ship, tools and all equipment.	Finest and completest equipment obtainable for instruction.
PART-TIME WORK	None.	None.	None.	Part time work at hourly rates.	None.	None.	Possible in maintenance department of school.

SCHOOLS	COURSES AND RATES	STUDENT ACCOMMODATIONS	PLACEMENT ARRANGEMENTS	EQUIPMENT	PART-TIME WORK
INTER CITY AIRLINES, INC., BOSTON MUNICIPAL AIRPORT, BOSTON, MASS.	Private Pilot. \$412-\$677 Limited Commercial 957 Commercial Course. 2745	Approved rooms near school.	None.	All necessary equipment for flight, ground and shop instruction.	None.
CURTISS WRIGHT TECHNICAL INSTITUTE, GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIFORNIA.	Aeronautical Engineering.....\$750 Master Mechanic... 600 Home study course in aeronautical drafting 125 Advanced Navigation..... 100 Commercial Pilot plus Ryan S-T-A Plane 5442 Airplane Drafting and Design 675 Aeronautical Engineering..... 1275 Master Mechanic... 625 Mechanical..... 175 Welding 100 Master Radio..... 250 Budget plan available.	Student housing arranged by registrar.	Maintains active placement service.	Complete shop and instruction equipment.	Arranged for by faculty.
RYAN SCHOOL OF AERONAUTICS, LINDBERGH FIELD, SAN DIEGO, CALIFORNIA.	Commercial Pilot. \$2285 Graduate Master Pilot..... 1180 Master Pilot 3275 Limited Commercial Pilot 795 Private Pilot 545 Solo Pilot..... 295 Advanced Navigation..... 100 Commercial Pilot plus Ryan S-T-A Plane 5442 Airplane Drafting and Design 675 Aeronautical Engineering..... 1275 Master Mechanic... 625 Mechanical..... 175 Welding 100 Master Radio..... 250 Budget plan available.	Personally selected accommodations in private homes, YMCA of San Diego Athletic Club.	Qualified students assisted in placement.	The most complete and modern equipment, including ten new all-metal ships.	Possible in some courses in latter part of training.
BOEING SCHOOL OF AERONAUTICS, OAKLAND MUNICIPAL AIRPORT, OAKLAND, CALIFORNIA.	Dispatching and Meteorology.....\$ 540 Airline Technician..... 540 Airline Mechanic. 720 Operations 1080 Air Transport Engineering..... 1440 Practical Aeronautical Engineering..... 1440 Airline Flight Officer 5860 Airline Pilot and Operations... 5680 Special Airline Pilot..... 2760 Commercial Pilot. 2968 Private Pilot..... 995 Solo Pilot..... 355 Sheet Metal..... 225 Terms available.	Accommodations in selected private homes, apartments, or at near-by inn.	Maintains placement department.	Complete equipment, including ten planes for instruction in all courses.	None.
THE STEWART TECHNICAL TRADE SCHOOL, 253-5-7 W. 64TH ST., NEW YORK, N. Y.	Aircraft and Engine Mechanics. \$525 Aircraft Sheet Metal..... 315 Aircraft and Diesel Engines... 525 Aeronautical Drafting and Design 450 Aircraft Radio 125	Accommodations arranged for in near-by private homes.	Maintains very successful placement service.	Completely equipped with all necessary shop and laboratory apparatus.	None.
CALIFORNIA POLYTECHNIC SCHOOL, SAN LUIS OBISPO, CALIFORNIA.	Write to the registrar, California Polytechnic, San Luis Obispo, Calif.	Student accommodations in dormitories.	Maintains large placement service for recommended graduates.	Complete equipment for instruction in courses given.	Can be arranged.
CALIFORNIA FLYERS, INC., LOS ANGELES MUNICIPAL AIRPORT, INGLEWOOD, CALIFORNIA.	Executive Transport Pilot...\$2475 Transport Pilot... 1875 Limited Commercial Pilot. 695 Private Pilot..... 495 Amateur Pilot..... 350 Solo Pilot..... 195 Instrument and Beam Flying..... 325 Master Mechanics. 550 Aircraft Sheet Metal..... 275 Aircraft Riveting and Welding..... 195 Instrument Technician..... 480 Aeronautical Engineering write Airplane Drafting 225 Combinations of Above write Terms available.	Accommodations arranged at near-by homes and apartments by the registrar.	Efficient placement service maintained.	Complete equipment in every respect, including Link Trainer and ten training planes of varied types.	This is not recommended by the school.

Unfortunately at the time of going to press, the necessary information from the following schools had not been received:

BALTIMORE FLYING SERVICE, INC., CURTISS-WRIGHT AIRPORT, SMITH & GREENSPRING AVES., BALTIMORE, MD.	Flying and Ground. Private and Solo.	NEW ENGLAND AIRCRAFT SCHOOL, 126 NEWBURY STREET, BOSTON, MASS.	Airplane and Engine Mechanic.
BRINKERHOFF FLYING SERVICE, INC., COLLEGE PARK AIRPORT, COLLEGE PARK, MD.	Flying and Ground. Private.	OKLAHOMA MILITARY ACADEMY, CLAREMORE, OKLAHOMA.	Flying and Ground. Solo. Private, Lim. Commercial.
DALLAS AVIATION SCHOOL AND AIR COLLEGE, LOVE FIELD, DALLAS, TEXAS.	Flying and Ground. Commercial. Lim. Commercial. Private, Solo.	PARKS AIR COLLEGE, PARKS AIRPORT, EAST ST. LOUIS, ILL.	Flying and Ground. Commercial, Lim. Commercial. Private, Solo. Airplane and Engine Mechanic.
ERICKSON & REMBERT, FLOYD BENNETT FIELD, BROOKLYN, N. Y.	Flying and Ground. Private. Solo.	PYPER FLYING SERVICE, PITTSBURGH-BUTLER AIRPORT, BUTLER, PA.	Flying and Ground. Private.
LINCOLN AIRPLANE & FLYING SCHOOL, 2415 O STREET, LINCOLN, NEBRASKA	Commercial, Lim. Commercial. Flying and Ground. Private, Solo. Airplane and Engine Mechanic.	SAFAIR, INC., HANGAR B, ROOSEVELT FIELD, GARDEN CITY, L. I.	Flying and Ground. Commercial, Lim. Commercial. Private, Solo.
LOS ANGELES AIRCRAFT, LTD., LOS ANGELES MUNICIPAL AIRPORT, INGLEWOOD, CALIF.	Flying and Ground. Private.	CAPT. SANSON'S AVIATION SCHOOL, 157 CHARTER OAK AVE., HARTFORD, CONN.	Airplane and Engine Mechanic.
MUNCIE AVIATION CORPORATION, CENTER PIKE, MUNCIE, IND.	Flying and Ground. Lim. Commercial. Private, Solo.	SCOTT FLYING SERVICE, MUNICIPAL AIRPORT, LONG BEACH, CALIF.	Flying and Ground. Private, Solo.
		RAY WILSON FLYING SCHOOL, PARK HILL AIRPORT, DENVER, COLORADO.	Flying and Ground. Commercial. Private, Solo.

THE ABOVE AND ADDITIONAL INFORMATION CAN BE OBTAINED BY WRITING THE REGISTRARS OF THESE SCHOOLS.



MESSerschmitt TAIFUN

Very popular in German private plane flying, the Messerschmitt Taifun bears a family resemblance to the most formidable Messerschmitt Bf.109 military model. This four-passenger low-wing monoplane speeds at 189 m.p.h. and lands at 52.7 m.p.h.

AIR PROGRESS

A Summary of Aviation News



The Flying Hotel, alias the DC-4, showing clean lines made possible by retractable tricycle landing gear.

TRANSPORT

While both Douglas and Boeing are staging a spectacular race for airliner supremacy with four-engined ships, there is a noticeable undercurrent of feeling among other manufacturers that no modern airliner is safe with more than two engines. They point out that until aero engines can be boosted in power, so that about 4,000 h.p. can be offered in two plants, it is useless to make the airliner more complicated by adding two more engines.

A new Curtiss-Wright transport using two engines has been quietly built which, according to the manufacturers, will equal the performance of the DC-4 and the Stratoliner. It is understood that this new ship will have a pressure cabin and suitably supercharged engines for stratosphere flying.

Generally speaking the transport industry is in something of a turmoil, owing to the tremendous competition being waged by the various air lines to obtain the absolute latest in aircraft. The manufacturers do not help the situation much, either, because as soon as they induce the public to demand one type of transport, they are already setting up the

jigs and dies for another. Under this pressure, the air lines are being hard put to it to get their money's worth out of their equipment.

General conditions in Europe may delay transatlantic passenger air service, according to Glenn L. Martin. Suitable legislation, protecting operators provided by the terminal nations, will have to be enacted before further basic tests can be risked. In other words, Mr. Martin wants to be certain his Clippers will not be "commandeered" in case war breaks out.

The Post Office Department, according to Harlee Branch, Second Assistant Postmaster General, has virtually completed its "primary" system of air mail routes, which means that a new "feeder" system will be organized between cities not as yet directly connected with main routes. Funds for these new lines will be asked for in the 1940 budget.

A rigorous training schedule for all permanent employees of the new Trans-Canada Air Lines is proceeding slowly but with remarkable thoroughness. The government is providing complete radio ranges, a meteorological

service, emergency landing fields and other navigational aids. The airway from Vancouver to Winnipeg is practically complete and twenty-eight complete trips were carried out during the first month of operation. A regular night schedule is now being maintained between Regina and Winnipeg.

It is believed that *Mercury*, the upper component of the Mayo composite aircraft, will make her first transatlantic trip from England to Newfoundland shortly. She has already been launched from *Maia* with a full tank load and at this writing was carrying out local endurance test flights.

The British-built Burnelli plane is almost ready for flight. According to advices from overseas the new ship will use British Bristol engines.

The second of the Armstrong-Whitworth four-engined Ensign transports has been completed and named *Egeria*.

For the benefit of hundreds who have asked us when the next National Air Races will be staged—and where—we can now state that they will be put on, as usual, by Cliff Henderson at the Municipal Airport, Cleveland, on September 3rd-5th.

AIR FORCES

The most interesting news of the past few weeks was the purchase of 400 American military-type planes by the British Air Ministry. The Air Mission which came over here to inspect American craft did not place any orders, but after making their reports, orders were given to two American aircraft salesmen who accompanied the mission back to London. The planes purchased were Lockheed 14's, air transports which can be converted into bombers, and North American BT-9R trainers.

It is believed too that the Grumman firm is also angling for an order for their fighters. Al Williams, noted stunt pilot, is now in Britain demonstrating his

(Turn to page 90)

ARMY OFFERS

FLYING HOTEL

America's greatest and most luxurious airliner, the DC-4, includes every development known to commercial aviation.

By WILLIAM WINTER

CLIMAXING 500,000 hours of engineering and two years of design and construction, the DC-4 has at last been trundled forth from its scaffolding and testing rigs. The much-awaited flight tests were an eminent success as the all-metal monster, responding perfectly to the pilot's touch, soared aloft with effortless ease.

In the DC-4 are incorporated so many new and unusual features, both in design and in equipment, that it is difficult for even the most rabid progressive to assimilate the multitudinous improvements.

The design's paramount features are the tricycle landing gear—all three wheels are fully retractable—and a dihedral tail with three vertical surfaces. For the passengers' comfort probably the most complete installation of equipment ever made in a heavier-than-air machine stamps the DC-4 as the realization of aviation's dream ship.

Steam heat will maintain automatically a cabin temperature of 70 degrees. Air forced into the cabin at 1,250 feet per minute will be regulated by the individual passenger. Auxiliary power plants will supply electricity for lighting, electric stoves, percolators, toasters, curlers and electric razors. Such things as a ship "library"

The DC-4 taking off on its initial test flight. The tricycle landing gear, here not yet retracted, is the first to be used on ships of this size. This new Douglas lands at 68½ m.p.h.

dictaphone and check room lend distinction to the luxurious DC-4.

Statistics are always impressive; those of the DC-4 are astronomical. Their mere recital would be pointless but for the fact that they do give an idea of the tremendous expenditure of labor, material and engineering that went into the mammoth ship.

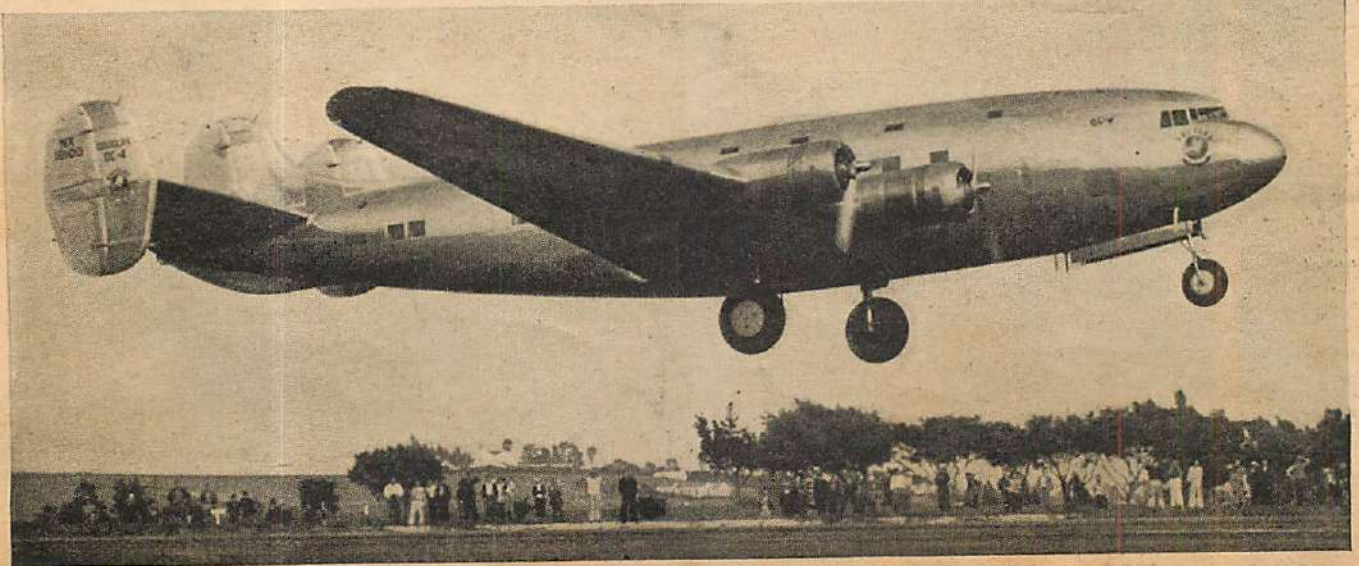
For instance, 1,300,000 rivets were used in fabricating the ship! Electrical wiring alone totaled 21,000 feet. Even the control cables totaled more than a mile. For construction 553,000 square feet of blueprints were required. In addition to the 500,000 hours of engineering, 100,000 more were needed for testing. Averaging 25 minutes each, 866 wind-tunnel tests were made. All

tanks were subjected to vibration tests for 125 hours at a frequency equivalent to that experienced at cruising speed—195 m.p.h. The main landing gear wheels were given 50 separate drop tests. On some of these a total of 120,000 pounds impact force was experienced. The nose wheel withstood 25 tests at a maximum impact force of 54,000 pounds. Over 160 other tests were applied to the various parts of the machine.

Before entering into a detailed description of Douglas' newest creation, the story preceding the DC-4's birth might be sketchily reviewed. We are all familiar with the ruinous competition of our domestic air lines. The rapid obsolescence of whole fleets of the finest transports available seems finally to have brought the air transportation companies to the realization of a common cause. Our five greatest companies pooled their efforts to have designed and developed a ship embodying all the latest developments known to commercial aviation. It followed that Douglas, the colossus of the international transport market, should be commissioned with the gigantic task of producing from scratch this new airliner of the skyways. The collective technical brains of manufacturer and air lines, the vast operational experience of the air lines, and the expenditure of over \$1,500,000 created the DC-4.

The plane the engineers had visualized and which we have just seen go through its preliminary paces is a 138 foot, 3 inch low wing that, on the ground, towers

Photo by "Dick" Whittington



24 feet, 6½ inches high. Into the leading edge of the immense 4½-foot-thick wing are fitted the four 1,400 h.p. Pratt & Whitney Twin Wasps, developing in total 5,600 h.p. and swinging, each, 14-foot propellers. Over 26 feet tread separates the two 1674-pound main wheels. Seating arrangements in production models to be delivered to the contracting air lines after completion of tests on the experimental ship, will accommodate 42 passengers by day; 30 as a sleeper. Crew members are five. With a fully loaded weight of 65,000 pounds the useful load is 20,000 pounds!

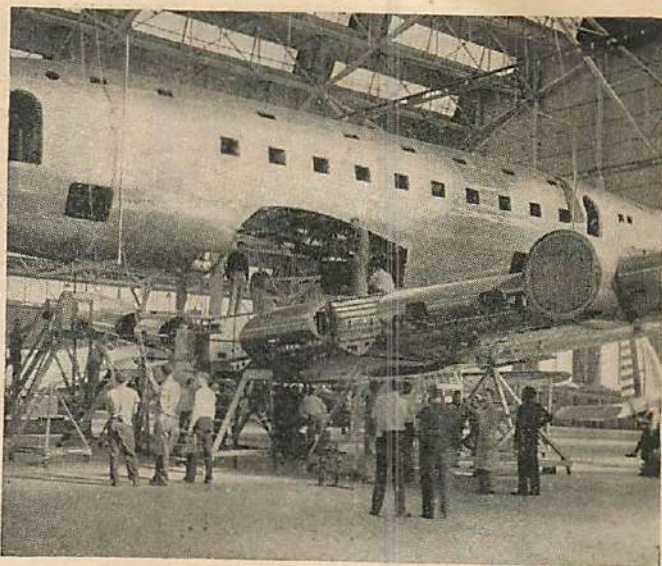
The performance figures are impressive, as is everything about the DC-4. Top speed is 240 m.p.h., considerably faster than even the DC-3. Using but 65 per cent of the total power available, the cruising speed at 8,000 feet is 196 m.p.h. Absolute ceiling is 24,000 feet, service ceiling 22,900. The DC-4 will slide in on her tricycle landing gear at 68½ m.p.h. Tankage is for 2,200 gallons—enough for nearly 5 transatlantic hops in the *Spirit of St. Louis*.

Douglas technique in testing the DC-4 proved to be quite startling. Ingenious rigs were devised to subject the machine to the stresses of actual flight before the completed ship was ever taken from the hangar. Quoting from a release by Douglas, "... mathematics and a million pounds of lead bars were handled in equal proportions, with slide rules and elbow grease doing their share."

Standard practice in the past has been to pile loads of sandbags on the fuselage and surfaces of the inverted ship to be static-tested. The DC-4 is entirely too formidable a structure to be so unceremoniously handled. Instead, an arrangement of steel scaffolding and hydraulic jacks permitted the complete testing of the airliner, upright on the plant floor.

Moreover, the tests were not the mere cursory ones commonly employed. For instance, the ship was tested for down-load and high-angle-of-attack positions. Later tests were equivalent to zooming the plane from level flight at 240 m.p.h. The rigs devised to simulate wing deflection conditions consisted of the (Turn to page 88)

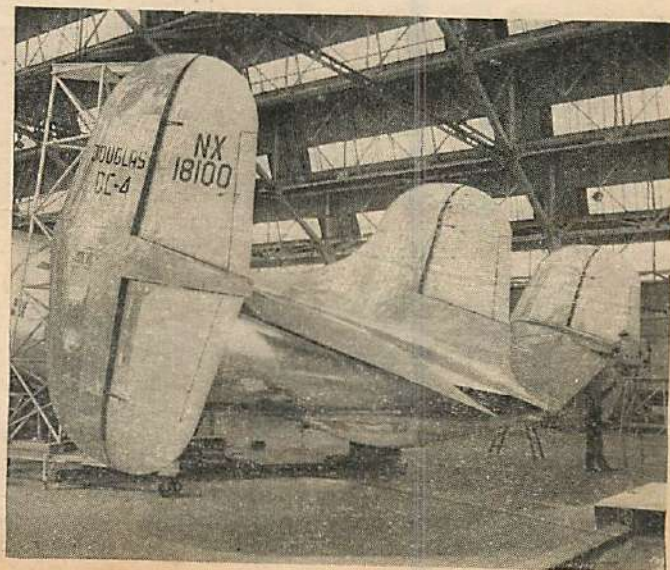
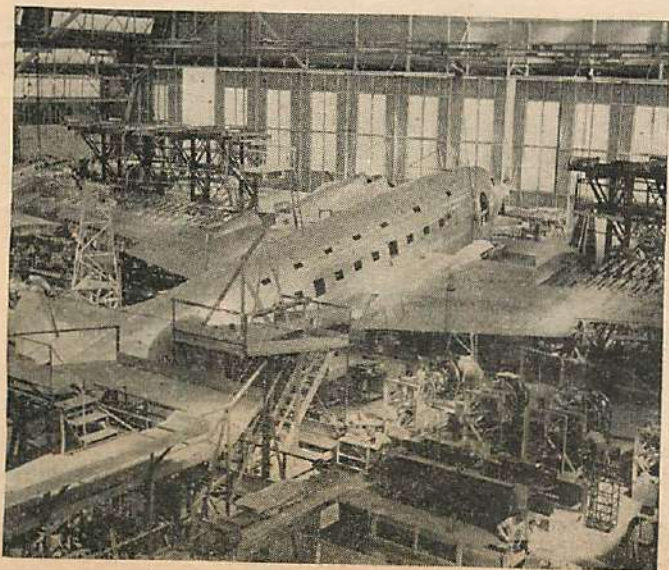
A special arrangement of steel scaffolding and hydraulic jacks permitted the complete "flight" testing of the ship while still within the hangar, a procedure new to manufacture.



Attaching the center section to the fuselage. Note that the outboard engine nacelles are already installed. Assembly, as necessitated by the plane's hugeness, was unique.



Above—A million pounds of lead were used in testing operations. Below—A closeup of the gigantic tri-ruddered tail. Note dihedral and protective bump beneath body.



WINGS OF MIST

THROUGH THE FOG OF CRIME
JUSTICE FLIES A WEIRD COURSE

By

JOHN DUBARRY

SKIMMING the fog at half throttle, Benny Welch lined the plane's nose on distant Agate Peak and on the second bridge tower, already nearly covered by the mist rolling in from the sea. When the tip of the Navy radio mast moved exactly to the windshield corner, he eased the stick forward, cut the ignition, and shut off the gas.

Immediately he was gliding into thick white silence. He seemed to stand still. There was nothing to show that he was moving. Only the airspeed indicator hovering at 63. He watched the altimeter drop, his hands tightening on the wheel, his breath slowing until his chest ached with tension and his heart beat louder and louder.

And then the bottomless fog that muffled him rested suddenly on a dark surface, and he snatched back the wheel and felt the twin floats touch.

His sense of motion returned with the blur of choppy water streaking close beneath his wings and a series of bumps across the unseen swell. With motion came sound once more—hissing thumps as the floats grooved the bay. The Waco slowed and settled.

Benny unclamped his hands from the wheel. They trembled as he wiped his moist forehead and upper lip. Well, he was down. He wished his heart would stop pounding so he could hear. He muttered meaningless curses as he slid open the side cabin window.

Through the dense gray mist came the mournful toll of a bell buoy.

His thin lips relaxed in a smile and he swore softly. Right on the nose! That was flying. It took Benny Welch to do it, after only three rehearsals—Benny Welch, the best stick-juggler who ever flew a load of snow across the international line!

Benny spat at the black water and felt the plane swing with the tide drift

while he listened to the unseen bell. It was coming nearer—just the way it should. He scrambled down on the left float and poised the noosed mooring line.

When the buoy, nodding and dipping, loomed hazily, he saw that he was drifting wide. He threw the rope. It hit the iron framework and fell off. Quickly he pulled it in and threw it again. He lurched and grasped the prop for support as he watched anxiously. The noose tightened around the tip of the swaying pyramid. He fastened the line securely to a float cross-strut and climbed back to the cabin with wet feet. The plane swung in a semicircle and the tide began to make little slapping noises against the floats.

Fog. It was like the plane was packed in dirty cotton. He hated the damn stuff. And that bell, like a funeral. It gave you the creeps. But for two grand—and for Mike Merten—

The plane rocked gently. Benny slumped in the seat. He felt once for the automatic pistol in his right pocket. Far out across the wide bay a vessel hooted in a long-drawn-out wail. Waiting was nothing. Hadn't he waited two years already? And Mike would make it. They said the Island was escape-proof. But leave it to smart Mike. He'd show up, like he'd arranged. And then—

Benny was thinking of that with musing, half-closed eyes when he heard a voice. He sat straight and peered toward the buoy.

A man was there in the water, clutching the framework. He waved an arm feebly.

Benny waved back. The man left the buoy and swam for the plane. When he reached a float, he hung there for some seconds before he dragged himself halfway up with leaden effort, to cling gasping in a limp, sodden heap. It was plain that he was very tired.

"Y'all right?" Benny called. He watched the man intently.

"Yeah." The other's voice was dull with fatigue. "Gimme a hand, fer—"

Through the fog burst the bellow of a siren that sounded startlingly near. It began low and mounted up and up until it became a wild, appalling shriek that seemed to call to the whole harbor, the whole world.

It pierced at Benny's ears, shaking him. It was the alarm! He gripped the window edge with whitened knuckles.

"Get that rope in!" he shouted. "Fast! We gotta scam outa here!"

The dripping figure below hunched itself to knees, to feet, and reached for the mooring line. Doggedly Mike Merten tugged until the plane floated close to the buoy. He thrashed the slack line until the noose slipped free.

"Bring it in here!" Benny yelled. The prison siren still screamed, but the first shock of it had passed off and he felt calmer now. The wavering agony of the siren persisted as a half-heard background to his racing thoughts, spurring them to jerking, feverish pitch. He knew again what he was going to do.

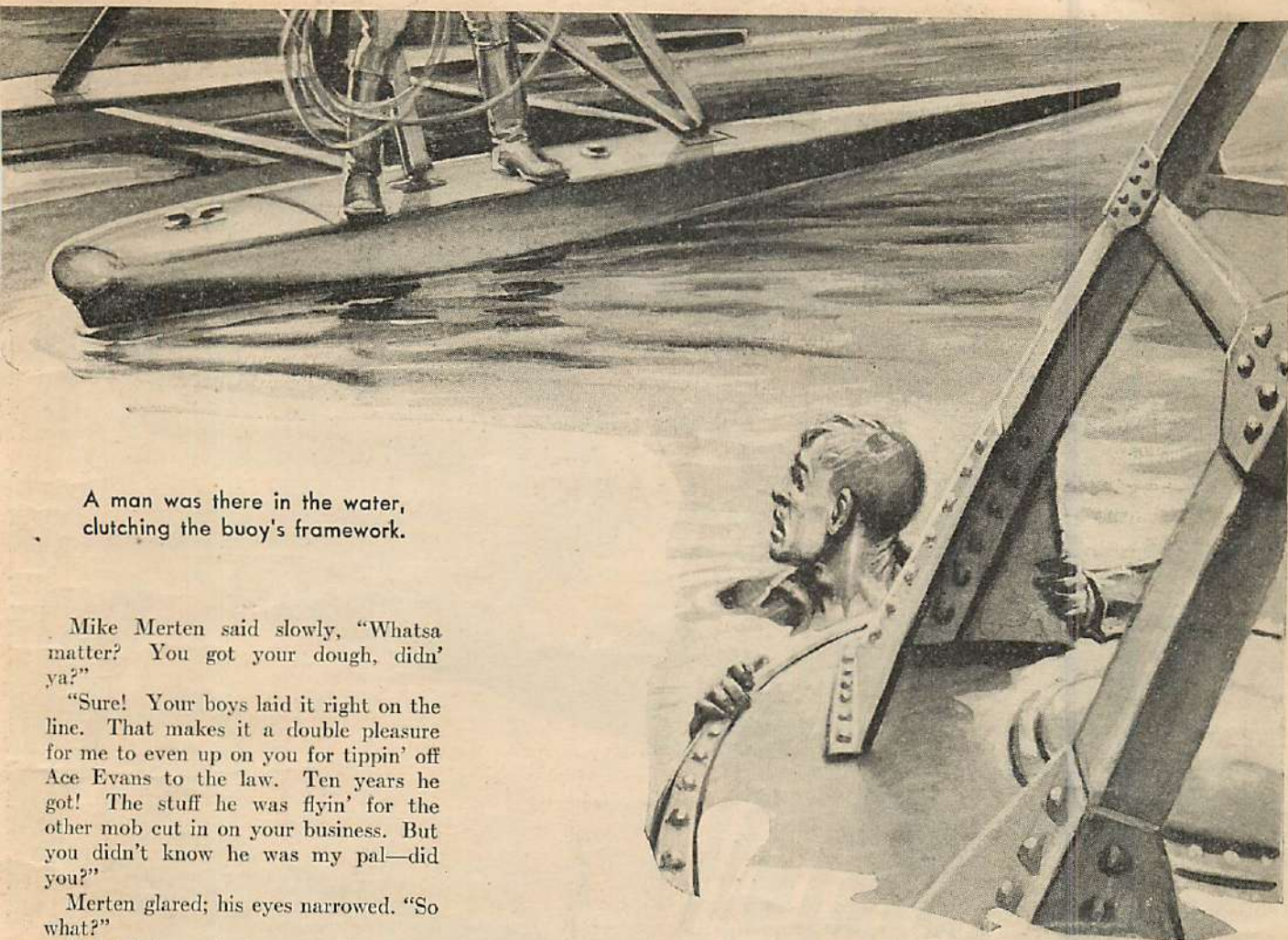
Mike Merten gathered up the rope against his body and held it with one hand while he got onto the lower wing. The plane was wheeling down with the tide, swaying as it met the swells. He staggered and clutched the cabin door that Benny pushed open.

His staring eyes were red-rimmed and his teeth chattered. The prison uniform, with its number stenciled on the breast, clung to his trembling figure.

"Hello—rat!" Benny greeted him.

Mike Merten halted at the door. He fixed those glaring, bloodshot eyes on the pilot.

"Yeah—I said rat—dirty, squealin' rat!" Benny sneered. "You think you're gonna take a ride with me, eh? Not today!"



A man was there in the water, clutching the buoy's framework.

Mike Merten said slowly, "Whatsa matter? You got your dough, didn' ya?"

"Sure! Your boys laid it right on the line. That makes it a double pleasure for me to even up on you for tippin' off Ace Evans to the law. Ten years he got! The stuff he was flyin' for the other mob cut in on your business. But you didn't know he was my pal—did you?"

Merten glared; his eyes narrowed. "So what?"

"I'd 'a' done this for nothin', just for the pleasure of tellin' you what I think of you and shovin' you back in the drink to drown! Say your prayers, rat!"

Merten let the tangle of wet rope fall and drew a knife from his pocket, a table knife that had been rubbed down to dagger sharpness.

"I just give it to a lousy screw who got in my way," he said. "I won't hang any harder for croakin' you too if you don't fly me! Get goin'!"

Benny Welch shrank back momentarily as Merten shouldered in, but then he snatched out his automatic. Merten froze.

"You ain't gonna croak nobody except yourself!" Benny snarled. "I'm leavin' here right now—but you ain't! G'wan—hit the water, or I'll weigh you down with lead!"

Their eyes clashed. Merten heaved forward. Benny pulled the trigger, but his wrist was jerking away from the knife's slashing arc as he did so, and the bullet bored the cabin roof. Merten stumbled against him. Benny whipped up the gun and bludgeoned the close-shaven skull. Merten staggered, dropping the knife.

The convict fell back through the doorway, surprise numbing his livid features. His twisting body tangled with the rope that coiled there. His clawing fingers scratched at the slippery wing sur-

face. He began to slide down the wing's curve. Then he was gone.

The siren shrieked on. Benny dropped the pistol and ground the engine starter. The big radial caught with a roar.

Through the fog ahead of him a low black shape darted across his path, spray pluming behind. The police boat! Frantically he ruddered into the prop blast. The Waco turned, picking up speed. When the compass showed ten degrees off north, he gave her everything.

The swirling mist rushed at him. It became a wall into which he drove with every nerve straining, begging for the lift that wouldn't seem to come.

Each rapid thump sent a shudder through the plane that nosed her into the next swell. But the airspeed needles crept up and with a desperate pull he lifted her off. He thought for an instant that she was going to dive in. Something was wrong. She still shuddered, but he held her steady.

And then a side glance showed the police boat angling in from the fog, with a speed almost as great as his. He couldn't bank yet. He flew straight.

Round holes leaped into the windshield and damp air struck his face. They were shooting!

His eyes measured altitude. He couldn't—yet. Just a few more feet! Inwardly cringing from the seeking bul-

lets, he waited, feeling the plane's strange shudder, grasping for the exact moment. It was—almost— Now!

He swung the wheel and ruddered gently. He felt the right wings rise. It was good. The police boat—gone. A clear getaway—

Something snatched at the plane. She seemed to falter. Air played on the left side of his face, through the open window. He was slipping!

He had just time to fold his arms before his face when she struck. He felt himself thrown forward, then buffeted around violently. Everything went dark and water poured in. Then she bounced back and floated at a slant. He picked himself up, feeling bruised and dazed.

The prop was bent, the left wing sagging. But otherwise she had survived. The cops— He felt on the floor for the pistol. It was gone.

He was a fool. Forget the pistol. They had nothing on him! Mike was gone. And the landing back there was because—engine trouble. Sure. They had nothing on him.

The motorboat came slowing through the fog. Waiting nervously, he saw them stop a dozen yards away. Men reached over the side and lifted in— A body?

There was a rope attached to it.

He saw the boat (Turn to page 98)



LEVIATHAN

OF THE AIR

Boeing answers transport's
call for a super-clipper.

BY GORDON SEAR WILLIAMS

AS the first of Boeing's huge new 41-ton super-clippers is being made ready for its initial test flights from Seattle's beautiful harbor, an excellent opportunity is

afforded us to look more closely at this engineering masterpiece and see just what has been accomplished by its world-famed manufacturer.

The development of a ship of such giant proportions, having a wing span of 152 feet and seating 80 people, has

Dressed in a flowing train of spray, the Queen of Clippers makes her entrance into the select group of American-born super-ships designed to girdle world-wide air routes.



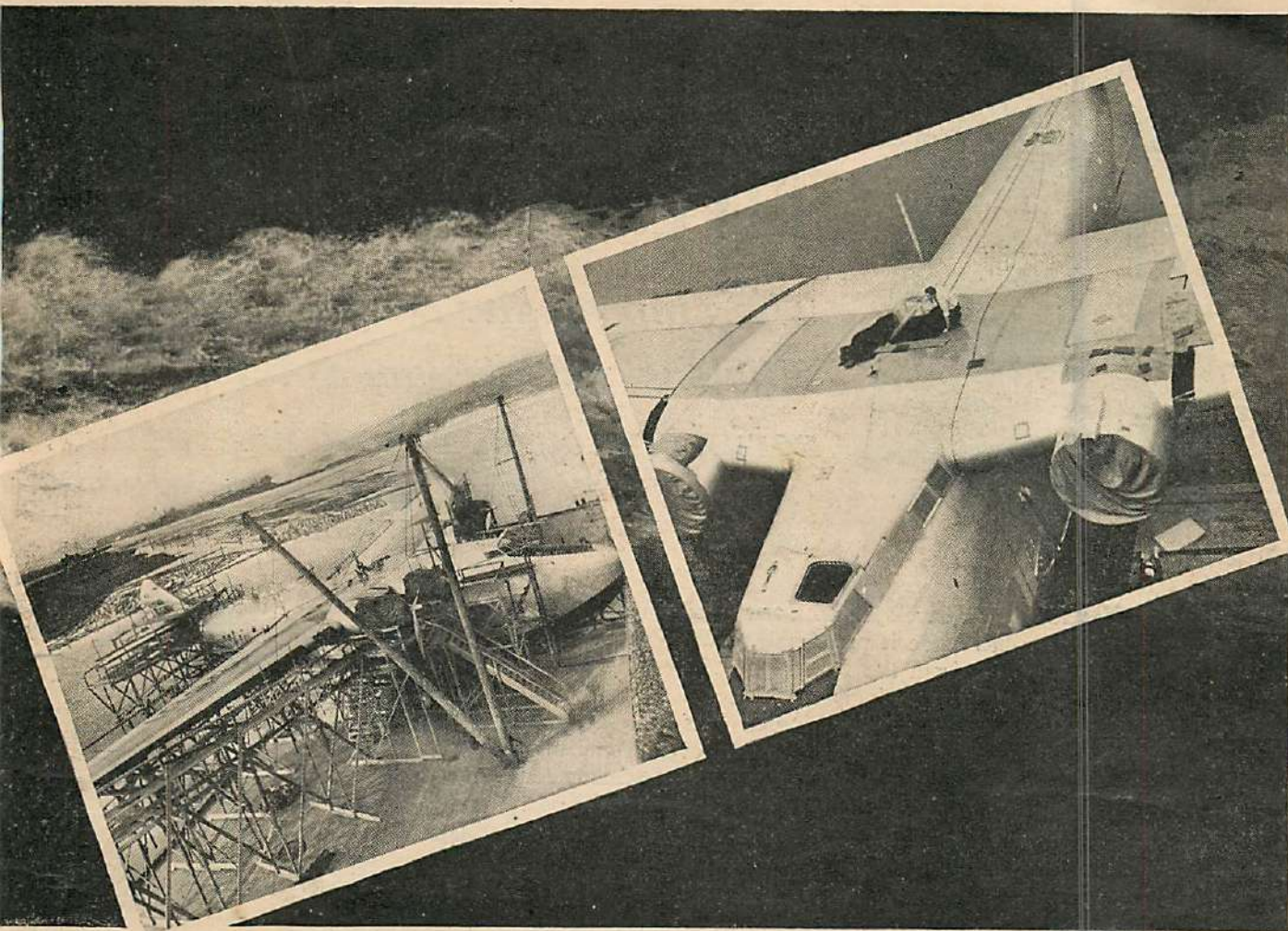
necessarily required many years of almost incessant

work. Prior to the advent of these model 314 super-clippers, Boeing had built a variety of types, ranging from

small pursuit planes to four-engined Army bombers and commercial transports. Even earlier, however, Boeing made many excellent flying boats and seaplanes, and as a matter of fact his very first plane, the B&W of 1916, was a two-place seaplane. A rapid survey of Boeing types to date shows us that no less than fifteen kinds of seaplanes have been built, many of which are still in service.

Preliminary design work, tunnel testing and structural computation for the model 314 were made early in 1936. In that year Pan-American Airways awarded a contract for six of these ships at a price of \$500,000 each. Although this flying boat is known as the model 314, only

The Boeing 314 at rest during taxi tests for a check. Note the small "sea wings" or sponsons directly under the true wings. In them are housed some of the ship's fuel tanks.



a small part of these designs has actually been built. To date, some 70 different types have been turned out at the Boeing plant, the rest of the numbers being "ghost" ships that did not leave the drawing board.

This Pan-American contract was remarkable in that it was awarded for a ship that existed only on paper. However, much valuable research work of the model 299 and the XB-15 (model 294) four-engine bombers laid an excellent foundation for the clippers. The wing as used on the model 314 is of the same type, and has substantially the same dimensions as that of the XB-15 "super-fortress" bomber. Thus, Boeing was able to service-test the structure of its mighty clipper wing before actually starting on the Pan-American contract.

One entire full-size wing of this type was built for static load tests and tested to destruction to determine its strength characteristics. It was found to have exactly the strength characteristics that had been predetermined on paper, and measured up to all expectations. This panel, a sharply tapered, cantilever span, is of a composite type, having sheet metal covering from leading edge to rear spar, and fabric from this point to the trailing edge. Two truss-type spars form the backbone of this panel, and built-up ribs of normal Boeing type complete the structure. Heavy corrugated dural sheets are riveted to the upper and lower surfaces of the wing, between the

spars, and take the main bending loads. It is to these sheets that the final smooth Alclad skin is attached.

Boeing has introduced spot-welding into these ships in a number of places. Although not as yet used in highly stressed parts, spot-welding has been found well adapted to fastening Alclad sheets together before final riveting, and is further used in non-structural parts such as floors, walls, etc. A Federal electric spot-welder, looking and operating much like a huge sewing machine, literally "sews" the metal sheets together.

Pan-American Airways has especially stressed serviceability and general robustness in these super-clippers, as speed is not nearly so important a factor on long over-sea routes as it is on the relatively short city-to-city hops of our continental airlines. Furthermore, it is safe to venture that for some years to come payload and low operating costs in over-water planes will remain more important than mere speed. In spite of the stipulation for low operating costs and large payloads, the model 314 will have a top speed of approximately 200 miles an hour, and will cruise at 150 miles per hour for some 4,000 miles. Add to this the fact that in addition to the fuel for this range, forty passengers and freight, as well as an eight-man crew, may be carried. On shorter hops up to 72 passengers can be accommodated.

The 314 has been designed and built (*Turn to page 80*)

Out of all this seeming confusion of scaffolding and derricks came the perfect finished product. Construction, because of the hugeness of the plane, was done out of doors.

An idea of the size of the 314 may be obtained from the man emerging from the glass-enclosed observation blister on the top of the fuselage. The ship will accommodate 80.



"THE EXPLORER"

The ship on the cover is the most efficient yet designed for use in aerial photography and observation.

By FRANK TINSLEY

BORN of human flight and developed with the speed of the airplane that has made it practicable, aerial photography has grown from the fumbling art of the World War period into the amazingly exact science it has become today. The possibility of sending cameras high into the air to record true "bird's-eye" views of otherwise unpicturable subjects, received but scant attention prior to 1914. A few aerial photographs of European cities were taken from kites, balloons and dirigibles and used to illustrate guide books.

The natural limitations of these camera platforms, however, precluded accurate results. The kite suffers because the camera it supports must be manipulated either from the ground or else by some elaborate mechanism. The large free balloon, while permitting the transportation of a human photographer, is at the mercy of the winds both as to its direction and speed of travel. The captive balloon provides a fairly steady platform, but is incapable of navigating from place to place in such a way as to permit the rapid or continuous photography of extended areas. The dirigible was the only satisfactory camera conveyance of pre-war days. Indeed, in many ways it is perhaps superior to the airplane for photographic purposes. Dirigibles, however, are expensive, cumbersome to handle and not always available.

Airplane photography, as we understand it today, had its birth and passed through a period of feverish development during the World War. It was a natural extension of the military airplane's function as the "eyes of the army." During the early months of the conflict the airplane was used almost exclusively for reconnaissance. Observation was visual and was recorded in notes and hurried sketches. It was soon found, however, that the capacity of the human eye for complete and rapid study of military objectives was insufficient. Moreover, the need of constant vigilance against aerial attack distracted the observer from his real task. Very early in the war, therefore, men's minds turned to photography as a means of recording for future study the details lost by human limitations.

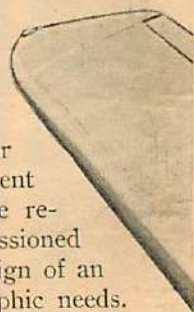
Although the inception and early development of aerial photography was almost entirely military, the principal use of the winged camera of today is for peace-

ful purposes. The preparation of accurate and comprehensive maps by this means promises to supplant older methods. Several organizations now operating in this country have become highly expert in this difficult art. Prominent among them is the Abrams Aerial Survey Corp. of Lansing, Mich. Not content with the makeshift flying equipment available for camera work, Talbert Abrams, president of the concern, assembled data on the requirements of the industry and commissioned Kenneth Ronan to superintend the design of an aircraft especially adapted to photographic needs. The happy result, a two-place plane christened the *Explorer*, provides unlimited visibility, high cruising speed, rapid rate of climb to operating altitudes, stability, oxygen-equipped cabin and long range of action.

The *Explorer* is decidedly unusual in appearance. The pilot and photographer sit in tandem in the projecting nose of a long, narrow nacelle which terminates aft in a pusher power plant. The single, cantilever wing is designed with a straight trailing edge and a swept-back leading edge which further improves visibility. On it are mounted a pair of outrigger booms which support the tail surfaces. Tricycle type landing wheels complete the unconventionality of the design.

The nacelle is of welded steel-tube construction. The forward end is almost entirely enclosed with safety glass, permitting unusually complete visibility. Aft of the leading edge, a covering of stressed dural sheet is employed. No steps are necessary to enter the nacelle as the level landing gear brings it close to the ground. A large door on either side opens directly on the pilot's and cameraman's seats, respectively. The former is seated in the extreme forward end of the machine, directly over the nose wheel. He is provided with a complete set of flight and engine instruments. Dual stick and rudder controls are available and may be operated either separately or simultaneously.

Directly behind the pilot's seat is a vertical mapping camera set in a special mounting. The lens projects through a port hole in the floor of the nacelle. This port is hermetically sealed when the camera is in place. The



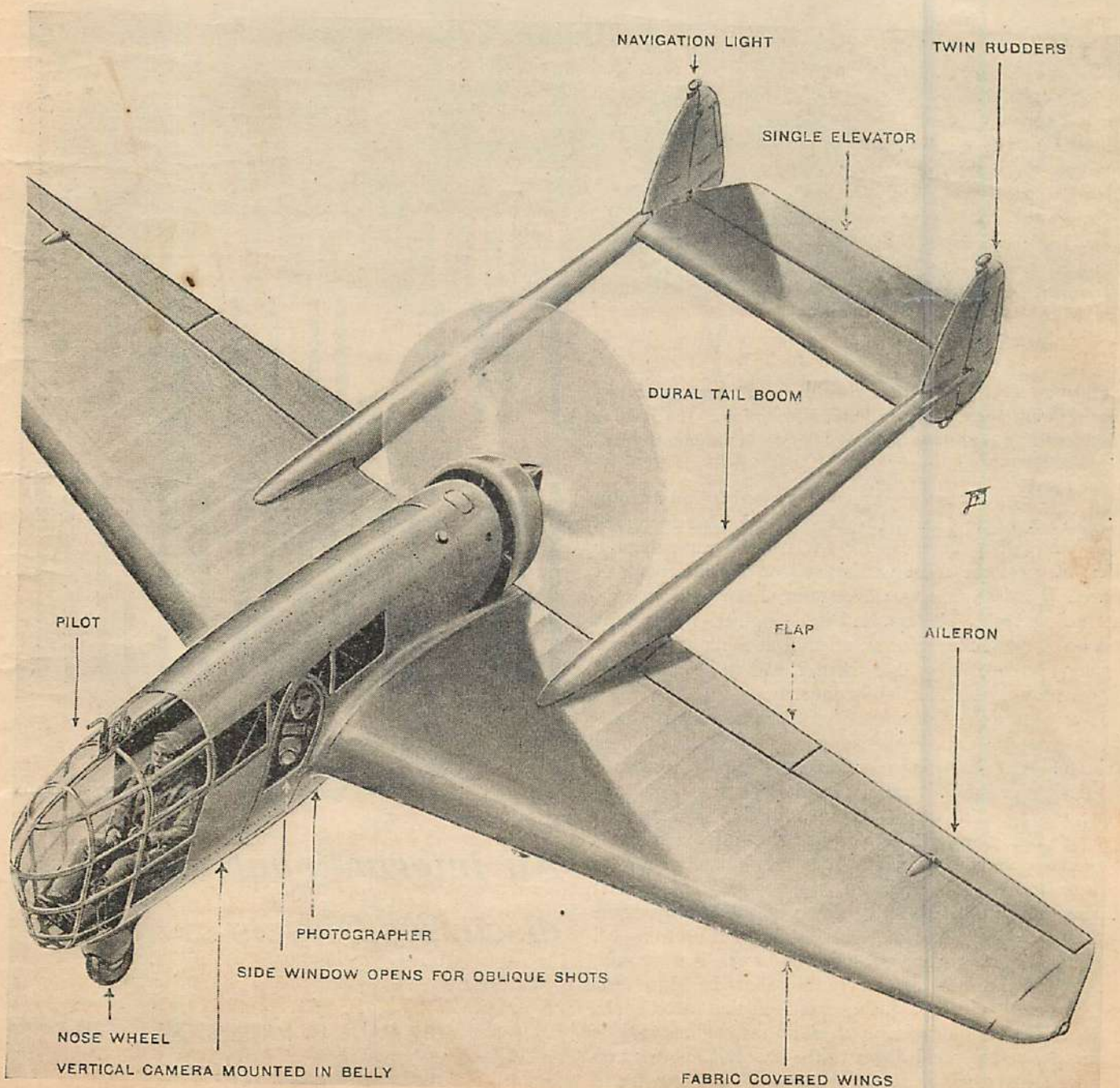
photographer sits within easy reach of the apparatus. At his left in the upper half of the entry door is inserted a large glass casement which may be opened independently for oblique angle shots with a hand camera.

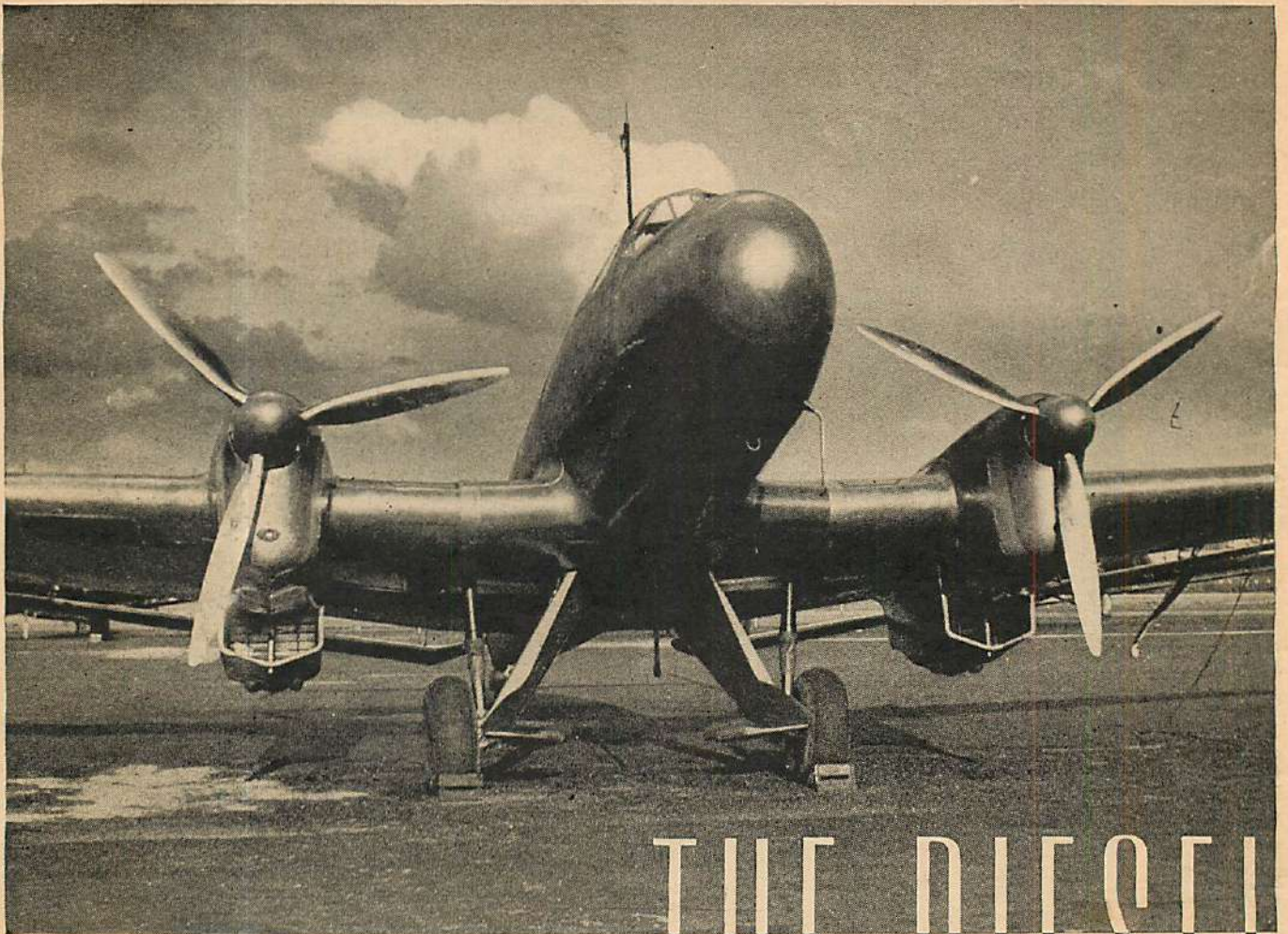
Supercharged air is circulated throughout the cabin during the high altitude flights necessary for photo-mapping. The safety-glass skin of the nacelle is sealed in and stressed to resist the resultant pressures, as are the doors and movable windows. Aft of the cabin is the main fuel tank holding 120 gallons. This, with the 10 gallons of oil carried, is sufficient to permit a cruising range of 1200 miles. Behind the tank is the power plant. It consists of a Wright "Whirlwind" R975-E1 which develops a total of 365 h.p. at 2100 r.p.m. The engine is cradled in a Lord mounting, drives a two-bladed Hamilton Standard propeller and is covered with an N.A.C.A. cowling. Although the first *Explorer* is powered with a comparatively light engine for test purposes, it is designed to take a supercharged engine of

450 h.p. allowing for greater speeds.

The wings are of the full cantilever monospar type with a structure of welded steel tubing. The center section has a metal skin and the outer panels are covered with fabric. An N.A.C.A. 23012 airfoil section is used. The ailerons are balanced and the trailing-edge type flaps are manually operated. A special device partially lowers both during take-offs to increase the wing lift and reduce the take-off run. The tail group is carried on two booms of monocoque construction, covered with a skin of stressed dural. Twin fins and rudders are connected by a single stabilizer and elevator assembly. The rudders are equipped with trimming tabs. All tail surfaces are of the cantilever type with a structure of welded steel tube and fabric covering.

The landing gear is of the tricycle, safety type. It consists of two main wheels enclosed in streamlined spats and mounted under the wings at the junctions of the wing spar and tail booms. The (Turn to page 96)





Diesel power at rest. Front view of the Junkers Ju.86 airliner showing engine and radiator installations. The Ju.86 is considered by experts to be one of the world's cleanest ships.

HAVE you ever seen a plane prepared for an attempt at a world's record? If you had been fortunate enough to have been on board the catapult ship *Westfalen* off the coast of England on the afternoon of March 27th last, you would certainly have witnessed an interesting sight. There, a Diesel-engined flying boat was being made ready for an attempt at the long-distance seaplane record, and what's more, it was to be catapulted into the air at the start of its journey.

Everywhere there was activity. Weather reports coming in over the radio were being studied and the course to be followed was being plotted on the map. Outside on the deck, the catapult rails were being greased and the plane, resting on its cradle, its tanks filled to capacity, was being carefully inspected to insure that all the controls worked to perfection. Half an hour before the time for departure, one after the other the two engines were started; roaring into life, they settled down into a healthy drone as they were warmed and gradually brought up to speed.

Finally the crew came out on deck, farewells were said, and the four intrepid airmen climbed aboard. More testing of the engines took place, and then the "zero hour" arrived. The flight captain revved up the engines to their maximum and phoned down to the catapult engineer on the deck that they were all set to go. Bracing them-

THE DIESEL THE DIESEL IN AVIATION

PART TWO

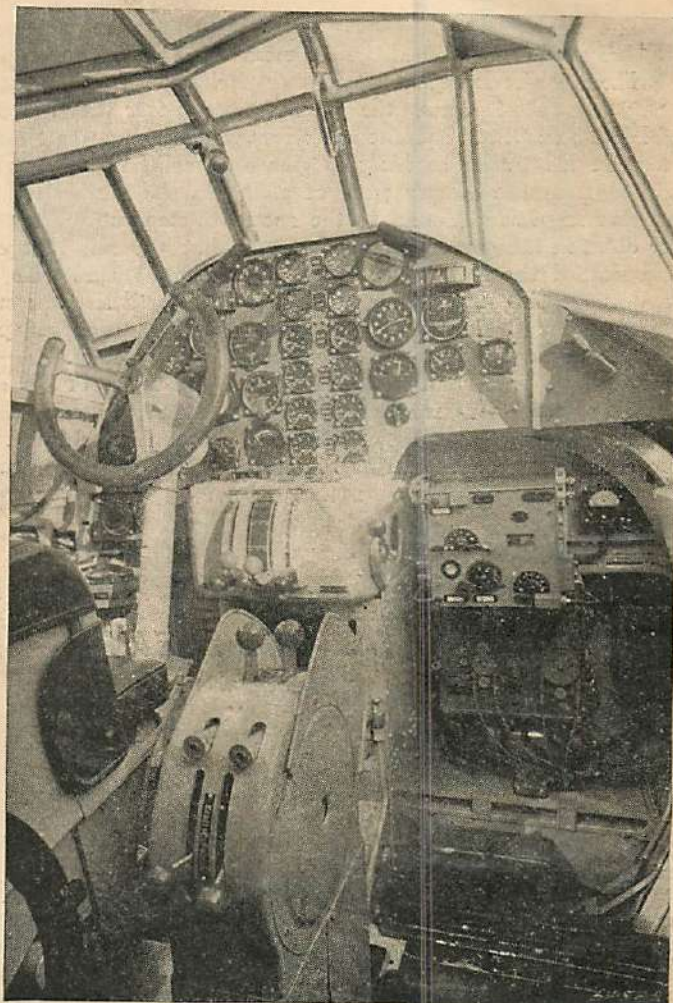
*An international authority
discusses Diesels in the air.*

By PAUL H. WILKINSON

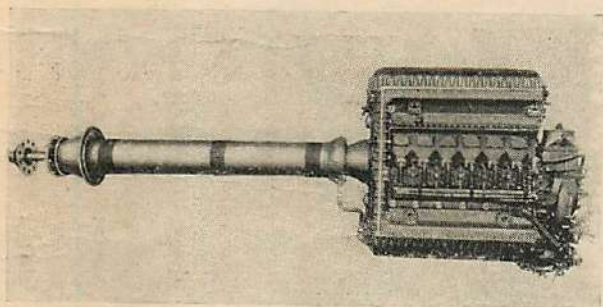
Author of "Diesel Aircraft Engines"

selves in their seats, the crew awaited the most thrilling moment of all. At last the air valve was opened and the plane, on its cradle, began to move along the rails, slowly at first and then with breathtaking rapidity as the twelve-ton craft was launched at flying speed into the air. The cradle came to rest at the end of the rails and the plane sped on, and another record-breaking attempt was under way!

The D-ANHR, as the German flying boat was marked, was catapulted from the Deutsche Luft-hansa floating base at 2:05 p.m. Greenwich Time (or 9:05 a.m. Eastern Standard Time). Piloted by Captain von Engel, it followed a southwesterly course, crossing the Bay of Biscay and then taking a bee-line over the Canary Islands and the Cape Verde Islands to Pernambuco, on the northeast coast of Brazil. From there it followed the coast line toward Rio de Janeiro. North of the Equator, favorable winds had been encountered, but after crossing the Line, side and head winds and bad weather slowed up the plane considerably. It was decided not to try and push on to Rio as had originally been intended, but to land at Caravellas, 450 miles away. There the plane touched water at 4:15 a.m. (Eastern Standard Time) on the morning of March 29th, and the flight came to an end. So successful was this 5,200-mile flight that it broke the previous record of 4,362 miles, held by Italy, and exceeded by about 1,900 miles the best flight of the United States in this category. The elapsed time from England to South America was 43 hours and ten minutes, which works out at an average speed of 120 m.p.h.



The rear engine of the Zephyr, showing the extension propeller shaft of the Junkers Jumo 205 Diesel. Below—The Nordwind ready for hoisting aboard the catapult.



The interesting cockpit arrangement of the Junkers Ju.86 airliner. The engine throttles are to the right of the pilot's seat, and in the foreground are the fuel pumps for starting.

The plane which broke the record was a Dornier Do.18 flying boat, and the engines which made this possible were Junkers Jumo 205 Diesels. Much of the success of the flight can be attributed to these engines, which showed the remarkably low fuel consumption of 0.34 pound per h.p. per hour, far below that of any other airplane engine in the world. This was not the first time, however, that the Dornier plane and the Junkers engines had put up a fine performance.

About two years ago a small group of aviation enthusiasts gathered at Port Washington on Long Island to witness the arrival of another plane that was to make history. Anxiously they waited, and at last their patience was rewarded. Far in the east a small speck appeared, and a few moments later a sleek, twin-engined flying boat flashed into sight, roared overhead with fast-beating exhausts, and glided down to a safe landing. This was the *Zephyr*, 22 hours out from the Azores on the first airmail survey flight across the North Atlantic. More important still, it was the first time that a modern Diesel-engined plane had flown in the United States.

Two days later another plane of the same type, the *Acolus*, made the crossing. Then for two months these two planes crossed and recrossed the ocean, completing eight scheduled flights without the slightest (Turn to page 85)

THE single shot pierced the darkness like a jab of swift lightning.

"Sandy" Sanders, the youngest of Bill Barnes' little squadron of flyers, froze in his tracks as his idle glance shifted from the moon's path of gold across Long Island Sound to the spot, far down in the garden, where the shot had slashed the night. He stood motionless, holding his breath, trying to peer into the shadows.

Then he saw the young woman hurry out of the garden, and he faded back behind an enormous magnolia bush in full bloom. The woman had one hand pressed against her mouth as she hur-

ried toward the hotel, and Sandy could hear her quick, frightened breathing. The fear that was evident in her every movement was almost tangible, like an evening wrap draped over her shoulders. As she hurried by him, Sandy wanted to step out and speak to her, offer help, but the sob that came from her lips stopped him. He remained watching her until she was swallowed up by the shifting throngs of people on the hotel's wide veranda.

A vision of her as he had seen her that afternoon on the boardwalk flashed through his mind. . . .

He and Bill Barnes had flown down

THE

Bill and his

A COMPLETE BILL BARNES AIR NOVEL

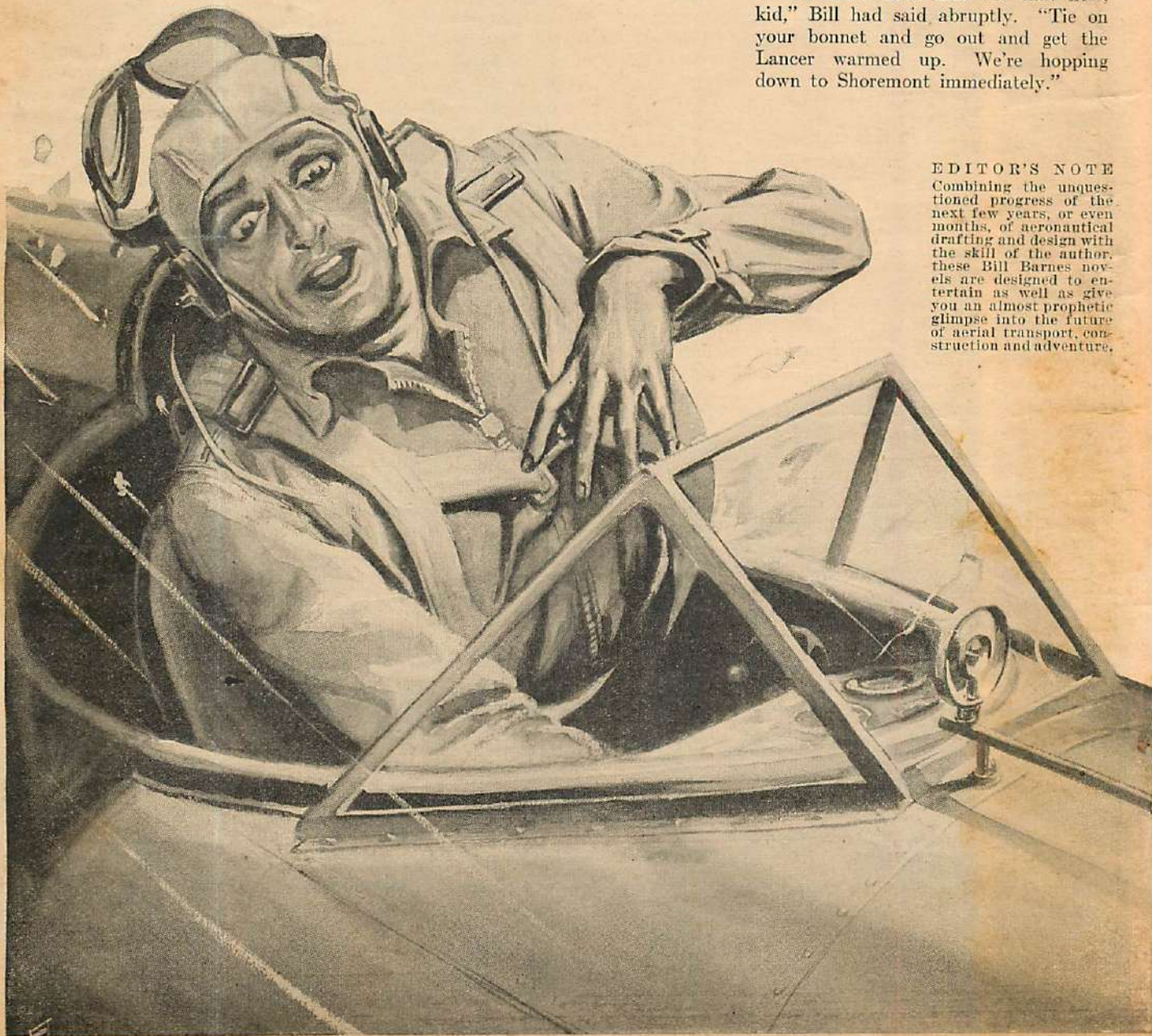
BY GEORGE L. EATON

to Shoremont, on the tip of Long Island, from Barnes Field that afternoon.

At three o'clock Bill had entered his private office to find Sandy there working over the plans of a scale model plane. Sandy had tried to show them to him.

"We don't have time for that now, kid," Bill had said abruptly. "Tie on your bonnet and go out and get the Lancer warmed up. We're hopping down to Shoremont immediately."

EDITOR'S NOTE
Combining the unquestioned progress of the next few years, or even months, of aeronautical drafting and design with the skill of the author, these Bill Barnes novels are designed to entertain as well as give you an almost prophetic glimpse into the future of aerial transport, construction and adventure.



LANCER'S LAST FLIGHT

squadron roar aloft to combat foreign intrigue—

"What's the idea?" Sandy asked. "We going down for a swim?"

"I just had a phone call from—" Bill began, then stopped suddenly. "Swim!" he roared. "What do you think this place is—a summer camp? Haul your ashes out of here and check the Lancer. We're going to Shoremont on business. I'll be out in ten minutes."

A half hour later Bill slapped the big silver bullet he called the Lancer down on the private field of the Shoremont Hotel, and they went in to register.

"You have a swim if you want to, kid," Bill said. "I'm going to be busy. If you should see me talking to anyone don't interrupt me or even speak to me. I'll meet you in our room at seven for dinner. Do you understand?"

"Hey!" Sandy said. "What you got up your sleeve, Bill?"

"A couple of Easter rabbits and a bird dog," Bill grinned. "Scram. I'll tell you about things later."

Sandy had scrambled into the ocean, and at five o'clock had taken a walk on the boardwalk. That was when he first saw the young woman.

She was with a tall, well-built man whose clothes fitted him as though he had been poured into them. The slight fringe of gray hair at his temples and the way he carried himself gave him a distinguished air that would have made him stand out in any crowd.

But Sandy didn't pay much attention

to him after he had looked at the young woman. She took his breath away, she was so attractive and so wholesome looking. He judged that she was about thirty-six years old. Her eyes were a soft, cornflower blue, and her hair, with the sun on it, was a mass of gold that seemed to have been shaped by a sculptor. She and the man were standing in front of an open-front florist's shop, and she was pinning a corsage of white violets to her frock.

Through Sandy's mind had flashed a picture of his own mother as he remembered her. He reflected that she would be just about the age of this woman if she were still living. A wave of loneliness swept over him and for a moment he was anything but the intrepid flyer who had followed Bill Barnes high above the seven seas. He was a sixteen-year-old youngster who wished he had a mother.

Then, she had turned around and her glance fell on Sandy's face. She had smiled at him, gently.

"That boy," she had said to the man with her as they started down the boardwalk, "he looks so lonely."

Sandy had colored and bowed a slight acknowledgment of her smile.

After he and Bill had finished dinner in their room, Sandy had seen her again. She was leaving the hotel veranda with another man, and without pausing to think he had followed them out into the garden. There they disappeared,

and he had stopped to admire the moonlight on the water and wonder why Bill Barnes was so uncommunicative about his errand at Shoremont.

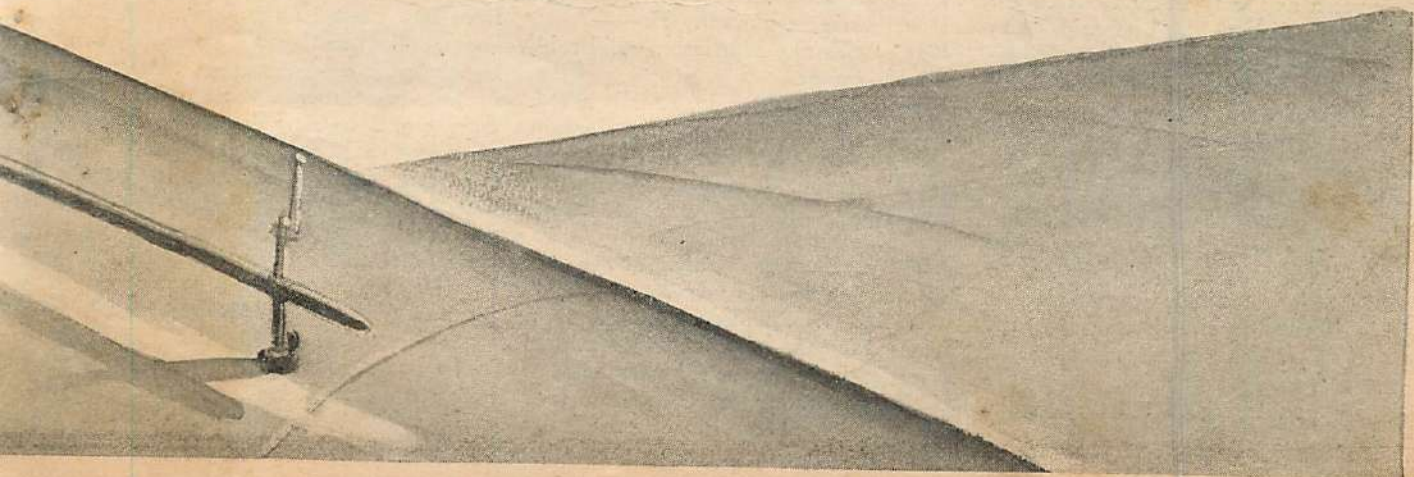
Then had come the shot. . . .

Sandy waited behind the magnolia bush for a few minutes until he was sure no one had heard the shot at the hotel, or that the man who had walked down there with her was not going to follow her back. Then he began to saunter toward the spot where the shot had been fired. It was dark and once or twice he stumbled off the path into the bushes lining it. His heart was in his mouth and his stomach felt as though he might be sick at any moment. He didn't know what he was going to find, but he was afraid for the young woman who had smiled at him.

He came to a little square bordered with a low privet hedge. There was a marble fountain in the center that sparkled and danced in the light of the moon. Sprawled out beside the fountain was the form of a man.

Breath hissing between his teeth, Sandy knelt down and felt for a wrist. He found it and knew that the man was dead. Digging a book of paper matches from his pocket, he lit one of them. The man's head was lying on a pillow made of his own blood. There was a neat hole through his temple, sur-

This time he
was too late!



rounded by powder burns, and in his right hand was a small black automatic pistol.

"She didn't do it!" Sandy said vehemently as he rose.

Then he knew that he had better get out of there and tell some one fast. But whom would he tell, and what would he say? It came to him with overwhelming suddenness that he was in a jam. If he told the police he had seen the young woman going into the garden with the man and had heard the shot fired and had seen her hurry away, it might mean her death.

Sandy's mind was a maelstrom as he took a roundabout path back to the hotel and rushed for the room telephones. He asked for his own room number and prayed that Bill would be

"It looks like murder, Bill," Sandy said. "But I tell you *she* didn't do it!"

II—ON GOVERNMENT BUSINESS

"DID you touch anything out there besides the man's wrist?" Bill asked him when he had got a straight account.

"Nothing," Sandy said.

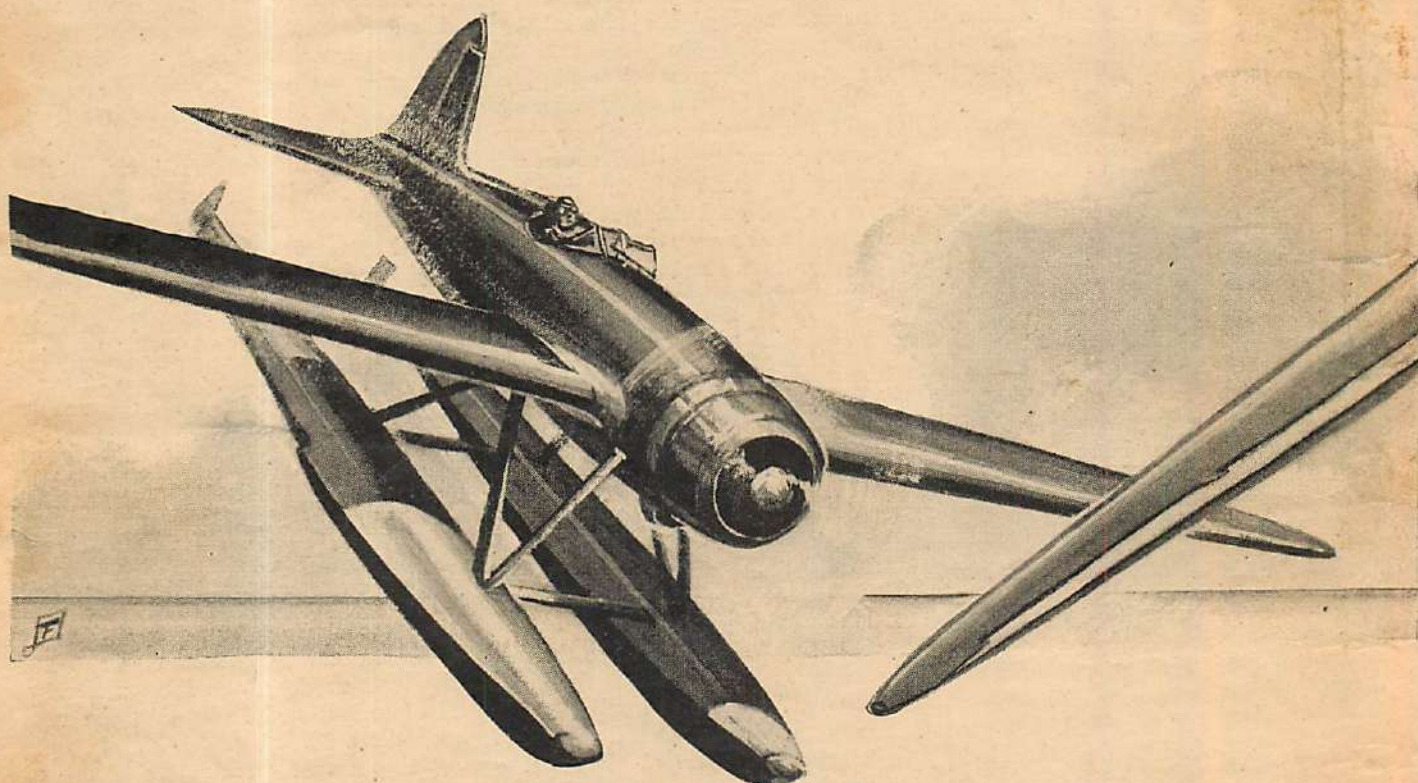
"Your footprints will be there," Bill sat down and put his forefinger in his mouth and began to chew on the knuckle. In a moment he said, "Wait a minute, kid. I want to think." Suddenly he looked up. "Give me a description of the man with her on the boardwalk this afternoon."

"Well," Sandy said, "he was tall, powerful, with gray hair at the temples, bluish eyes, well dressed. He looked

might call on me to give them a hand. They called me this afternoon and asked me to come down here. They have other men working here. I'm waiting for word from one of them."

"What's it all about, Bill?" Sandy asked.

"National defense, kid. About a week ago the general staff of the Army had a meeting—the Secretary of War and all the generals commanding the nine corps areas. At that meeting two maps of the military priorities of the new national highway system were shown. They were secret maps of new military roads that will honeycomb the United States from the Atlantic to the Pacific and from Canada to Mexico. Along with the maps were shown the plans for a new hundred-mile-an-hour



there to hear his story.

Bill's voice sounded in his ear and he said, "Wait there for me, Bill! I'm coming right up!"

Bill was standing in the doorway of their room as Sandy hurried out of the elevator. "Listen, kid," he said, "I'm expecting an important call from Washington and I want you to wait until I—"

"What I've got to say can't wait!" Sandy said, pushing him inside. "Close the door, Bill."

He was white beneath his coat of tan and freckles and his eyes were round and frightened as he began to talk so fast that his words failed to make sense.

Bill Barnes grabbed him by the lapels, shook him violently. "Shut up, kid! Get hold of yourself. What the hell are you trying to tell me? Take it easy."

He dropped the left wing and dove over the side head-first—

like a—an aristocrat. Big, with a lot of confidence in himself. He—"

"It sounds like Martinson," Bill said, half to himself.

"What had I better do?" Sandy asked.

"Nothing for the moment. I want you to listen carefully to what I'm going to tell you. I may not be able to finish. But what you've told me links with why we are here."

"Okay," Sandy said, awed at the way Bill had lowered his voice.

"I had a confidential letter from James Morton, head of the Criminal Investigation of the Department of Justice, the other day. He hinted that the Intelligence service of the Army

tank that mounts a new anti-aircraft gun.

"Around those military highways and the new mobile anti-aircraft gun is to be built the greatest air defense in the world. A fleet of those tanks can get from one coast to the other in thirty hours, and when they get there they can lay down an aerial barrage that nothing can get through. The first line of defense will be new destroyers capable of forty-five knots an hour, and they will also mount the new anti-aircraft guns. If an attacking fleet of bombing planes gets past the destroyers and their defense the tanks will be on the coast to lay down a barrage they can't get around. The War Department has worked over the military roads and the anti-aircraft gun for five years. They now have it perfected and in another two years we'll be immune.

"Good gosh, Bill," Sandy said.

"Where do you come in?"

"Because some fool made a mistake,"

Bill said. "After that meeting those plans were taken back to one of the War Department buildings in Washington to be put away in a vault. The man who had charge of them received an ordinary telephone



call from someone in authority. This person told him he was sending an engineer to look at the maps. The man in charge of them went to luncheon and told his assistant about expecting the engineer.

"The assistant got the maps out when the man came in to look at them. His credentials were perfect. While the assistant was spreading the maps out on a table the man stepped behind him and slapped him on the head with a blackjack. He then rolled up the maps, put them under his arm and strolled out of the Munitions Building with them.

Just as simple as that."

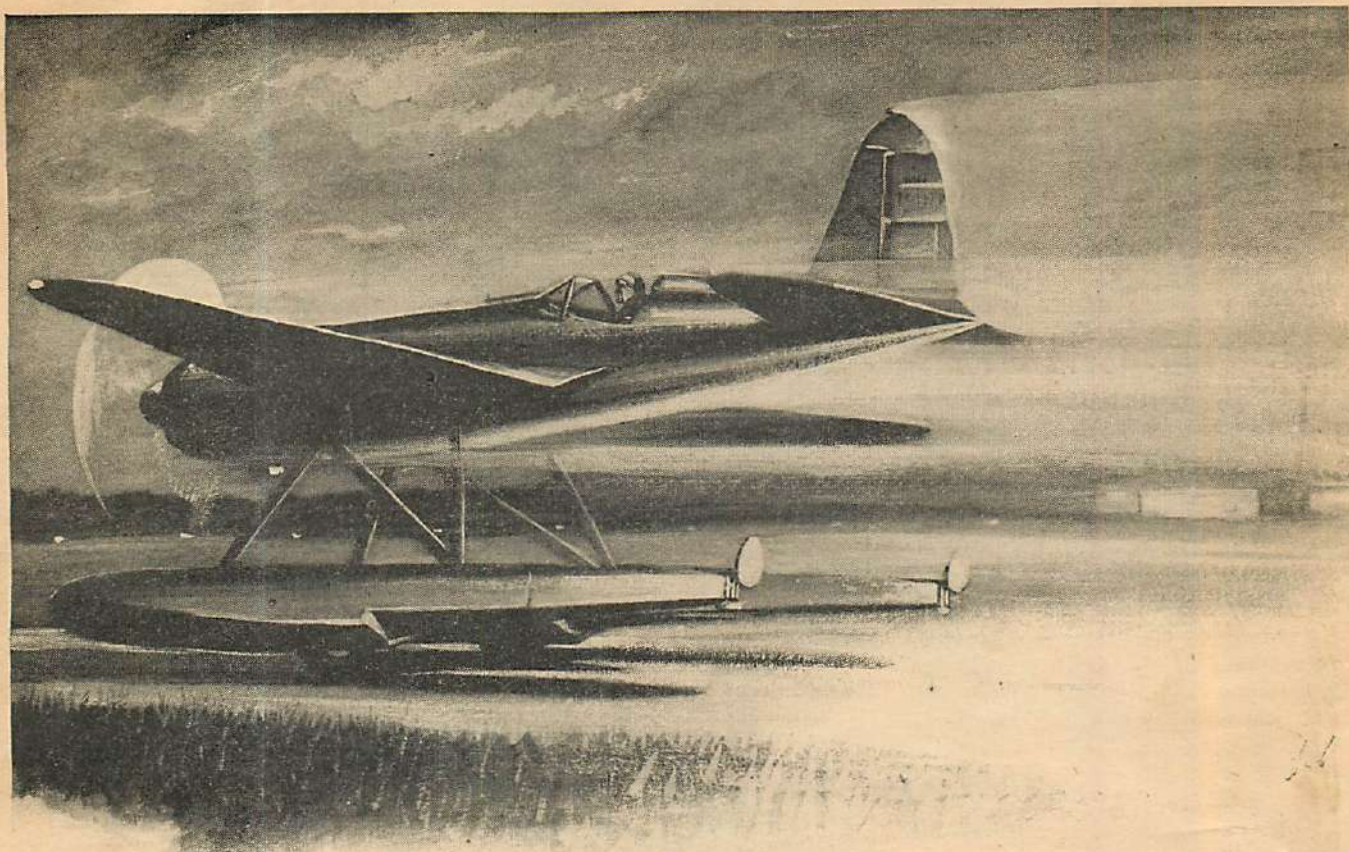
"Did he get away with it?" Sandy asked breathlessly.

"He did," Bill said grimly. "It all sounds very simple. But it wasn't. The man who committed the robbery had timed everything perfectly. He got by the first man in authority—I can't tell you his name—by presenting a forged letter from the Secretary of War. The authentic telephone call did the rest. He waited to make his visit until the

man in charge of the plans went to luncheon. He knew just what the assistant would do when he got the maps. It was perfect because of its very simplicity."

"Haven't they found him?" Sandy asked. "The assistant must have—"

"The assistant is dead with a smashed skull," Bill said. "They don't even have a description of the man. But they think they know who engineered the scheme. And they think he



is here at Shoremont now. He flew here with a fast Meredith Falcon. Secret Service men and men from the Intelligence branch are here watching every move he makes and going through his things with a fine-tooth comb. If he takes off I'm to follow him, wherever he goes. They think he has those maps and plans here with him."

"Why don't they arrest him?"

"They want the maps and plans more than they want him," Bill answered. "He's the head of an international espionage ring and he's clever enough to be in a position to laugh at them if they do arrest him. He knows they couldn't make it stick and they know it too—unless they get the actual goods on him."

"How does all this link up with what I told you?" Sandy asked. He was all eyes and ears now, almost trembling with eagerness.

"The man you described, the one with the young woman on the boardwalk this afternoon, was Clayton Martinson. He is the man they are watching. The young woman is his wife."

"But, good gosh, Bill," Sandy protested, "she's no spy. You ought to see her face. Why, she wouldn't hurt a fly. I'd stake my life on that."

"Don't do that, kid," Bill said dryly. "You might lose it. What was she doing out in the garden with this man she shot or who shot himself if she isn't mixed up in it?"

"I can't tell you that, Bill——"

He saw the black-and-orange Meredith Falcon flash down the runway under the bright floodlights——

"Well, I'll have a phone call any moment. Then we'll know more about things. We won't say anything of what you saw unless it seems necessary. What you know won't do anyone any harm or any good. I think——"

He broke off and grabbed at the telephone as its bell rang. "Barnes speaking!"

"Payne calling, Barnes," a voice said in his ear. "C. M. is checking out and having his plane warmed up. It's your cue."

"Right. Anything new?"

"Nothing," Payne said. "You'll have to use your own judgment."

"What about the man in the garden?" Bill asked.

There was a short silence and Bill could almost hear Payne thinking.

"How did you know about that?" Payne asked.

"What difference does that make? I'll explain how I knew later. Does it have any bearing on things?"

"It may. We're checking it. So far it looks like suicide. At least that's what we've decided to call it for the time being. It has all been handled very quietly."

"Do you know what actually happened?"

"Yes. You'd better get ready to shove."

"I'm on the way," Bill said. "I'll make contact with you through my field. Okay?"

"Okay," Payne said and hung up.

"Get out there fast and warm up the Lancer," Bill instructed Sandy. "And keep your mouth shut."

"But Bill——" Sandy began.

"But hell! Do as your ordered!"

"Yes, sir," Sandy said. "She'll be ready to go when you come out."

III—TRAIL TO THE NORTH

A HALF-DOZEN grease monkeys and mechanics jacked up the big sesquiplane that was the Lancer and ran her out on the apron for Sandy. He climbed into the forward cockpit, and the very hangars seemed to vibrate as he brought the twin Barnes-Diesels to life.

Young Sandy was more than a little conscious of the rôle he was playing as he sat in Bill's seat, eyes on the instrument panel, and gunned the three thousand horses in the powerful Diesels. He knew that the dozen or more spectators watching him respectfully would each have given their teeth to have been in his position. But he didn't let their apparent admiration interfere with the job at hand.

He inspected the two .50-caliber Browning machine guns that fired through troughs along the engine hous-

ing and were equipped with automatic ammunition counters and engine-driven synchronizing gear; and examined the burnished-metal, telescopic sight that was directly before his eyes. He snapped on the navigation lights on the ends of the silver, all-metal cantilever wings, and tested the emergency landing flares.

As the two triple-bladed, automatic-pitch props increased their tempo, his eyes danced back and forth across the instruments on the panel and checked the Kreusi short-wave direction finder and the Sperry automatic pilot. He lifted the infra-red-ray telescope that permitted Bill to see through fog, clouds or the black of night, checked it and let it drop back into its folding recess in the instrument panel.

After he had checked the fuel in the enormous tanks, he was satisfied with the equipment but not with the sound of the tandem Diesels that drove the twin props in different directions. He told Bill so when the latter stuck his nose over the rim of the cockpit a moment later.

Bill pointed to his ears, shook his head and thumbed Sandy into the rear cockpit. He climbed over the side and slid down into the bucket seat and adjusted the intercockpit telephone.

"What did you say, kid?" he asked.

"She's okay," Sandy said, "but she doesn't have what she used to have."

Bill sat with his head cocked slightly on one side while he nursed open the throttles and listened to the full-throated roar of the three thousand horses in the nose.

He knew, and the knowing hurt him more than he would admit even to himself, that the Lancer was not what she had been before she was rammed above the Isle of Wight and sank in ten fathoms of water. After he had brought what was left of her back from England, old "Scotty" MacCloskey, head technician and major domo on Barnes Field, had insisted she would never fly again. For Scotty MacCloskey to make such a statement about a ship that was like a grandchild to him had been almost beyond belief. But while he was mourning her loss he was figuring out in his canny mind how to make her skyworthy again.

And between them they had done it. They had nursed her back to life. But deep down in his heart Bill knew that she was not the same. He knew she had left a part of herself buried beneath the waters of the English Channel. He could feel it, but he was too loyal to her because of the way she had answered his demands a thousand and one times when his life had been the stake, to make verbal admission.

"She'll do," he now growled into his microphone. "I'm going to contact

Tony and tell him to send Shorty or Red down in a Snorter to pick you up in the morning. I—"

"Hey!" Sandy shouted. "You're going to leave me here just when the job begins to get interesting?"

"I'm going to leave you here to get acquainted with the young woman you so much admire," Bill said. "Martinson is leaving his wife here. I want you to get acquainted with her—the manager will arrange an introduction—and find out what she knows."

"Listen, I don't want to talk to any women! Good gosh, Bill!"

"Haul your fannie out of there!" Bill shouted back. "There goes Martinson. I'll contact Tony when I get in the air. Lam, kid!"

Bill's eyes were grim as he saw the black-and-orange Meredith Falcon flash down the runway under the bright floodlights and skim into the air. He released his wheel brakes and blasted the big ship around into the wind. The field melted away from under him as he raced the silver bullet down the runway. The tail lifted and he whipped the nose up with that delicate touch for which he was justly famous.

He slid back the hatch above his head and let the wind beat against his face as he laid the nose of the Lancer on the tail light of the fast-disappearing biplane. When he was a few hundred feet above and behind the speeding ship, he threw the key on his radio panel and began to chant the call letters of Barnes Field into the microphone.

"BBX answering. . . . BBX answering BB. . . . BBX answering BB," Tony Lamport, Superintendent of Communications on Barnes Field, said in his ear a moment later.

"Okay, Tony. I'm laying a course almost due west on the tail of the man I came down here to watch. Make contact with 89 in Washington and tell him. Send Shorty or Red down to the

Shoremont Hotel in the morning to pick up Sandy. I left him there. I'll keep in contact with you. I don't know what the game is yet. But I think things are going to happen. Tell Shorty to get down there early in the morning to keep an eye on Sandy. He may be in a jam by then."

"Okay, Bill. Anything else?"

"Nothing else, Tony. I'm signing off."

Bill kept his eyes on the dim outline of the ship below him. Watching his compass he saw that the biplane was beginning to bear north. Then the dark waters of Long Island Sound were under his wings and the faint outline of the Connecticut shore began to take shape.

A few moments later Bill suddenly realized another thing. He grinned silently at the cleverness of the pilot below him. While Bill had been correcting his slight drift from an easterly wind, Martinson had been letting his ship drift farther and farther off to the left. In another few minutes he would have drifted far enough away to have turned off his navigation lights, stuck his nose down in a vertical dive, and left Bill chasing a black void.

He kicked his rudder and skidded the Lancer off to left until the biplane's lights were directly under him again. Then he began to speculate on the destination of Martinson. He glanced at his compass, snapped on a light above the map rack. Drawing out a chart, he studied it for a moment and decided that Canada was the logical place.

When the Catskill Mountains loomed up black and menacing behind the lights of the river towns along the Hudson Valley, Bill became certain that Canada was his goal. He settled back in his bucket seat and put his automatic pilot to work.

The Mohawk River poured its dark waters into the Hudson and then the Hudson, above Albany, dwindled until it was little more than a swollen creek.

On and on they sped through the night above the dark, silent countryside, their motors throbbing out a rattle of thunder. As the Adirondack Mountains towered into the night ahead, Martinson nosed the black-and-orange biplane upward, and Bill once more climbed above him.

The tedious roar of the Lancer's motors was making Bill more and more sleepy. He was trying to figure out just how to handle the situation when they both would set their ships down on the airport at Montreal. He wondered whether the Secret Service would have any authority or dare take any action on Canadian soil.

He was so immersed in his thoughts that he didn't notice Martinson whip his ship up in a flashing chandelle. He didn't realize the other was not still be-

Farewell to the Lancer—



low him until he was diving back with machine-gun bullets and fire jetting from twin troughs along his engine housing.

Bill cursed himself as he slapped the control stick of the Lancer to the right and kicked his rudder. For one brief instant the black mass of the Adirondacks swung out from under him in a dizzy circle, and the brilliant moon danced across the night sky. He neutralized his controls for an instant and yanked the stick back into his stomach, as a black cloud hurtled above him and began to turn tightly to the right.

His nose came up, and for one brief moment the black cloud that had become a biplane appeared under his sights. Grimly he clamped down on his gun trips and his powerful .50-caliber weapons belched lead and flame. Feathery wisps of smoke from his tracers floated off the starboard wing of the fast biplane, and Bill knew that he had overestimated the speed of the other's turn.

A hard-bitten grin came to Bill's face. He made a slight bow to the pilot of the black ship. He knew now that the men who had told him about the cleverness of Martinson had not exaggerated. He knew that only a cool, cagy combat pilot would have slowed up his turn as Bill zoomed up beneath him after his dive. The ordinary pilot would have tightened the turn, so that he would have run directly into Bill's bullets. But Martinson had slowed it, causing Bill to overshoot his target.

As he continued his climbing turn, Bill could see him looking back and down in the bright moonlight, waiting to learn what he himself was going to do. Bill cut his throttles for a moment and waited until the black ship was nearly around, then opened them wide and hung the Lancer on its two three-bladed props and came up beneath him. But the biplane skidded out of range as though his intentions had been telegraphed.

Suddenly, it came to Bill clearly that the dive-and-zoom method of fighting was Martinson's particular dish. He had handled that first attack with the skill of a master pilot.

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

Then they began to circle, seeking an opening, like a pair of skillful boxers feinting at long range, until Bill threw discretion to the winds and closed in to

try the man's skill at infighting. His spirits surged as he got Martinson under his sights for an instant. But before his guns could speak the biplane had reversed its direction, and the two ships whirled into a series of Immelmans that turned the sky into a flaming inferno of noise and spitting exhausts as the motors wailed their screaming protests and the machine guns throbbed their deadly litany. Up and over they looped and rolled, firing burst after burst without telling effect, passing and repassing with only the breadth of a gnat's wing between their wing tips.

It was a duel to the death such as Bill had never fought before. He realized now and admitted to himself at last that the Lancer was not what she should be. She was like an old race horse that has reached an age where it can no longer depend on its speed to win, but must trust to the skill of its jockey. For one of the few times in his life Bill was fighting with a ship whose speed and maneuverability did not match his opponent's. And he knew that Martinson was his equal as a combat pilot.

He cursed softly to himself as he felt Martinson's bullets driving into his port wing. He flipped over in a half roll to throw the black ship off his tail, and whipped up and back to get it under his sights. But again the biplane slipped away as though some invisible giant was controlling its destiny with a set of puppet strings.

And then, so suddenly that Bill could not believe what he saw, the sky seemed to be filled with slashing, roaring black biplanes. He hung the Lancer on her props as Martinson's ship stuck its nose down in a vertical dive and pulled out of the fight. The other planes—they resolved themselves to two in number—came toward him, and Bill realized that he had been tricked into following Martinson to a rendezvous where these henchmen were waiting for him. Martinson had engaged him in combat so that these two fast fighters could find them. Now he had peeled off to go where he had intended to in the first place.

The new enemies were like darting hawks as they converged their fire to get Bill between them. They were everywhere, charging in from all angles, their guns screaming lead. Bill managed to pick up Martinson's navigation lights far to the south as he rolled the Lancer out of range of their bullets. Then he went to work. He could feel his blood pounding in his throat with the rage that engulfed him. And he knew that he had to coordinate with the speed of light if he was to survive the onslaught of those two biplanes. He eased the throttles of the Lancer open another notch. He saw his bullets tracing designs on the side of one of

the black ships, but the pilot survived as though he bore a charmed life.

Bill felt the Lancer buck and shiver as bullets drove into it. He fought on, his face a mask of tense concentration, whipping the Lancer as a jockey would whip a tired horse. He talked to it, he cursed it, he begged it as he zoomed and dove and rolled to avoid the fire of those two fast fighters. He knew only too well that one lone error in judgment would mean his death.

Then the two ships got him inside a tight circle he could not break out of. Each time he tried a terrific burst of fire across his nose drove him back where they could get him ready for the kill. Bill's breath whistled in his nostrils. His body was soaked with perspiration, and his arms and legs were as heavy as lead. It did not seem possible that he could survive the terrific concentration of gunfire turned on him.

Then the two ships began to tighten their circle again, their guns yammering constantly. Bill waited now, waited until one of them would, in a split fraction of a second, make an error.

He cut his throttles until one plane was nearly on his tail. Then he whipped the Lancer around in a climbing turn that was so fast that his exhaust pipes were just a blurred glow in the night air. The next instant his bullets were driving up through the belly of the fuselage of one of the black biplanes. The biplane bucked and then the nose shot upward, only to fall away a moment later.

The black ship became a great mass of smoke and orange flame as it plunged to its death toward the mountains below.

Bill yanked the Lancer out of its climbing turn. The single black biplane that was left was diving on him as he began a turn to the right. He increased the tightness of his turn, felt his ship tremble, knew that she had had enough.

"All right old girl," he said as he might have spoken to a human being. He stuck the Lancer's nose toward the black vault of heaven.

The single black biplane pulled out of its dive and started to follow him. Two thousand feet separated them as they climbed steadily upward. At twenty thousand feet Bill closed his hatches and turned on his oxygen. He saw the other ship wallowing as it reached the twenty-two thousand mark, and he realized that it had found its ceiling.

Snapping on the light above his chart rack, he settled back in his bucket seat as he headed for an invisible Barnes Field. He closed his burning eyes for a few seconds, but rest was impossible.

He flicked the key on his radio panel and spoke into the microphone.



"Calling BBX. . . BB calling BBX. . . BB calling BBX," he chanted wearily. His mind ached; his body ached, and he was sick at heart.

"BBX answering BB. . . Go ahead, Bill," Tony said in his ear.

"Listen, Tony! Send out a broadcast to all airports to check on a Meredith Falcon that mounts two machine guns. Make it confidential. Keep it from the papers. Have Shorty and Red and Bev stand by their ships ready to take the air if you get any trace of it. I'll go back to Shoremont and pick up Sandy. I may be able to pick up its trail again from there."

"Did you lose it, Bill?" Tony asked. "Are you all right?"

"I lost it and I'm all right," Bill said. "I'm all right except that I'm growing old along with the Lancer. We can't either one of us take it any more, Tony. Contact 89 in Washington and let him know and get orders from him."

"Are you sure you're all right, Bill?" Tony asked anxiously.

"Yes!" Bill shouted. He was angry with himself and the whole world.

"You'll be back here after you pick up Sandy?" Tony asked.

"In the morning. I've got to have some sleep. An old man needs a lot of sleep, Tony."

There was a silence for a moment and then another voice came over the radio. The voice of Shorty Hassfurth, Bill's right arm and chief of staff. "What's the matter, fellah?" he asked gently. "Do you want me to hop a Snorter out to meet you?"

"No," Bill said, managing a bitter laugh. "I can get home alone in the dark. Tell Tony to make the proper reports on a black-and-orange Meredith Falcon that attacked me and I shot down over the Adirondacks. That's all. I'm signing off."

IV—THE MURDERER

BILL BARNES was more than a little disgusted with himself when he made a check of the Lancer at Shoremont. He found that one of his wings had a half-dozen bullet holes through it and his tail assembly another dozen.

He was in no mood to talk to a woman when he found Sandy with Mrs. Martinson in the lounge of the big hotel. It was nearly twelve o'clock at night and the place was deserted, except for the basement grill, from which came the strains of a swing band. But Bill was instantly struck by the wholesome sweetness of the woman when Sandy introduced them. In spite of the fact

"He was behind us before either of us realized it."

that her eyes were red and swollen from crying she was still beautiful. She was pathetically afraid, but her inherent pride and courage kept her from going completely to pieces.

"We—we've been talking, Bill," Sandy said. "I told Mrs. Martinson I saw her coming out of the garden after that shot was fired and—"

"Has anyone questioned you about being out there?" Bill interrupted.

"No," she said. "No one seems to have known I was there. I don't know what to do."

"Perhaps I can help you decide," Bill said. "There may be some things you don't know that will help you. First, tell me how long you have been married to Clayton Martinson."

A little pucker appeared between her frightened eyes, and for a moment Bill was afraid she was going to start crying again.

"Six—no, seven months," she said.

"Where did you meet him? Do you know anything about his business?"

"In Paris," she said. "A mutual friend introduced us. We fell desperately in love at once and were married a week after we met. I have never asked him about his business. I didn't care about any of those things. They seemed of no importance compared to the thought of always being with him."

"Haven't you wondered where all the money came from that he spends so freely?"

"Yes," she answered slowly, "but I never asked him. I decided it was none of my affair if he didn't want to tell me. We have moved around so fast that I haven't had much time for serious thought. It has all been a beautiful dream."

"Yes," Bill said grimly, "and it's going to be tough waking up. I wish I didn't have to tell you what I'm going to tell you, Mrs. Martinson. Perhaps I'm a sap to do it. Perhaps you're not the naïve person I believe you are. You may be as clever as your husband. But for some reason I believe in you."

She didn't answer, just stared into his eyes.

"You want to hear?" Bill asked.

"Yes," she said in a whisper.

"Your husband, Mrs. Martinson, is the cleverest thief alive today!"

"Hey, Bill—" Sandy exclaimed as a little moan came from the woman's lips.

"I don't think it's much harder for you to hear what I'm saying than it is for me to say it," Bill went on. "I don't mean he is an ordinary thief. He is far from it. He deals in the most deadly things in the world. He is an international spy, Mrs. Martinson. His mother was a Russian, as you know, of course, and his father an Englishman. He flew with the Russians during the World

War and after it. He deals in plans and maps of fortifications. He steals the military information of one country and sells it to the highest bidder. He doesn't work for any one nation. He doesn't play any favorites. He will steal—"

"Oh! Oh!" she said and buried her face in her handkerchief.

"Listen, Bill, aren't you being pretty rough?" Sandy's face was crimson.

"It has to be said," Bill said. "It's better to have her know than to get her mixed up in it. She's in a jam now and she's got to clear her skirts so that she doesn't get in deeper. I'm trying to help her."

She lifted her face, and although she was deathly white her eyes seemed clearer because of the courage and pride that shone in them. "Yes," she said. "It is better that you tell me. Sometimes I've been afraid it would all end this way. Desperately afraid. It did not seem possible that anyone could be so happy. Yet sometimes I noticed little things about him—things I didn't like. Tonight I knew the things I suspected were true."

"He introduced you to the man with whom you walked in the garden?"

"Yes. They met in the lobby. It seemed like a chance meeting of old friends. He suggested a walk in the garden. We started out—the three of us. Then Clayton excused himself. He said he had forgotten something, cigarettes, I think. He said he would meet us down at the end where we could see the moon on the water. We walked to the fountain and waited. We were standing there and—"

She broke off and began to tremble.

"And suddenly someone appeared beside you and shot Weyer, the man you were with," Bill said.

She nodded her head.

"He appeared in the shrubbery behind us before either of us realized it. I saw his gun flame in the darkness and Mr. Weyer collapsed. Then he—"

"He wiped his handkerchief over the gun, bent down and put it in Weyer's hand," Bill said. "Then he took something out of Weyer's pocket."

"That's right," she whispered. "When he straightened up, I could see his face in the light of the moon. It was—"

"It was your husband," Bill supplied.

Again she nodded her head in mute surrender. "I didn't know what to do," she went on, trying desperately to keep control of herself. "I ran back to the hotel. He disappeared into the bushes without speaking a word. But I knew him. When I got back to our room I was in a state of collapse. He was there, changing his clothes. I couldn't believe my eyes. He got me some brandy and seemed so concerned about

my condition. He asked me what had happened and I didn't tell him because I didn't know what to say. I just stared at him and said I had left Mr. Weyer in the garden. It sounds insane. But I couldn't think. He was so casual. He said he had forgotten all about an engagement he had. That he was changing his clothes to fly some place to be there early in the morning. He said he would be back sometime tomorrow and I was to wait here for him.

"I was beginning to get hold of myself by then and I convinced myself that I hadn't seen him in the garden. He was hurrying, rushing around, throwing things into a bag. He was concerned about me. Said he would wire the people he had to see that he couldn't come. That convinced me I hadn't seen him in the garden. It didn't seem possible that a man could commit murder and then act as he acted."

"Acting is the word for it," Bill said. "Weyer stole some military maps and the plans of an anti-aircraft gun in Washington for your husband. Evidently your husband was having some trouble getting them from Weyer. Probably because of price. Your husband had an engagement some place to sell those maps and plans. Weyer's refusal to give them up might have prevented the sale. Your husband took the easiest way to get them."

"But to involve me!" she said. "How could he do that after—"

"Your husband would involve anyone under any circumstances," Bill said. "He is that kind of person. If he has confided anything to you or has given you any papers or told you anything that you were not to repeat, you must tell me."

Her hand flew to a spot above her heart this time and her head lifted in angry pride. "Because he is that kind of person does not mean that I am, Mr. Barnes," she said. "It seems that life ends for me tonight, but that does not mean that I must be guilty of the same treachery of which he is capable. Remember, I loved him. I still love him as I knew him. Until now. He was my husband."

Bill's hard-bitten face softened for an instant. "I understand. And I admire you tremendously. Not many people could take what you've just heard in the way you've done. Now, I was sent here to follow your husband if he tried to leave. It was almost certain that if he left in his plane he would have those plans with him, and I was supposed to get them. I followed him north for nearly three hundred miles." He related what had taken place, then asked, "Have you any idea in the world where he was going tonight? Did he say anything that you can remember to give me a clue?"



Sylvia Martinson

"He was looking at a map," she said, "and he left— No, he didn't say anything to me that would give you a clue. I—"

"Okay," Bill said suddenly, and got to his feet. "I'm going to get some sleep now. Excuse me while I telephone Barnes Field. I'll be back in a moment."

V—THE CROSS-MARK

BILL went into the lobby, out of their sight, and motioned to a tall, dark-haired man who was lounging against the cigar stand. The man seemed to be half asleep as he first looked at Bill, but when Bill motioned to him he became very much awake and followed him around a corner behind the desk.

"Listen, Payne," Bill said, "you've got a pass key to Mrs. Martinson's room?"

"In my pocket."

"Get up there fast and see if you can find a map Martinson left there. I'll go back in the lobby and talk to her and to Sanders until I see you again. Okay?"

"Okay," Payne said. He moved toward the elevators at amazing speed considering he wasn't running.

Bill returned to the lounge, and he could not help feeling a terrific pang of remorse as he looked into Sylvia Martinson's tragic face.

"You'd better try to get some sleep," he said. "No one will bother you. I want you to know that. There are Secret Service men here who know how Weyer was killed and who killed him. You'll have to talk to them sooner or later, confidentially. But they won't make any trouble for you. You see, they have been checking both of you ever since you were married. They know more about you than you know about yourself. And they know you have nothing to do with his actions. But don't try to hold anything out on them. They're keeping the whole thing very quiet because they want to get those plans and maps back first, above everything else."

"I—I suppose I should hate you for the things you've told me," she said, "but I don't. I appreciate how hard it was to tell me. And I know they are true."

"You're a thoroughbred," Bill said. "Sanders is going to stay here at Shoremont. He'll do anything he can to help you."

"I—I don't know what to do."

"Get some sleep first," Bill advised her. "Sandy, I'm going back to Barnes Field now. I'll send Shorty down with a Snorter in the morning. Also Red. They'll leave one of them here for you in case you need it. I'll get in touch with you tomorrow."

"Right," Sandy said.

"Good night," Mrs. Martinson said. She held out her hand to Bill.

"Good night, Mrs. Martinson," Bill said softly. "You've got what it takes. You'd better call the doctor and get some sleeping pills from him."

"I will," she said. "Good night, Sandy."

They watched her trim little figure disappear into the lobby.

"Listen, you big baboon!" Sandy said, his eyes snapping, "did you have to get so tough with her? She—she's a wonderful person."

"I did it for her sake, kid. I wanted to drive the whole thing home to her. It will be better that way. And now, you listen. I want you to stick with her every minute. Her husband probably will try to get in touch with her. Get her to talk. We've got to find him. The minute you learn anything telephone Tony. I'll be in touch with him. Don't miss a trick. This guy Martinson made a sap of me tonight and I'm going to find him and get those papers if it's the last thing I do alive."

"Okay," Sandy said. "But don't think I'm going to double-cross her."

"No one wants you to double-cross her, Galahad."

"Here you are, Barnes," the angular, grinning Payne said behind Bill.

Bill whirled and reached for the map Payne held in his hand. He unfolded it and saw that it was a map of the New England States. An exclamation escaped him on discovering a little cross that had been made with a pencil. The cross indicated a small lake at the northern end of New Hampshire, very close to the Canadian border.

"That might be it," he said to himself. And aloud to Payne, "Thanks. I think this may do the trick. Anything new?"

"Nothing. We're waiting for you."

"You'll be hearing from me," Bill said, starting toward the door. "Good night."

Three minutes later he was whipping the Lancer off the end of the field and taking it upstairs in a long, low climb.

At three thousand feet he leveled off and watched his airspeed indicator climb to four hundred miles an hour. The towns of Long Island were dark and silent as he raced above them. Presently he saw the powerful floodlights flash on Barnes Field as the electric eye in the traffic tower picked him up.

He glanced down at the illuminated wind sock and came around in a sweeping half turn. His four wheels kissed the runway as one, and his engines blasted again as he taxied up to the apron.

Old Scotty MacCloskey, Shorty Hass-further, Eric (the Red) Gleason and Beverly Bates, the youngest of his

The black ship became a mass of smoke and flame—

carry out my assignment in spite of them. I'm going to get this Martinson and those plans and maps or go into the business of making baby carriages for half-witted children. I ought to know something about *that*.

"But right now I've got to get some sleep. I'll contact you in the morning from New Hampshire."

After they had filed

flyers next to Sandy, were on the apron to meet him. He killed the two fifteen-hundred h.p. super-charged Diesels and dropped over the side.

"Have Martin go to work on the Lancer," he told Scotty. "I'll be using her again in a couple of hours."

"You need some sleep, fellah," Red Gleason said.

"Yeah!" Bill rasped. "I need a lot of things I'm not going to get. Come on over to my cottage, all of you. I want to talk to you for five minutes. Then I'm going to bed."

They spread themselves around in easy chairs while Bill spoke. He told them all the things that had occurred since leaving the field that afternoon, and then asked for their opinions.

"I think you've got it sized up about right, Bill," Shorty said. "Weyer was holding out on Martinson and got himself killed for his trouble. The Secret Service must be putting on a lot of pressure to keep it all quiet."

"You know the way they work in this espionage game," Bill said. "It's every man for himself. If Germany sends a man into France, or vice versa, and the man is caught seeking military information, it's his tough luck. His government can't help him, no one can help him. He has to take it and like it. It's a dangerous game."

"Do you think Martinson really went to that place in New Hampshire?" Bev Bates asked.

"I don't know. It might as well be there as anywhere else. That spot was marked on the map he was reading just before he left. Tony hasn't been able to

learn anything about him. He hasn't landed on any commercial field in the United States or Canada. It's like hunting for the proverbial needle in the haystack. That is the best lead I have. I'm going to get a little sleep and then hop up there so I'll arrive at about dawn and be able to find the place."

"Do you want any of us to go with you?" Shorty asked.

"No," Bill said. "I want you and Red to fly two Snorters down to Shoremont at dawn. Leave one of them there for Sandy. Then both of you come back here and stand by along with Bev. I want all three of you ready to take to the air at a moment's notice."

"If you receive word that Martinson has landed some place, I want you to get there fast and get him. And I want you to hold him, under any circumstances, until I can get there. I was assigned to the job of staying on his tail if he left Shoremont and I flubbed it."

"You couldn't know he was leading you into a trap," Red Gleason said in defense.

"The hell I couldn't!" Bill snapped. "It's my job to watch out for traps and

out of the room he threw himself on his bed with all his clothes on. In thirty seconds he was fast asleep.

VI—AT GUYOT LAKE

OLD CHARLIE, the cook on Barnes Field, wakened Bill at four o'clock, bringing in orange juice, toast and coffee. Bill slapped cold water on his face, cursing softly, and started gulping the food.

"The Lancer's ready?" he asked.

"Yes, sir," Charlie said, "she's warmed up and ready to go. Scotty has been tinkering with her for two hours."

"She needs it."

Ten minutes later Bill was out on the apron talking to Scotty. The twin opposed props of the Lancer were ticking over slowly, making large discs of shimmering light under the bright floodlights. Old Scotty shook his head sadly as Bill asked him about the Lancer.

"She's not right, boy," he said. "She's

old. She's had to stand some terrible punishment in the last two and a half years. I'm afraid you'll have to retire her."

"Retire her, hell!" Bill snapped. "Then what'll I use to get around with—a glider?"

He climbed into the forward cockpit, tested his guns and ammunition counters and revved up the powerful motors. Then he cut them and shouted at Scotty: "Is Tony back in the control room?"

Scotty nodded.

"Tell him to stand by until he hears from me," Bill said.

He blasted his motors again and the big ship streaked down the runway.

The tail came up and Bill lifted the nose gently into the air as the first light of false dawn came to the eastern sky.

As he spiraled upward the amphibian gear slid up into the belly and the wing tips and the yellow and green lights on his instrument

He was thinking about the thousand and one places the Lancer had taken him, and the thousand and one times he had staked his life on her speed and maneuverability. Without realizing it he thought of the Lancer as something animate, something that lived and breathed. He thought of her with the same affection and loyalty he had for his men.

"Retire her!" he snorted aloud. "Bunk! She still has more guts than anything else with wings."

He began to chart a course to that little lake nestling on the Canadian border near Dixville Notch. He figured it would take him just about an hour to cover the four hundred miles, and that it would be light when he arrived.

A half hour later he nosed the Lancer up to eight thousand feet as the peaks of the White Mountains began to climb under him.

The Lakes of the Clouds sparkled on Mt. Munroe, and then Mt. Washington loomed up beneath his wing tips. He was checking the lakes and rivers and mountains below him with the topography of his map as he flashed above the Balsams at Dixville Notch and spotted the sun-kissed little lake due north of it, called Guyot

he circled high above it. Then his heart climbed into his mouth as he picked out a long, low cabin with two wings jutting out from it set back a hundred feet from the lake. At the water's edge was a boat house with a speed boat moored alongside the dock, and fifty feet out from the shore a black amphibian rode its hook.

He took a photograph of the surrounding countryside with his eyes, as he began to spiral downward, and filed it away in his mind. He saw a lone man come out of the boat house and gaze upward. He saw him studying the Lancer, then rush back into the boat house and emerge with a bag, which he threw into a rowboat. A moment later he was pulling toward the Meredith Falcon moored on the lake with great, sweeping strokes of his oars.

Bill was down to three thousand feet as the man clambered into the forward cockpit of the Meredith, and he knew that he could make a landing and cover the black biplane with his guns before it could get off the lake unless it had been warmed up previously.

Bill lowered his amphibian gear, came around in a vertical bank, and barely skimmed the tree tops at the edge of the lake as he went in for a landing. But just as his main float and wing tip pontoons touched the water he heard the motor of the black and orange biplane raise its crescendo. Out of the corner of his eye he saw the pilot kick it around into the wind, and then they were speeding down the lake side by side.

They were three hundred feet from the far end of the lake, their motors bellowing like two

panels gleamed for an instant and disappeared. The Silver Lancer became a streak of gray light against the false dawn. At five thousand feet he leveled off and snapped on his chart light and took the map Payne had given him out of his chart drawer. But for the moment he wasn't thinking of the map or Martinson. He was thinking of what Scotty had said about the Lancer.

Lake, that Martinson had marked. His pulse quickened as



great monsters, when they both eased their ships off the water. Each man hung his ship on its props to get the all-important advantage of altitude. Up and up they raced, and Bill knew again that the Lancer was not capable of doing the things she had done before her crash. He gave her all the juice she would take, but the Meredith Falcon was climbing as fast as the Lancer.

Suddenly, the black ship whipped over in a ninety-degree turn so that it was between Bill and the morning sun. For an instant he lost sight of it. The next instant he felt the Lancer quiver like a thing mortally wounded. For a fraction of a second he sat immobile, frozen to the stick. Then he yanked back on the control column and zoomed the ship up and over on its back, as the black biplane went beneath him and leveled off.

At the top of his loop Bill half-rolled the Lancer level and gazed over the side.

Again the black ship came zooming up from beneath him with its twin guns spewing burst after burst of fire. Lead chewed through the leading edge of his left wing until he skidded the Lancer from the line of fire. Then the biplane roared upward and came back in a chandelle on Bill's tail as he began a sweeping turn to the left. But instead of opening fire from above the other pilot held his dive and once more flashed up from underneath with his guns chattering.

Bill was half choked with rage as he rolled out of that deadly storm. The next moment the two ships were roaring at one another with terrific speed. Bill's fingers tightened on his gun trips this time and he could see his tracers driving into the black biplane's fuselage before it skidded out of range.

"That isn't Martinson," Bill said aloud. "If it was I'd be dead now the way the Lancer is behaving."

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

"He's good, but not as good as Martinson," Bill muttered.

He came up in a lightninglike chandelle and dived on the speeding Meredith, but when he clamped down on his trips the pilot had crabbed out from under his sights as though he knew where Bill's bullets were going. Bill shook his head with a gesture of disgust, realizing that because of the performance of the Lancer he was bearing down too hard. He was overcontrolling in his effort to make the ship do things it could no longer accomplish.

The next time the black biplane flashed across his sights he held his fire until the pilot had automatically made his correction to escape Bill's aim. Then

he kicked his rudder and his bullets wove a pattern on the side of the black ship from the spinner to the trimming tabs on the rudder. It skidded off dangerously on one wing and yawed wildly. Bill whipped around and came back to the attack with all the speed the Lancer would give him. He poured round after round at the black ship, but the pilot rolled it out of danger.

Bill pushed the stick of the Lancer forward with a slam, as the biplane nosed down in a vertical dive. At one time they had worked five miles away from the little lake, but now they were back over it again as the biplane pulled out of its dive and came up in a fast loop to roll level at the top. Bill came up and rolled with him, then at four thousand feet he whipped over to return to the attack. He knew that this was the time to put on the pressure. If he couldn't get the black ship now he would never get it. He mustered all his reserve strength as he called on his muscles and mind to coordinate.

The pilot of the black ship became panic-stricken as Bill zoomed over on his back, neutralized his controls and sought him in his sights while hanging head downward. He waited for Bill to roll level. Before he realized that Bill was not going to do so, the bullets that were destined to cost him his life were driving into the biplane.

The pilot dropped the nose in another terrific dive, with Bill on his tail. Eight hundred feet from the surface of the lake he pulled the nose up, then stuck it down again in a shallow dive.

The big black ship struck the water and sent two geysers of water shooting high on either side. Then it settled and began to race across the lake, leaving two churning wakes in its rear. The motor roared, and died when the ship was only a hundred feet from the shore. It kept straight on until its pontoons ran up on the beach, where it came to a shuddering, crumpling halt.

Bill followed it down and in and went over the side of the Lancer into four feet of water. He struggled to the shore, his legs pumping high as he raced up the beach. He was afraid the pilot, if still conscious after the impact, would rise over the rim of the cockpit with an automatic in his hand.

Swinging himself up on the steps, he stuck his head over the side. He knew then that he didn't have to worry about the pilot any longer. The man was slumped forward over the stick and he was dead.

Bill climbed into the cockpit and lifted the suitcase that had been put in the closed rear cockpit up on the coaming. He jerked it open and began to rummage through the contents. At the bottom he found what he had been looking for. It was a large, almost square manila envelope. His hands

were trembling as he pulled forth the papers inside.

There were two maps of a national military highway system and the detailed plans of a tank mounting an anti-aircraft gun. Swearing softly, he took another quick glance at the seemingly deserted log cabin, and stuffed the plans and map back into the envelope. Lifting the blood-smeared face of the dead man, he made certain that it was not Martinson. Then he dropped off the side of the biplane and started back toward the Lancer.

He expected to hear the bark of guns and the slap of bullets hitting the water around him at any moment. But none came. He wondered if he ought to go ashore and investigate the log cabin. He decided against it; he had what he had come after. Cold perspiration was running into his eyes as he lifted the Lancer off the lake and threw the key on his radio panel and chanted Barnes Field call letters into his microphone. Tony Lamport answered him a moment later.

"Bill speaking, Tony," he said, and he couldn't keep the exultation out of his voice. "Report to 89 in Washington. Tell him I have the plans and maps. I'm on my way back to the field. Tell 89 Martinson is still at large. He must have left the maps at Guyot Lake last night for delivery at another rendezvous this morning. I arrived just as Martinson's man was about to leave with them. I shot him down and found them in a bag in his ship. That's all, Tony. I'll be in shortly."

"Nice going, Bill," Tony said. "Shorty and Red just came back from Shoremont. They left a Snorter there for Sandy. They didn't disturb him because Payne told them he had been up all night with the Martinson woman and had just gone to bed when they arrived. I'm signing off."

A warm sense of satisfaction caused a wide grin to steal across Bill's bronzed face. "Things are never as bad as they seem," he said to himself. "If you always keep your eye on the ball you're more than a little apt to hit it."

With that sage observation he laid the nose of the Lancer on Barnes Field and settled back in his comfortable seat to relax.

VII—THERMAL BOMB

BILL'S EYES flitted from his artificial horizon to his airspeed indicator, and then he leaned forward to look over the ammunition counter at the engine instrument panel. He opened the throttles a little wider, and although his r.p.m.'s increased on the tachometer, his airspeed failed to go up. A frown wrinkled his forehead as he realized that the Lancer was losing a tremendous amount of power in some way.

"Maybe it's the timing," he said. But in his heart he knew it wasn't. He knew that Scotty MacCloskey had spoken the truth.

Brattleboro, Vermont, flashed under his wing tips and was gone as the light on his radio panel gleamed scarlet. He threw the switch and spoke into the microphone.

Young Sandy's voice came back to him with surprising suddenness. "Bill! Bill! Come in! . . . Come in!" Sandy was saying over and over. And there was something tense and terrible in his high-pitched tone.

"All right, kid!" Bill snapped. "I'm in. What's the matter?"

"Sandy speaking, Bill! Where are you? Quick!"

"I'm just east of North Adams, Massachusetts," Bill said. "Why?"

"Listen to what I'm telling you, Bill," Sandy said. "Pick a place where you can bail out of the Lancer and let her crash. But not near a town. In the Berkshires if you can get down safely yourself. If she crashes in a town she may burn up everything for miles around."

"Hey!" Bill shouted. "Where are you? What the hell are you talking about, kid?"

"I'm sitting in the Snorter Shorty and Red left for me this morning." Sandy's words were running together in a way to make them almost unintelligible. "I'm at Shoremont. They left while I was still asleep. I was up until nearly dawn, Bill. But I'll tell you about that later. You've got to get out of the Lancer or you'll burn with her!"

"Listen!" Bill snarled. "Pull yourself together. Talk sense. The Lancer is all right. I'm on my way back to the field. I'll be there in a half hour. You get your Snorter into the air and meet me there and tell me what happened last night."

"Bill," Sandy was hardly able to keep the tremor from his voice, "one of Martinson's men put a thermal bomb in one of your fuel tanks last night when you were here at Shoremont. It's all a frame-up to get you. It—"

"Put a *what* in my fuel tank?"

"A thermal bomb," Sandy repeated. "It's no larger than a pencil. It has two compartments separated by a wall of lead. There are two secret formulas in it, liquid. When one of them eats through the lead and joins the other it will cause such terrific heat in your tank that your fuel will catch fire. If you

don't get out in time you'll go with it!"

"Okay, kid," Bill said as calmly as he could. He was trying to steady Sandy's emotions with his voice so that he could get a coherent story from him. "Now tell me some more about it. Take it easy. How did you learn about this bomb?"

"From Sylvia Martinson. She woke me up with a telephone call a few minutes ago to tell me. I was up until dawn with her, Bill. She telephoned me a little while after you left. She said—"

"Never mind that now! What did she tell you just now when she woke you up?"

"Her husband told her this morning," Sandy said.

"She talked to her husband this morning?"

"Yes," Sandy said. "He sent a man here early this morning to take her down on the tip of the island to meet him. She accused him of all the things you told her last night and he admitted them. Then he threatened to kill her. She managed to get away from him and get back here to tell me about the bomb. They planted it last night to take action about this time this morning. They figured you would be in the Lancer now. You've got to get out of that ship, Bill! She knew what she was talking about!"

"Nuts!" Bill snarled. "Why didn't Payne grab Martinson if she went to see him?"

"She slipped out without Payne knowing it. Martinson had made a landing on Lake Montauk and was ready to get away fast if anyone followed her."

"Then she's in the thing with Martinson too?"

"No, no, she isn't," Sandy said. "But that doesn't make any difference now. You've got to bail out of the Lancer or you'll be burned to a cinder!"

"I'm not going to bail out of anything," Bill said. "Now, listen to me, kid. I'm legging it toward Barnes Field as fast as I can go and I want you to do the same so I can get the whole thing straight and find out what's behind it. I'm signing off now."

"Bill! Don't do that! If you won't bail out alter your course a couple of points east and cut straight down across Connecticut to New London and I'll pick you up off the tip of the island. Will you do that, Bill? I'll get into the air immediately and get up to ten thousand to meet you. Will you do that, Bill?"

"All right, kid. Take it easy. It's a bluff of some kind."

He threw his radio key, nudged the left rudder, and laid the nose of the Lancer on the eastward tip of Long Island.

Martinson



"In a pig's eye I'll leave this ship," Bill Barnes gritted to himself. "But what the hell did her husband go back to see her about unless he's as much in love with her as she was with him?" he went on. "He risked his life and freedom by doing that. It wasn't for love. He's too much of a louse for that. He's one of those birds who would sell out his own mother for a little excitement and a few dollars. . . . Thermal bomb! And Sandy fell for it. What was his idea in telling her that? Is she in with him too? What was he doing down here when those plans and maps were up in New Hampshire?"

Bill shook his head in bewilderment and gazed down over the side of the Lancer as the city of Hartford, Connecticut, sped under him. He tapped the inside pocket of his overall to be sure that he still had the manila envelope. He shifted uncomfortably in his bucket seat and opened the hatch above his head a little wider. Gazing up at the hot morning sun, he wished he was wearing a lighter overall. He could feel perspiration streaming down his body inside it.

He decided that he was just worn out and tired from lack of sleep and excitement. Deliberately he set his mind on the Lancer, the way she had been behaving, and he concentrated on the vague ideas he had had lately about a new ship.

"Not one to take the Lancer's place," he said aloud, "but one I can use alternately so the Lancer won't have to take so much punishment."

Suddenly he was conscious of the fact that the whole right side of his body was so hot that it was almost unbearable. A gust of hot air like a blast from a fiery furnace struck his right cheek.

His eyes traveled along the trailing edge of his starboard wing, taking in the flap and balanced aileron and stopping at the navigation light on the tip. They came back along the leading edge, and it was there that he first noticed what was happening. The paint on the wing was rising in little blisters all along its length, and the wind was peeling it off!

He stared at it for a moment, unable to believe what he saw. Then he knew that Sandy was right. Only terrific heat inside the wing could cause the paint to peel. Through his mind flashed the theory of Diesel engines: that the mist of crude oil injected into the combustion chamber was ignited by compressed air entering the same chamber at such force that it reached a temperature of nearly 1100° Fahrenheit. If, he thought in a panic, a thermal bomb could cause such heat it might ignite the whole tank at any moment.

For an instant he fought with himself to keep from going over the side.

He snapped on the built-in parachute attached to his seat and looked at the starboard wing again. The paint was almost entirely gone now, and the stressed skin was beginning to take on a bluish tinge the color of a highly tempered piece of steel. He cursed viciously as he remembered the debonair, mocking expression on Martinson's face.

"I'll be damned if he licks me!" he exclaimed through clenched teeth. "I'll take her to Barnes Field and have the fire equipment on the apron to meet me. I'll take her in if it's the last thing I ever do!"

He could see the choppy waters of the Sound ahead as the little city of Norwich flashed under his wings. He was reaching for the radio key to get Tony Lamport on the radiophone when the panel light gleamed scarlet again.

"Calling BB. . . . Calling BB. . . . Calling BB!" Sandy's frantic voice said in his ear.

"Bill speaking, kid!" he answered. "Go ahead! Go ahead!"

"Bill!" Sandy shouted. "One of those Meredith Falcons is trying to shoot my buttons off!"

"Where are you?" Bill snapped.

"Off the tip of Long Island—"

There was silence for a moment and Bill could hear the scream of Sandy's motor as the other yanked his Snorter up and over in an Immelmann turn. "I was cruising waiting for you when he came out of the sun," Sandy panted. "I'm afraid he's too much for me. I'm trying to—"

"Keep your head, kid. Keep him off your tail. I'm just leaving the Connecticut coast. Try getting upstairs. The Lancer is on fire but I'll be there in a few minutes, Sandy. Don't give him a chance to get a clean shot at you. Keep your head!"

"I'm not going to have any head in a minute if you don't hurry up," Sandy gasped.

"Listen, I can see you now. Hold on another couple of minutes, kid. We'll take him."

Writhing from the now horrible heat, Bill saw that the silver metal of the starboard wing was beginning to turn a dull red, that the duralumin was starting to twist.

He knew that in another five minutes the whole wing would go. He put his arm up across the right side of his face to protect it as he gave the big ship all the juice she would take. His two opposed props screaming in protest, he nosed the Lancer up to get above the two tumbling ships ahead.

His heart was in his mouth as he called Sandy's name. He had made up his mind what he was going to do by the time Sandy answered. Perspiration was pouring down his face, nearly blinding him, as he bit into his lips to keep

from crying out in pain. He could feel his whole body baking inside his overall.

Bits of the starboard wing tore away and black smoke gushed out to leave a blinding screen behind.

"Get ready, kid!" he shouted to Sandy. "When I'm two hundred yards away from you hang your ship on her props and get upstairs and keep going. Try to get above the Meredith before I reach you. Do you get it?"

"Right, Bill! I think it's Martinson in the Meredith!"

"Get clear," Bill repeated. "If I miss him you'll have to fight him off and then pick me up or we're both goners."

"What are you going to do?" Sandy screamed.

"I'm going to ram him!" Bill said. "He put a thermal bomb in the Lancer to destroy her. We'll let him die with her. Get upstairs!"

VIII—"I'LL FINISH IT"

BILL'S BLISTERED face was a mask of anguish as he climbed up on the bucket seat of the Lancer and held the nose dead on the speeding black and orange biplane ahead.

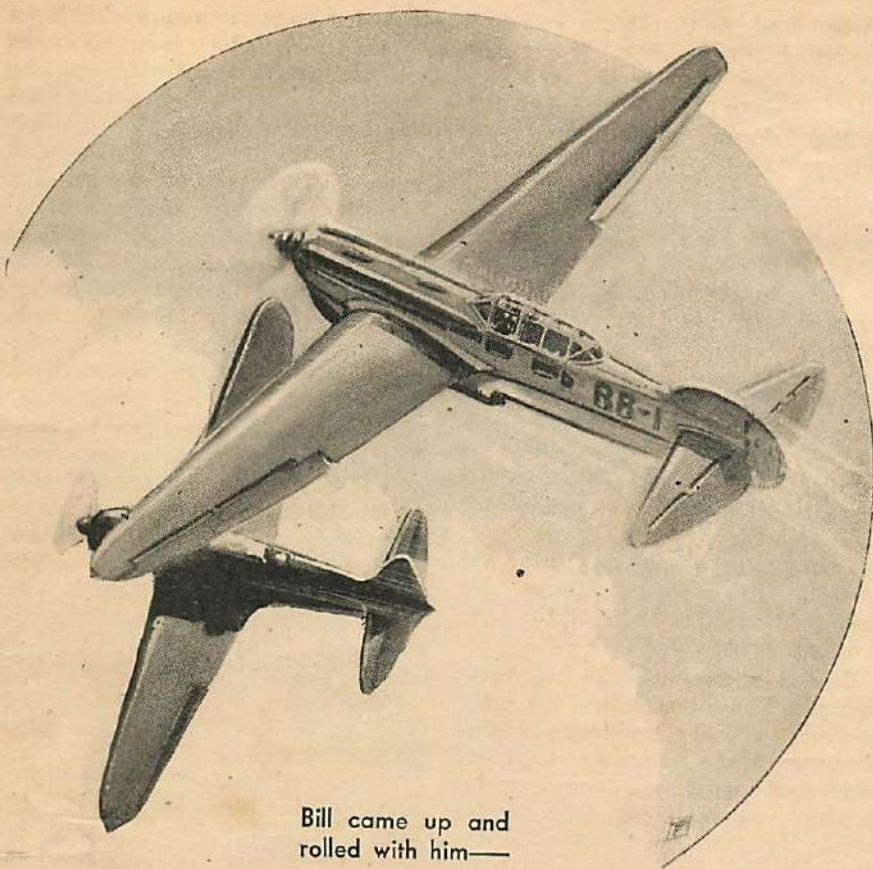
When only fifty yards separated the two ships, he moved the control column of the Lancer for the last time. A sob that was half pain and half grief escaped his lips as he dropped the left wing and at the same time dove over the side head first.

The Lancer seemed to bounce as it lost his two hundred pounds of ballast. It looked like some mad creation straight from the depths of hell as it tore its flaming path through the air toward the biplane.

A frenzied scream that was drowned by the roar of his motor and the wail of his prop came from the pilot as he saw Bill go over the side and realized what he was trying to do. But he didn't lose his head entirely. He yanked his stick back into his stomach. . . . For a moment it seemed that nothing could save him. Then the nose of the fast biplane lifted and the Lancer passed under it so close that the heat from its starboard wing scorched the belly of its fuselage.

Six hundred feet overhead young Sandy brought his Snorter around in a vertical bank to watch the drama unfold beneath him. He saw Bill go plummeting toward the waters below. He saw flame lick out of the Lancer in a half-dozen different places as it plunged toward the Meredith Falcon like a crazed bull. He saw the whole starboard wing rip off and go fluttering downward, red with heat. He held his breath as the distance between the two ships closed with the speed of a camera shutter.

Then the biplane zoomed out of dan-



Bill came up and rolled with him—

ger, and his breath escaped like air from a punctured balloon. He realized only too well what he was up against now. He leveled his Snorter off as he saw a puff of white snap out behind Bill's plunging body and become a parachute an instant later. He knew he must get down beside Bill and pick him up when he dropped into the Atlantic.

But what was the pilot of the black and orange ship going to do?

The answer came at once. The pilot of the biplane had dropped his nose and was pointing it straight at Bill. Sandy's heart climbed into his mouth as he saw that Bill was watching the smoke-shrouded Lancer plunging seaward. He tried to shout at him as he saw tracers whip out of the nose of the diving biplane.

As the black plane came roaring down and the chatter of its machine guns joined the bellow of its motor, Bill veered his eyes from the Lancer. He could see the white smoke of tracers and hear the whine of the bullets as they tore by him. An easterly wind became his ally as his parachute began to side-slip, spin and roll. He gathered the shrouds first on one side, then on the other, to add to his oscillation. His body became a jumping-jack on the end of a string.

The black ship nosed up until it almost stalled, then came back at him in a climbing turn. Bill could see the face of Martinson, still deathly pale from

the shock of nearly being rammed by the Lancer. He cursed and raised one fist to shake it at him, then dropped it back by his side as a shadow loomed above the biplane. The Snorter—

Young Sandy came out of nowhere to send Martinson into a frantic roll to get out of his line of fire. He nosed the Snorter up and came around in a vertical bank, attacking with a speed and fury that was an indication of the horror which had engulfed him as he saw Martinson begin to machine-gun Bill while he hung defenseless. Then Martinson was on his tail, his two machine guns vomiting lead and death. Sandy felt the Snorter quiver, and for a moment he wondered if this was going to be the end for both him and Bill.

Yanking at the stick, he zoomed the Snorter up and over on its back as the black and orange biplane dove beneath him. At the top of his loop he rolled level and gazed over the side as Martinson pulled out of his dive and came around in a wide, sweeping bank.

He could see Bill dangling on the end of his shrouds far below, and knew that he must dispense with Martinson and go to his rescue within a few minutes. If Bill got tangled in his parachute after landing, it might be too late. His face suddenly flushed, and his blood racing through his body like fire, Sandy opened his throttles wide and zoomed upward in an abrupt climbing turn until his engines almost stalled. Then he

dropped the nose and started down beside Bill to ward off Martinson's next attack.

But in the instant while he was locating Bill, Martinson had nosed up. He followed Sandy and was underneath him when he started his dive. The lead from his machine guns chewed through the leading edge of the Snorter's port wing. Sandy rolled over twice to get out of the line of fire as anger half-choked him.

The biplane roared upward and dived back to the attack. Sandy pulled on his stick and went up to meet him. The two planes roared at one another with terrific speed. Sandy's fingers tightened on the gun trips this time, all his fear gone, and his bullets drove through the biplane's fuselage before the other could get out of range. The enemy was by no means disabled, however, and there followed a series of streaking maneuvers that sent the two craft tumbling about the sky, their speed making accurate shooting impossible.

"I'll carve my initials on his back in a minute," Sandy snarled. "He's good but he's not good enough. He's started something and I'll finish it for him!" He knew that he must get Martinson fast in order to pick up Bill. In his frenzy he was bearing down too hard, "freezing on his controls" at the wrong time. Perspiration almost blinding his eyes, he used all his powers of concentration to get control of himself while he studied Martinson's tactics.

The next time the black ship flashed under his sights he kicked his rudder ever so little, his fingers gripping the gun trips. The nose of his Snorter followed the course of the biplane for a split fraction of a second. His bullets wove a pattern from the engine housing to the tail assembly. The black ship skidded off dangerously, then recovered. Sandy whipped the Snorter around and returned to the attack. His breath was coming in short, agonized gasps. He poured round after round at the other ship as it tried to dive out of danger.

Sandy pushed the stick of the Snorter forward with all his strength to keep the nose down as he followed it. Then he eased back to pull out as the black and orange biplane nosed up and rolled level in a flashing Immelmann turn. Now the other was above Sandy and diving on him with guns flaming. Sandy dropped his nose again and horsed his throttles wide. Five thousand feet below him Bill dangled in the harness of his parachute.

Down and down and down he plunged. For an instant he fought the nose up, only to drop it again and slap the stick all the way forward. He gulped and tried to shout as the pressure became terrific. His insides felt as though they were being dragged out of

him on the end of a log chain. Then he was up and climbing without having "blacked out."

Still giddy and weak, he probed the air for the biplane. He knew an instant later where it was without seeing it, as he felt bullets drumming into the belly of his Snorter. He barrel-rolled to get out of range as the black ship zoomed by him. Then he was under its belly, his machine guns chattering. He could see his tracers pumping into it.

Together they raced upward, each trying to get the advantage of altitude. At four thousand feet Sandy whipped up in a dazzling chandelle to return to the attack, his exhaust stacks bellowing. His hand was trembling on the stick now; he was tired. The black ship began a wide turn to the left as Sandy's fingers tightened on his trips. He saw his tracer smoke curl above Martinson's head. He tried to correct his aim and saw his bullets tearing into the biplane's tail surfaces. His teeth were tightly clenched. He knew that now he must put on the pressure. If he didn't get Martinson now he would never get him. He mustered all his reserve strength and plucked an excerpt from the life of Bill Barnes. He called into play all those tricks of aerial combat that Bill had so patiently taught him.

If Martinson thought Sandy had been fighting before, he must have become amazed now. He must have realized in those next few seconds as he had not realized before that he was fighting for his life. One minute he was secure in his own ability to outfight and outshoot Sandy. The next instant panic seized him. He suddenly found himself being maneuvered into errors that brought Sandy's deadly aim closer and closer.

Then Sandy used the trick that was Bill's *coup de grâce*. And he did it with the same confidence in his own ability that Bill would have displayed.

As Sandy zoomed over on his back, neutralizing his controls and seeking Martinson in his sights while he hung head-down, Martinson made his worst mistake. He waited for Sandy to roll level and dive on him. Before he realized that Sandy was not going to roll level, machine-gun bullets were creeping into the engine housing of his ship.

He tried with a desperation born of despair and fear to throw the black ship out of line. But this time he was too late. A half-dozen bullets found their mark in his body. His lifeless hand slid off the control column. The nose of the little biplane lifted, then dropped. His body fell forward over the stick and the noble little ship began a fluttering descent to the blue-green waters of the Atlantic.

Young Sandy watched the doomed ship plunging down and down until it disappeared, like a diving gannet, into the choppy water. He was so com-

pletely exhausted that for a space of time his mind was a blank. It was only when his wandering gaze picked out those two spots of white far off to the left that he came to life again.

"Bill!" he shouted, and nosed his Snorter around and down.

Bill Barnes' breath escaped from his body in one great shout of relief as he saw the black and orange biplane yaw and go spinning to its death. It seemed to him that he had been fighting that fight, throwing his body this way and that to ride with Sandy's Snorter and get it out of line of Martinson's bullets. It seemed that he had been holding his breath for hours when Sandy poured that last fatal burst into Martinson's ship.

He had entirely forgotten that he was dropping into the Atlantic Ocean. He had forgotten everything but the frenzied fight above him.

Now he was glad as he had never been glad before that he had taken the time and had had the patience to teach Sandy the tricks he knew. A grin of pride and appreciation flashed on his face as he saw Sandy nose his Snorter down. He knew then that the kid was all right, that he hadn't collected a serious wound.

He looked down and saw that he was only two hundred feet above the water. He pulled off his helmet and

dropped it to see it plunge away from him at an alarming speed. Then he undid his chest buckle and his right leg strap. He waited while he dropped another hundred feet, and undid the left leg strap. Then a sudden gust of wind caught his 'chute and whirled him around in a dizzy circle. The next instant he was slapped on the surface of the water on his stomach. He tried to struggle out of his harness, but he had not entirely opened the chest buckle. Now completely submerged, he was being dragged through the water by the racing 'chute.

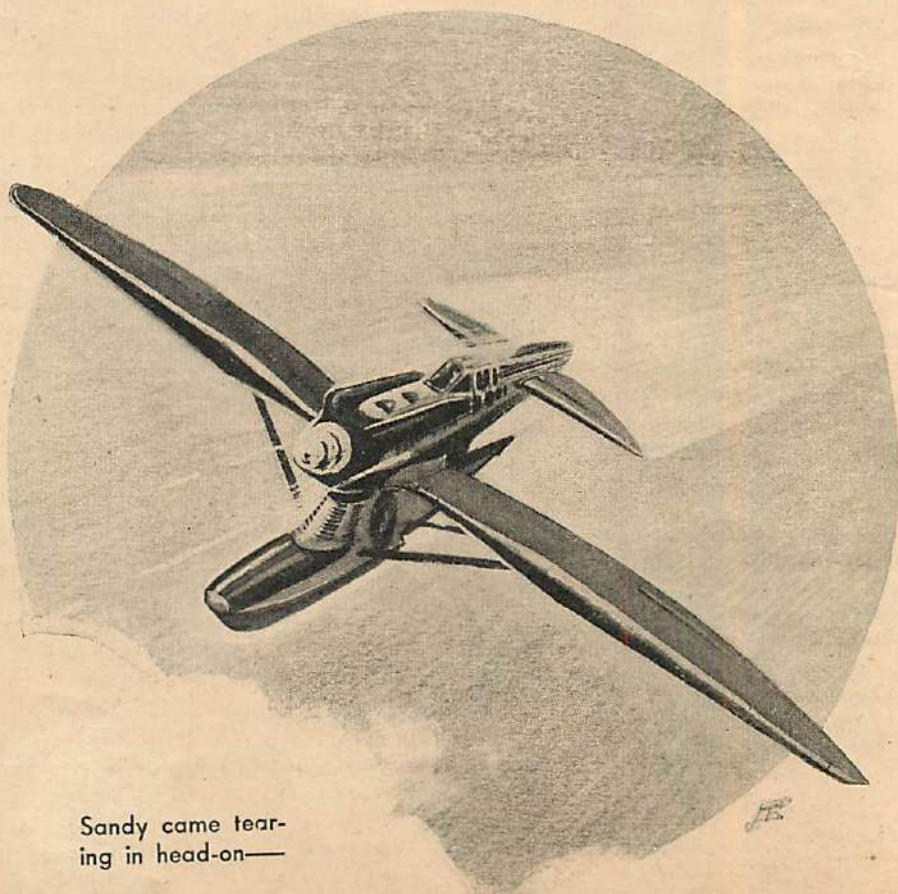
Desperately, he struggled with the chest buckle, holding his breath again until it seemed his lungs must burst. He let the air out of his body at the instant he cleared the chest buckle and fought to get to the surface. His head came up and he dragged air into his lungs again as Sandy's float struck the water and sent a cloud of spray high into the air.

Using his water rudder, Sandy brought the Snorter around until Bill got hold of a wing tip pontoon.

Puffing and cursing, he clambered up on the starboard wing and into the after cockpit of the gallant Snorter.

"That," Bill said to Sandy when he could get his breath, "was nice going, kid."

"Is that all you can say?" Sandy demanded.



Sandy came tearing in head-on—

"What do you want me to do—kiss you?" Bill snapped.

IX—BILL'S PROMISE

SANDY took the Snorter off the water in a long, low climb.

"You'd better circle back, kid," Bill said, "and see if by any chance Martinson is still alive."

"Not a chance, Bill," Sandy said. "He's down in a hundred fathoms of water. His engine would—"

"He's down with the Lancer where he ought to be," Bill said viciously.

Sandy swung around, starting to speak, and was silent as he saw Bill's face. He knew how Bill felt about the Lancer, and he didn't intrude on his thoughts.

"Anyway," Bill said in a moment, "I have the maps and plans he stole. I carried out my assignment even though it cost me the Lancer."

"No, you haven't, Bill."

"Haven't what?" Bill snapped.

"The maps and plans you have are fakes," Sandy said. "I tried to tell you over the radio but you wouldn't listen. They were rigged up for your special benefit, Martinson—"

"Then where the hell are they?" Bill roared.

"I have them. I tried to tell you that too."

"All right, kid," Bill said weakly. He dropped back in his bucket seat and spread his hands in front of him as he looked at the back of Sandy's head in complete bewilderment. "Let's have it."

"After you left last night," Sandy said, "I went to bed. I was just falling asleep when Mrs. Martinson called me on the telephone. She said she couldn't possibly go to sleep until she had talked to me again. She asked me to get dressed and meet her down in the garden. I hopped into some clothes and got down there fast, because I had a hunch. You remember when you said to her that if she had any information or papers or clues that would help in finding Martinson, she must tell you?"

"Okay," Bill said.

"Well, when you said that, I saw her hand touch a spot over her heart involuntarily," Sandy said. "I got an idea then that he had given her some papers to keep and had told her not to leave them in her room; to keep them constantly with her until he came back for them. I was trying to figure out how I could get them if she did have them, while I was falling asleep. I thought I might get her to go bathing today and rob her bathhouse while she was in the water but—"

"Yes, yes, kid," Bill said. "So what happened?"

"She was half-crazy when I met her down in the garden," Sandy went on.

"She circled all around the papers she had but finally she told me about them. It took me another hour to persuade her to open them and look at them. We agreed that if they were plans and maps she was to give them to me. If they were his personal property she was to keep them. We opened them up under a porch light. Payne was just around the corner, but I didn't let on to him. When she realized what they were she was only too glad to get rid of them. Her disillusionment was complete."

"Why didn't you give them to Payne?" Bill asked.

"I thought I'd better hang on to them," Sandy said. "I figured I'd give 'em to Shorty when he came down with a Snorter and he could take 'em back and put 'em in your vault. I finally persuaded her to go to bed, and did the same thing myself. I hadn't any more than got asleep than she called me again. At least it seemed that way. Actually it was several hours later and Shorty and Red had brought my Snorter and left it without calling me."

"This was after she saw her husband?" Bill asked.

"Yeah," Sandy said. "We're going right to Barnes Field, aren't we?"

"Right. Give her some soup."

"Okay. I got dressed again and went down to meet her. Gosh, Bill, I felt sorry for her. You know she's a swell woman. It's a shame she ever got mixed up with a louse like him."

"Sure, she is," Bill said, "but for the love of Moses, stick to your story. You sound like a couple of old ladies rocking on the front porch of a summer boarding house!"

"All right! All right! But I felt awful sorry for her."

"She's all right now. You're sure you have real plans and maps?"

"Positive," Sandy said.

"Then she's in the clear. There will be the usual investigation, but she won't have to worry. We'll take care of that."

"I knew you would, Bill," Sandy said. "You're a fair guy."

"Listen!" Bill shouted. "What happened after she'd seen her husband?"

"She was in a terrible dither because he had admitted all the things you told her. He had told her that he had framed you so that you'd be killed and what you thought were the maps and plans would burn when you burned."

"How did she explain not having them when she saw him?" Bill asked.

"Oh," Sandy said airily, "we fixed up a dummy package for her to give him. That was why he came after me."

"Now wait a minute," Bill said.

"You fixed up a dummy package to give him. Didn't he open it while she was there?"

"No, they got in a swell fight and he almost killed her. When she told him what you had said to her, he said he had fixed up a little plan to get rid of you. He told her he had left that map in his room purposely. He knew all the time why you were at Shoremont."

"He said he knew you'd fall for the map and go to New Hampshire. He had rigged up some dummy maps and plans for you to get up there when you landed. One of his men had placed that thermal bomb in the Lancer to take effect a couple of hours after dawn this morning. He counted on your making contact with Washington as soon as you had the dummy plans and maps telling them you had them. Then when the thermal set the Lancer on fire, both the plans and you would be destroyed. It was a slick idea."

"Yeah," Bill said, "it was slick. So slick it cost one of his men his life. He started to run away when I landed and I followed him. He attacked me and I had to shoot him down. Why did he do that?"

"That's one for you to answer," Sandy said. "Maybe he got his orders mixed. Do you get the idea now?"

"Yes," Bill said bitterly, "I get the idea. He laid a little plot to get rid of me and the dummy plans so he wouldn't be bothered while he sold them. He was going to get the real ones from his wife but you had them and he got a dummy set too."

"After he opened the dummy package," Sandy went on, "and found out they were fakes, he figured I had them. That's why he came after me. When you came into the picture with the Lancer on fire he figured his plan would still work if he killed you and then shot me down and got the real plans from me. Speaking of the Lancer—maybe after this little experience you'll pay some attention to those plans I've been working on for a new ship. I got an idea there for a retractable amphibian gear that is a lulu, Bill. It's—"

"All right! All right!" Bill said. "Pour a little more soup into this buggy. I've got to get some sleep."

"You'll take a look at my plans when you wake up, won't you, Bill?"

"Sure," Bill said, yawning.

There was a moment of silence and then Sandy spoke again. "I did some pretty smart work on this Martinson job, didn't I, Bill?"

"You sure did, kid," Bill's head dropped forward on his chest. "All in all, kid, you've got what it takes."

Sandy's freckles glowed with pleasure at such high words of tribute. He turned around to nod his thanks—and his face froze.

"Why, the big lug!" he said indignantly. "He was asleep when he said it!"

THE END.

PACIFIC AIR RACES BRILLIANT SPECTACLE

HIGH-SPEED racing, beautifully executed aerobatics, military exhibitions and novelty acts were features of the fast-moving First Pacific International Air Races, held under N.A.A. sanction at Oakland, California, May 28-29-30th.

In two of the three major races, Tony Le Vier, a dark horse who was doing his first racing, whipped his flashy little "Shoenfeldt Firecracker" around the pylons to capture first place. In the first race, the contest was a running fight between Le Vier and Steve Wittman, with Le Vier battling his way to the lead in the seventh of the nine laps. His time for the 75-mile course was clocked at 249.351 miles per hour.

In the closed course race on the second day, Le Vier and Wittman again led the field. Wittman was forced down and Le Vier crossed the finish line first, with Art Chester close behind.

The third major race was a nip-and-tuck battle between the veteran Roscoe Turner and Earl Ortman. In the sixteenth lap, Turner edged forward into the lead, but Ortman, in a sudden burst of speed, shot ahead to take first prize—the Exposition Trophy and \$5,000.

Aside from the "big-time" races, there were many other colorful features. The aerobatic flying was one of the outstanding. Paul Mantz and Frank Clarke, famous Hollywood stunt flyers, went through a series of breathtaking gyrations. Their ships were painted in brilliant color designs for a motion picture in which they are now taking part. Tex Rankin, the world championship aerobatic pilot, performed maneuvers which included outside loops, reversible spins, Cuban eights and a new outside spinning eight. An international note was added by the appearance of Captain Alex de Papan, of the Roumanian Air Force.

One of the most unusual and amusing performances was the low-flying comedy act by Mike Murphy in a Cub. He played tag with a racing automo-

bile, leapfrogging across it several times, and finally landing on a platform on the speeding machine's top.

Evelyn Hudson, the only woman in the show, gave a demonstration of how she refueled in flight when she set an endurance record last year. Swooping low over a moving automobile, she dropped a rope which the ground crew in the car hooked onto a gasoline can. Then, using a hand winch, she pulled the can aboard her plane.

Service flyers put on stirring exhibitions of military maneuvers. A Naval Reserve Squadron went through its paces in tight formation, doing a spectacular break-away in front of the crowd and ending up with a snake dance. A Marine Reserve outfit also gave an excellent performance, including a Lufberry Circle and a roaring demonstration of ground strafing.

One of the highlights of the three-day air carnival was the arrival of Frank Fuller from Vancouver, B. C. He streaked over the unofficial distance of 835 miles in an official time of 3 hours, 8 minutes and 43 seconds.

CHAMPION RACING PILOT FOR 1937

Rudy Kling, the practically unknown youngster who flew brilliantly to victory in the Thompson Trophy Race last year, only to be killed a few months later in a high-speed race at Miami, has been named the 1937 Championship Racing Pilot by the N.A.A.

Each year the Contest Board rates racing pilots according to the number of points won at major air races. Kling's total was 1,750 points. Second honors went to S. J. (Oshkosh) Wittman with 1,125 points. The scores of the three other leading speed flyers were: Earl Ortman, 900; Roger Don Rae, 650; and Art Chester, 640.

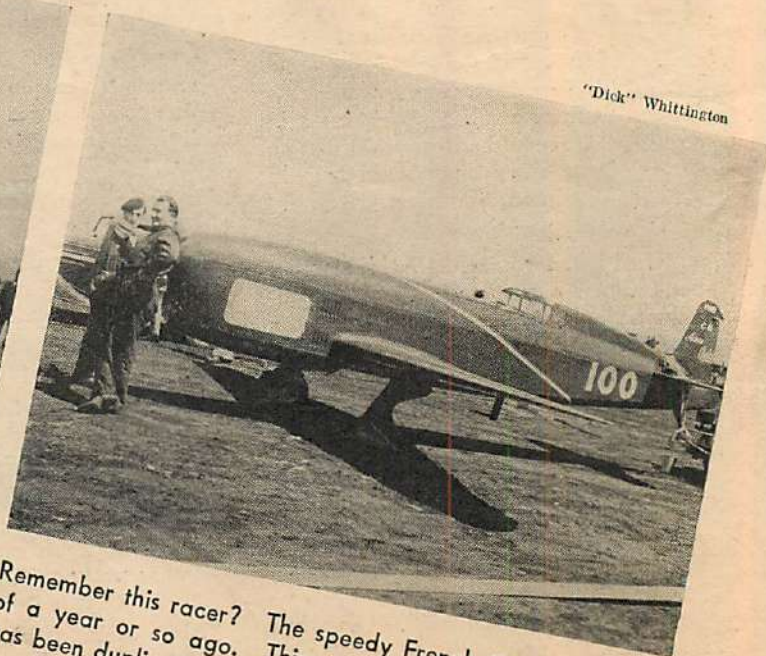
FRANCE LEADS IN WORLD RECORDS

The strong bid France has made for international air records during the past few years has won first place for that country among the nations of the world. French



Art Chester, famous designer and pilot of tiny racing planes, poses beside one of his famous products. Art usually finishes among the first. The plane is the ever-popular Jeep.

Miami News



"Dick" Whittington

Remember this racer? The speedy French Caudron C.460 of a year or so ago. This one-time world record holder has been duplicated in fighter form for the French air force.



Gordon Conner

OFFICIAL SENIOR N.A.A. NEWS

*New Developments In The
Nation's Aviation Activities
Reported By The National
Aeronautic Association*

*Prepared By
William R. Enyart
Secretary, N.A.A.*

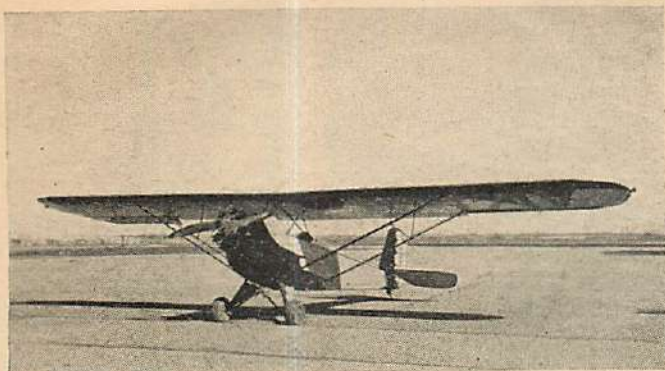
The Winnah! Earl Ortman, who at the close of a heart-stopping race with Roscoe Turner, passed him in a burst of speed to win the Exposition Trophy and \$5,000 prize.

airmen have amassed a total of 54 records, far outdistancing their nearest rival, Italy, which has a score of 33. Third place in record standing is held by the United States, for a number of years the leader, with a score of 20.

Germany and Russia are tied for fourth place, each with 18 records. Czechoslovakia has 13; Poland, 7; Great Britain, 6; Belgium, 3; Austria, 2; and Japan, 1.

Since many American airplanes are known to be superior in performance to foreign machines which now hold records, the United States could better its position considerably if our airmen would go out after the marks now held abroad.

World records provide proof of performance in terms that the average person can understand. The fact that present-day aircraft vary in size from the diminutive single-seater sport planes to huge multi-engined, trans-oceanic flying boats, and range in type through land planes and seaplanes to amphibians and autogiros, does not make the determination of just who (Turn to page 82)



A comparatively little known but nevertheless splendidly performing light plane is the American Eaglet 231, with its left-hand prop driven by the 40 h.p. Salmson AD-9 engine.



Another tailless light plane and an interesting one. The Batwing X, recently successfully tested. This ship, powered with the Pobjoy 85 h.p., is interesting for the midwing design.

light plane

*Sport flyers who throw
eral regulation must also
the advantages and privi
moted by the same body*

conducted by

send in your notes,

ONCE more we come up against the very touchy matter of government legislation as it affects the activity of amateur flyers.

Since my article of two months ago which covered in a somewhat sketchy manner the new Civil Air Regulations, this department has received a flock of letters from readers commenting on my stand, both pro and con. I will now report on these.

Let us first take the letter of Peyton Autry of Boonville, Indiana. Autry, according to his stationery, designs light aircraft and component parts and offers specific engineering services. He is a member of the Private Flyers Association, Inc., and president of the Light-plane Association of America. In other words, Mr. Autry must be considered an expert in aviation, an engineer and a man who would have no trouble in passing any normal requirement of a licensed engineer.

Mr. Autry takes me to task for backing legalized flying. I am one of the world's unhung ogres because I do not believe that unlicensed amateurs can build an airplane and fly it safely. I still believe that, and I see no reason why, if a man has the money and the ability to design, construct and fly his own ship, he should object to it being carefully inspected by the Bureau of Air Commerce and properly licensed.

It is quite possible that Mr. Autry, since he is an engineer and a designer of light planes, can build a ship equal in every respect to the Cub, the Taylorcraft or the Aeronca. He might even build one much better. Why, then, is he so inflamed against suitable legislation? He admits he does not believe in taking all the laws off and

letting everyone go haywire, but if Mr. Autry will show us where a line can be drawn between himself and the man who does go haywire, we'll be more than pleased to present his plan for nationwide consideration.

He seems to be putting up a gallant fight for what he considers the "homebuilder," the man who builds his dream ship in the barn and flies it out of the back lot. All that is very sporting and romantic, only too many young "homebuilders" have spun into the ground or have taken part in some plain and fancy homewrecking.

I can appreciate the thrill of designing and flying one's own plane. In years gone by I was one who cluttered up fields, highways and cow pastures with gliders. The kind I used is called a hang glider today, and that is a swell name. I was nearly "hung" on several occasions. I once tried to launch myself from the top of an old buggy. My friends assisted me by steering the buggy down a steep hill and hung on patiently waiting until I took off. Of course I never took off in the true sense. I sort of skimmed off, wrecked the buggy and blocked traffic on that particular stretch of highway for some hours—until we suddenly conceived the bright idea of setting fire to the glider and buggy to save time. . . .

Mr. Autry brings up the point that the State of Oregon recognizes and licenses home-made planes. If it passes state inspection, it is licensed and the builder can fly it to his heart's content. I believe it was just such a plane, Mr. Autry, that figured in a deplorable fatality in Oregon recently. It was a swell-looking low-wing monoplane, with an inverted motor neatly cowled and

flying clubs

*off the "shackles" of fed=
be prepared to relinquish
leges as allowed and pro=
for the benefit of airmen.*

arch whitehouse

news and snapshots.

a streamlined undercarriage. But the right wing came off—at 200 feet!

Mr. Autry is sincere and very honest in his project. He honestly believes that the average "homebuilder" is capable of designing and building his own plane and flying it without the Civil Air Regulations playing such a big part in the matter of safety. It seems that if you build your own plane, you must have it passed by a licensed engineer who will charge you \$300, and lose money on the deal, before the Bureau of Air Commerce will give you a license. Mr. Autry actually states that "the technically minded homebuilder can usually do as well as the average engineer, as far as designing a light plane for performance, flyability and ruggedness are



A speedy-looking light plane powered with the 100 h.p. Kinner K-5. This beautifully performing parasol monoplane is the States B-3. Note the widespread landing gear.



Presenting the latest thing in two-place Cubs. This de luxe J-3 Sport addition to the famous line boasts the 40 h.p. Continental A.40-5 engine, which delivers plenty of performance.

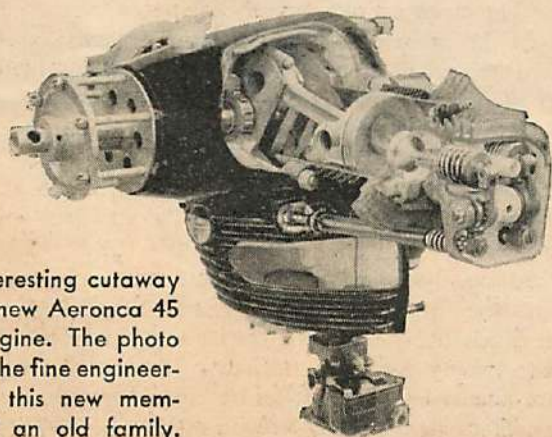
concerned. He doesn't get it by guessing, either. However, he seldom has the extensive engineering knowledge to run a stress analysis after the mode of the Engineering Division of a large aircraft concern."

One hardly knows what to say after that. Mr. Autry about sums it all up, there and then. But to clarify this for those who do not quite get Mr. Autry's reasoning, I might explain that he actually means that the "homebuilder" who does not have the extensive knowledge of the engineer, can do as well in designing light planes as the aforementioned engineer, even though he does not have the ability to run a stress analysis test.

Still, I am adamant in my statement that the gentleman is sincere and honest. He means well for the man who wants to design, build and fly his own plane. He believes that because *he* can do it, hundreds of others can. I do not question that he represents a true strata of the light plane fraternity, but unless they are all engineers or real technicians, I still object to their building planes and flying them, anywhere near where I live.

You see, I have pulled too many men out of crashes, and I know it is a very unpleasant way to go out. There are many other much better methods of fostering the spirit of aviation. Perhaps I am not quite the crusader I used to think I was, but I am at least trying to be sane about this air regulation business.

Incidentally, I might mention that Mr. Autry has a plan whereby the Lightplane Association of America will propose slight changes in the Civil Air Regulations which in some way will enable the "homebuilder" to carry on in his own way. If you are interested, Mr.



An interesting cutaway of the new Aeronca 45 h.p. engine. The photo shows the fine engineering in this new member of an old family.

LIGHT PLANES ABROAD



THE HILLSON PRAGA E.114 seems to resemble our own popular Aeronca K not only in appearance but also in popularity. Note the interesting full-cantilever wing.

OVER in Great Britain an English version of a very popular Czechoslovakian light plane appears to be meeting with great success. The plane is called the Hillson Praga and was patterned after the Praga Baby which appeared in Czechoslovakia in 1934. Several world records were set by the latter ship shortly after its introduction, and early in 1937 the British version was put into production, utilizing the 40 h.p. Praga two-cylinder, horizontally-opposed and air-cooled engine, which is very much like that built by Aeronca in this country.

Indeed, the airplane itself looks a great deal like our Aeronca C-3, which has now been remodeled into the new Aeronca model K. However, one distinguishing feature of the Praga is its full-cantilever wing, a rare feature in a light plane, and a tail unit braced with only one strut to the bottom of the fuselage. Quite novel, also, is the mode of access to the cabin, which seats two very comfortably in the side-by-side fashion. There are no doors and the lower portion of the windshield is fixed. However, the side windows fold down and outward and the top skylight, together with a large section of the leading edge of the wing, folds backward, with the front spar as the hinge point. This leaves a cabin with more open space around it than you have probably ever seen.

Construction is of the very simple kind, with wooden structure and plywood covering, the only exception being the movable tail surfaces, which are of steel tubing framework with fabric covering. The two-bladed propeller is of wood, with metal tips. The landing gear is of the divided tripod type, with the two legs which attach to the outer edge of the fuselage faired together. The third part runs from the stubby axle to the bottom of the fuselage at the center and is made of a piece of steel rod.

Over about one-half of the span the wing is rectangular in shape. At the point where the rectangle ends the ailerons begin and extend out to the wing tips. From this point also the trailing edge of the wing begins to taper, and the thickness of the wing also tapers from there out to the tip. The fuselage section is in the shape of a hexagon.

Flying characteristics are all that could be desired, and the plane will not spin or side-slip. A stall results only in a slight loss of height, after which the Praga settles into a straight glide of about 60 m.p.h. under excellent control. While cruising the plane flies in a slightly nose-down position, which gives excellent visibility forward and downward. The very large transparent panel in the wing allows good vision to the top and rear.

Specifications and performance data will be found on page 82.

Peyton Autry may be reached at Boonville, Indiana.

Of course I find that some readers agree with me. Don Lewis of Detroit, for instance, is of the opinion that since the Bureau of Air Commerce has done such a swell job so far, the same organization should take over the burden of organizing, financing and controlling light plane clubs; and he suggests that I do something about it. Lewis believes that if small representative groups of air-minded men got together and formed air clubs the Bureau of Air Commerce could be induced to take over all the business of subsidy, legislation, control and the selection of club instructors.

Mr. Lewis, as I say, has selected me to map out the plan—something of a problem, when we consider the wide range of opinions already expressed concerning the Bureau of Air Commerce. Of course it would be interesting to see how many of the anti-C.A.R. crowd would rally round the Bureau of Air Commerce flag if that organization once took over the direction of our light plane flying clubs.

Another reader who is interested in the build-your-own idea and who has constructive opinions on the matter is Lloyd R. Gabriel, Secretary of the Lightplane Association of America. Mr. Gabriel paints a pretty dreary picture of the average light plane club where members chip in and buy a plane for about \$1,500 and pay on an average of \$280 for an Amateur ticket. His argument, and it may have some basis, is that the average member of a light plane club does not get enough time in for his money. On the other hand, if he designed and built his own—or purchased a so-called kit and put one together himself—his time would be his own and he could fly to his heart's content.

Mr. Gabriel points out that the Heath "V" Parasol monoplane kit can be purchased \$350 f.o.b., which includes the engine. (These are Mr. Gabriel's figures.) The ship complete without accessories sells for about \$600. The kit includes a welded steel fuselage, tail unit, landing gear and wing support, and for about \$500 one can turn out a fairly good-looking job which is very cheap to operate. For the benefit of our readers again, we remind you that the Heath is manufactured by the Heath Aviation Company of Benton Harbor, Michigan. You can get complete details by writing to the company.

After reading many such letters on the subject, it is easy to understand the argument of those who object to being legislated "against" by the Bureau of Air Commerce. They point out that they can have their own colors, their own engine mounts and their own particular choices in instrument-board arrangements. They point out that most of these "homebuilder" jobs are not flown near big cities or over great airports. They are flown out in the open country by youngsters who practically teach themselves how to fly. They are supposed to be very stable and land at something like 32 m.p.h. They come with low power, which makes them little more than elaborate, powered gliders, and the wing loading is very low. They should not have serious accidents according to all the rules in the book. But somehow they do.

"So do flyers who use government-licensed ships," argue the "homebuilders." "Look at all the fatalities that black out the front pages almost weekly, in which ten to twenty people are killed in planes that are government-licensed and flown under close supervision." The fault there is that they are all ships (Turn to page 95)



ships in black and white

THE HOWARD DGA-11 dives into prominence as the product of one of the greatest designers of racing planes, Benny Howard. Embodying all the refinements of fine aircraft with the drafting genius of the racing designer, the DGA-11 offers the ultimate in safety plus speed plus appearance. Powered with a 400 h.p. Wasp Jr., the DGA-11 has a top speed of 195 m.p.h.,

a landing speed of 55 and a cruising speed of 208 at 12,000 ft. The rate of climb to a service ceiling of 26,000 ft. is set at 2,200 ft./min. It is interesting to note that a cruising range of 850 miles is possible with the 97 gallons of fuel carried. The welded chrome moly steel tubing fuselage and dural-covered cabin section make for security and strength as well as appearance. The DGA-11 is a splendid example of how racing plane design advances all commercial aviation. Note the resemblance to the famed "Mr. Mulligan,"

GLIDING AND SOARING

In the first half of 1938 American gliding and soaring made the biggest strides since its inception. A new American distance record of 212.45 miles was established by Lewin Barringer, representing sixty miles above the previous one held by Dick duPont, a new soaring technique of utilizing thermal up-currents over flat ground was put to test and found to yield rich results, a new



An interesting high performance sailplane built by the Royal Polytechnic Institute of Milan, The Penguin One.

although unofficial altitude record of 10,000 feet was broken by John Robbins of California, and through the improvement of winch towing equipment, ordinary soaring over level country was shown to be possible, thus eliminating the costly airplane tow method. And general interest in gliding and soaring has been vastly increased, judging merely by the number of letters received in our office.

Tremendous odds had to be overcome to accomplish this much. Ours is the only country which does not subsidize gliding. Everything done so far has had to be financed by the individuals who did it, and even that sometimes would not have been possible without the co-operation of the Soaring Society of America and its dynamic and untiring manager, Lewin B. Barringer.

Disregarding his personal interests and often his health, Lew has traveled far and wide over the United States,

Buzzard's eye view of the west coast record holder Don Stevens in his Franklin utility. Don is a specialist in doing what the safe and sane glider pilot turns thumbs down on such as inverted flight and diving into lone, unsuspecting haystacks.

lecturing and pleading for the cause of the movement before state and federal officials. Constantly he demonstrated the truth of his statements by testing them out in practice. His Texas expedition was a shining example of his profound knowledge of the art of soaring and meteorology. While in Tennessee he was responsible for the state aviation officials including gliding into the state aviation program. During the coming months Lew will tour the country with the new Ross-Stephens sailplane acquired by the S.S.A., demonstrating soaring technique and endeavoring to advance the movement.

You who are interested in gliding and soaring and wish to help make this country as great in that field as it is in powered flying, can do much by approaching your state aviation officials, chamber of commerces, and local leading clubs. Organize groups and before going into active flying sell the idea of gliding to these organizations. Join the Soaring Society of America, get its literature and write to Lew explaining your problems. He will gladly help you. The S.S.A. has a number of extremely interesting motion picture films on gliding which it lends to responsible groups free. The sum of \$15 required to be deposited with them as security is returned as soon as the film is mailed back. The address of the Society is 1500 Locust St., Philadelphia, Pa.

The only way we can possibly assist gliding and soaring in a concerted way is by all of us pitching in and helping the S.S.A. At present it is not self-supporting;



Conducted by Alexis Dawydoff

the membership is too small and the expenses are too great. Only through the generous contributions of Dick duPont, Mrs. Warren Eaton and others has it been able to get along. But if those interested in the greatest sport of them all join it and lend their helping hand, we will have an organization capable of putting gliding and soaring where it belongs in aviation. So far it has been the orphan of the industry instead of its primary stepping stone.

CLUB NEWS

Jack Brookhart of the Airhoppers Gliding & Soaring Club of Astoria, N. Y. C., earned his "C" license with a fine flight of 12 minutes over the club field at Hicksville, L. I. Arthur Lawrence, Secretary of the Soaring Society of America, was a recent visitor at the field and watched the boys fly their Franklin.

Emil A. Lehecka put on an exhibition of soaring with his Rhonsperber at an aviation meet held at the Aviation Country Club, L. I., N. Y.

To Elmer Zook, member of the XYZ Glider Club of Detroit, goes the honor of being the first pilot to call on Edsel Ford in a glider. Elmer took off from the Triangle Airport on a Sunday in his Franklin and soon climbed to an altitude of 5000 feet on a thermal. Looking down, he saw that he was too far from the airport to be able to return. The thermal gave out and the ship started losing altitude rapidly. Noting what appeared

to be an expansive patch of grass just below, he landed nicely on it. Before he could climb out the owner of the property appeared, asked where he came from, and readily helped dismantle the Franklin. With the gentleman's aid the ship was stored in the garage, and then calling his chauffeur the amiable host had Elmer driven home. On the way Zook asked the chauffeur who had helped him. "That was Edsel Ford," the other replied. In all of Elmer's experience in glider flying this was the biggest surprise he ever had. His distance on this flight was 36 miles, his route taking him across the City of Detroit.

Dick Randolph of Akron, O., has been busy flying his Westpreussen sailplane recently purchased from Art Rahn. Two of his flights were of over 2 hours' duration, maximum altitude reached being about 5000 feet. The Westpreussen is equipped with a two-wheel undercarriage which Dick drops on the take-off.

Ben Levene of the Philadelphia Soaring Society has had his Cadet II glider and his LeBlond-powered Davis monoplane relicensed, and is now operating at the Pine Valley Airport in New Jersey.

The members of the Nanticoke Valley Soaring Society of Maine report that they have made thirty flights with their Zeegling glider in one month of operation. They hope to be able to obtain a high-performance ship as soon as the membership in the club increases.

Frank Kelsey and Glen Mitchell of Salt Lake City, Utah, are busy building a two-place sailplane. It will have a wing spread of 52 feet.

Dr. Wolfgang Klemperer, Vice-president of the S.S.A. and holder of "C" license No. 1, took up his niece in Jay Buxton's Transporter for a flight of one hour along the Palo Verde hills, California.

Gil Walters of the Soaring Society of Northern California soared his Pegasus sailplane for 3 hours and 5 minutes at the Altamont soaring site located in the
(Turn to page 94)



Lewin Barringer, genial general manager of the Soaring Society of America and record holder, gathers more first-hand material for his famous series of motorless flight lectures and talks. The ship is the record-breaking Minimoa.



GREETINGS, Air Adventurers!

Going through the hundreds of letters that come to this department every month, I often see the phrase: "Words cannot express the enjoyment I get out of Air Trails and Air Adventurers." Sometimes it goes: "Words cannot express my interest in aviation and what you have done to build up my interest."

We appreciate these compliments, of course, but we often wish our readers and members could find the words they are talking about and really make an attempt to express themselves. We always get a let-down feeling when someone starts out so enthusiastically and then winds up with the old gag that "words cannot express." Words really can express, and we want you to put in a little effort digging up a few to let us know what you are doing, what you want to do, and what you want *us* to do.

By the time this appears in print, the summer will be well on its way out and we shall be looking forward to the usual winter of planning and the time when our model makers and light plane enthusiasts are deep in their plans for the coming year. This will be the time for all Air Adventurers to settle down and present something constructive to this department.

In looking over a representative batch of letters, I have discovered that our members are slowing up, perhaps not in their interest, but certainly in their efforts to turn out good material for the department. Many are even very careless in their handwriting, causing us to transcribe their names incorrectly—which always brings a return blast. What I am really getting at is more and better correspondence. I am sorry to say that most of our well-written and interesting letters and items seem to come from members in Canada, Australia, New Zealand and the British Isles. These fellows are careful of their writing, they know what they are talking about, and their spirit and enthusiasm are most sincere. These overseas and across-the-border members certainly manage to find "words that express," and we feel that it is time some of our home-grown members did something to keep up with them.

American members are sincere and enthusiastic, there is no question about that, but it appears that they are so close to modern airports, modern air transportation and the key cities of magazine distribution, that they become blasé in their consideration for us and careless in their efforts for the club itself. Members in Australia and New Zealand sometimes wait six months before they see a magazine carrying something they had requested. On my desk now is a letter from a member in New Brunswick who admits that he sees an airplane only

about twice a year and is hundreds of miles from an airport, but he is one of our most enthusiastic followers and his letters are well worth printing verbatim.

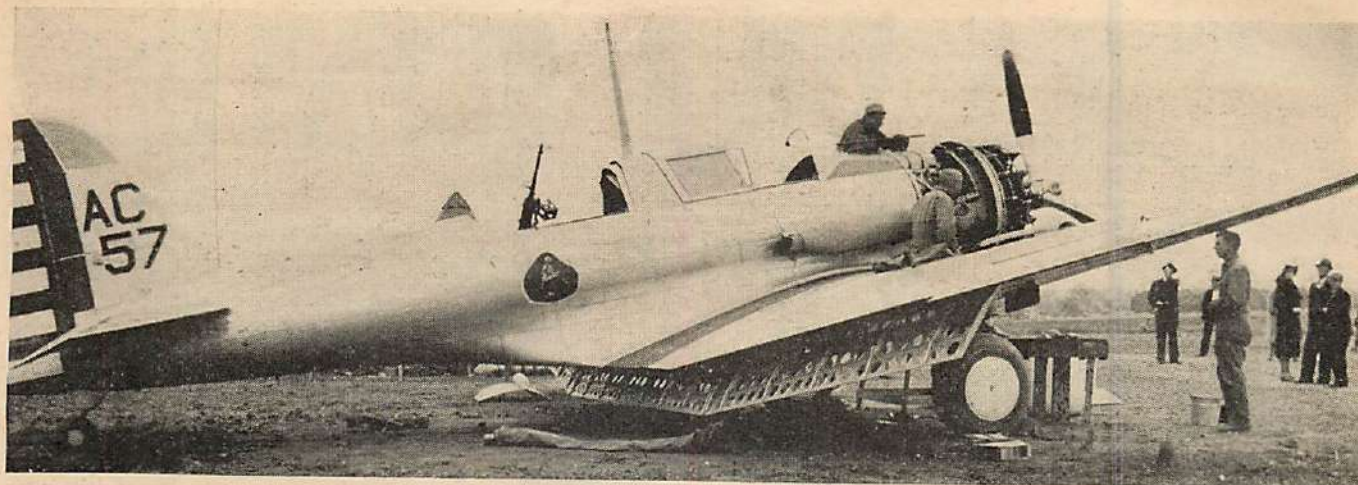
All the fine writing in the world by an editor is not enough to make a department "go." There must be a steady flow of good outside interest in the form of letters and suggestions. Our members have flocked and rallied to the call for membership in a manner that has been most encouraging. We do have an impressive membership list and are growing every day, but we must watch out for that canker of stagnation which may come through indifference, lack of personal interest and a dearth of good material to keep the columns filled with substantial reading.

You all like to read the comments on letters from other members. You say you eat up the model departments and question features, but you must remember that these are wholly the result of sincere outside interest. We can only know what you wish and how you wish it served when you tell us—and tell us with the proper amount of words.

So come on, Air Adventurers, sit down now and do the right thing. We want news of **YOU**, written by

What Air Adventurers look like. This is Joe Scordo of Lafayette, Colorado with a 55½ inch wing-span model of a Boeing air liner, complete even to the radio.





A Northrop Attack ship of the 13th Attack Squadron stripped down for overhaul, showing new engine silencers. The picture was taken by R. R. Meyers of Allentown, Pa.

you with all the words you can muster. We want your ideas and suggestions. You owe it to yourself and to the club. We also want more members, of course, which is why we include the usual coupon below, for you to fill out if you are not a member, or for you to show to that air-minded pal who should be.

Your Flight Commander,

ALBERT J. CARLSON.

AIR ADVENTURERS NEWS

But now to the more important business of the department.

Howard Soper, a new member, is overjoyed about getting into the crowd with us and likes Air Trails a lot. He believes, however, that we could do more in the way of showing what foreign planes look like and how they perform. He seems to be particularly interested in Italian and Russian ships. We do like to show foreign planes, but we find great difficulty in getting suitable photographs of the newest types from these countries.

Peter Boulton of Verdun, Quebec, has just discovered Air Trails and comes through with a most congratulatory letter. He states that he has sent for Walter Hinton's book and hopes through us to get well into aviation within a short time.

George Meyer of Ridgewood, N. Y., has joined and has already sent in the papers for his next rank. He also handles a crayon pretty effectively and adds a swell picture of an A-17-A attack ship. Sorry we can't reproduce it, George.

These Canadians continue to hold their end up in Air Adventurers. Don Brynes of Hamilton, Ontario, sends us a couple of swell pictures of a Stinson Reliant taken at the Hamilton airport. We have also received interesting letters from Willard McCaffrey of St. Stephen, N. B., and a full-fledged examination paper for a Flight Lieutenancy from Charles Genuit, Jr., of Toronto, Ontario. Genuit is a bright prospect to become a swell aeronautical artist. He has sent us several of his pen and ink sketches and they are usually good.

The Airplane Craftsman award goes to Dana Cunningham, of Old Town, Me., on the strength of his splendid model of a Seversky BT-8 trainer. He sent two pictures of it in, too, but they were not quite sharp enough to reproduce.

Thomas Luck—and what a swell name—of Indianapolis, knows how to get on with the big boys. Tommy, who recently won his Flight Lieutenant's award, is a great model builder and a short time ago he presented one of his models to former Governor McNutt of Indiana, now High Commissioner of the Philippines. It was a very complete job on the Douglas, and the former governor answered with:

DEAR TOMMY:—

Many thanks for the clever miniature airplane that you sent me for Christmas. I deeply appreciate the thoughtfulness in remembering me on this occasion.

With kindest personal regards and all good wishes, I am,
Very cordially yours,

(Signed) PAUL V. McNUTT.

Tommy has also passed his Photographer test with an excellent print of a Vultee V1A transport, and moreover gets his Observer award with a very full and descriptive account of a day at the Municipal Airport of Indianapolis.

Another fine descriptive account of an airport comes from Alfred H. Borkenheim of New (Turn to page 83)



Actual size of your Air Adventurers pin.

(MEMBERSHIP COUPON)

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

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

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

Name Age

Address

☐ Check here if interested in model building.

(This coupon may not be used after October 15, 1933.)

WHAT'S YOUR QUESTION?

By Clyde Pangborn

Question: To join the Naval air service, what must the applicant require? J. D. P., Brooklyn, N. Y.

Answer: To join the Naval air service one must have at least two years of college education or its equivalent and be physically perfect.

Question: I am interested in the construction (materials used) of motors used in light planes, and the type of props used for speed and for carrying loads. I am also interested in the cost of these and where I might obtain them if I so desire. R. A. S., Littlefield, Tex.

Answer: You can obtain all this information by writing to the Department of Commerce, Bureau of Aeronautics, Washington, D. C., or to the National Advisory Committee for Aeronautics, Washington, D. C. These organizations publish reports on aircraft construction.

Question: How many airplanes has the country of Poland and which of the planes are most heard of? B. S., Bethlehem, Pa.

Answer: All I know is that Poland has approximately over 1,000 military ships, a number of transports among them, Lockheeds 12 and 14. They have aircraft factories which produce some very fine ships. Their PZL fighters are rated among the best in Europe.

Question: I am very interested in flying, but have had only a grammar school education and have no money to go to an aviation school. Could you tell me the best thing to do? I am wondering if there is a school where I could work my way through. G. A., Waterbury, Conn.

Answer: A number of fellows have worked their way through flying courses before and there is no reason why you should not be able to do it as well. Try some flying service which is engaged in construction work. Offer them your services as a helper, and if you are serious in your desire to learn how to fly and impress them with your willingness to work earnestly for the instructions, you will undoubtedly succeed. See page 16 of this issue.

Question: Are there any airports or air concerns which offer apprentice



work? If so, would they give a sixteen-and-one-half-year-old boy apprentice work dealing with airplane work during the summer vacation? R. T., Tama, Iowa.

Answer: A number of fields hire young boys as apprentices or helpers, but they usually prefer to hire them permanently, because of trouble involved in breaking a man in and then having him quit just when he is getting useful to them. I would suggest that you finish school first before attempting to find work in the aircraft field, although there is no harm in trying it now if your mind is set on it.

Question: I am twenty-one years old and have a good job in a paper mill, but am interested in aviation. I would like to know if the drafting course offered by mail by Curtiss-Wright Tech is good and if they can secure me a job in their plant after completing it. G. S., Chilli-cothe, O.

Answer: The drafting course offered

AS SOON AS POSSIBLE AFTER BE-
ING 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 EN-
VELOPE TO INSURE ANSWERING.

by Curtiss-Wright Tech is very good and I recommend your taking it. However, I don't know if they would secure you a job in their plant upon the completion of it. Why not write them about it?

Question: Could you tell me the name of the best air school in the vicinity of New York? Does one need a college education to fly for the Navy, and which branch of the service gives better training, the Army or the Navy? J. H., Brooklyn, N. Y.

Answer: The best aviation school in this vicinity is the Roosevelt Flying School located at Mineola, L. I. You have to have at least two years of college education to enlist in the Naval or Army air services. Both branches give their men excellent training and one could not say which is the better because the training is identically good in both services.

Question: Are there any restrictions on pilots who fly the Thompson or Greve Trophy races? By that I mean restriction on licenses. Do you have to have a transport ticket, and how much experience is necessary to enter? J. W., Beaverton, Ore.

Answer: It requires many years of flying experience and ability to handle extremely fast airplanes. Therefore, as far as I know, all the entrants in these races are transport pilots, although due to the fact that the races are flown in non-commercial ships, you don't have to hold a transport license.

Question: I don't know whether you're the right one to ask or not, but I'd like to get some information about back issues of Air Trails. How much do they cost and where can you get them? What issue did the plans for the Bill Barnes Lancer come out in? Please let me know the same for the Snorter, the New Eaglet, and the Transport. B. L., Kingston, N. Y.

Answer: While this should really be referred to another department, I'm taking this opportunity of settling the matter for all readers who have similar inquiries. No back issues before August, 1936, are available. Those after that date can be had for 15 cents each; address Mr. Clifford of (Turn to page 96)

GUEST EDITORIAL

By Bill Atwood

(Nationally known model builder and original designer of the Baby Cyclone engine. Now affiliated with Phantom Motors as chief engineer in charge of production.)

Now that gasoline-powered models are here to stay, it is only natural that numerous engines of various size and displacement are being put on the market. The question therefore arises: "What can we do to establish a fair set of rules that will place each model on an equal basis as far as performance is concerned?" It is quite discouraging to see contests out here on the coast being carried on under different rules than those adopted by the N.A.A. The boys who are required to build models with a wing loading of 12 ounces per square foot, as coast rules now require, are at a distinct handicap when flying those same models against planes weighing only 8 ounces per square foot.

The reason that the rules here on the Pacific Coast have been set at 12 ounces per square foot is due to the fact that several contests were won by models of the "floater" type. These models were helped greatly by thermal conditions, and it was realized that a load limit must be set so that models flying early in the contest would not be at a disadvantage due to the lack of these conditions. When 300 or 400 models are to be flown during one contest, the average time of each flight should not be over 2 or 3 minutes. After several preliminary contests, in which comparisons of average times were computed it was found that the load limit of 12 ounces to the square foot was quite satisfactory for planes powered with motors of 5 c.c. displacement or over.

However, now that motors are being built smaller, lighter, and more reliable, a division point must be agreed on as to their displacement. It is my suggestion that when engines of less than 5 c.c. displacement are used, the wing loading should not be over 8 ounces per square foot, and models powered by engines of 5 c.c. displacement or over be required to have a wing loading of 10 or 12 ounces per square foot.

Model Making

AIR TRAILS DEPARTMENT OF PRACTICAL CONSTRUCTION

9 MODEL BUILDING ITEMS

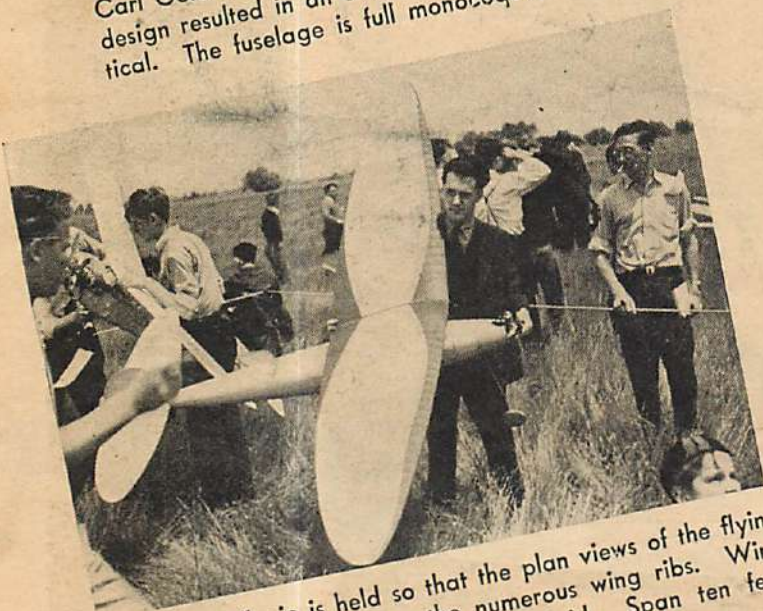
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THE VALKYRIE

PART I



Carl Goldberg releases the Valkyrie on a test glide. Clean design resulted in an unusual gliding ratio. Wings are elliptical. The fuselage is full monocoque, sheet balsa covered.



Here the Valkyrie is held so that the plan views of the flying surfaces are visible. Note the numerous wing ribs. Wing construction is multispar—extremely rigid. Span ten feet.

A High-Performance Gas Model combining light weight and streamlining.

THE Valkyrie is one of the most prominent models the hobby has ever produced. It is a pleasant combination of excellent design and clever construction—proving that an ultra-streamline model could be made lightweight. Beginning in the spring of 1936, much work was spent in design. Actual construction got under way in July and continued more or less steadily to February, 1937. The first test flight was on March 7th, lasting 4 minutes. The final flight was July 11th, taking 2nd place at the 1937 National Meet in Detroit. The Valkyrie was lost in Canadian territory after 53 minutes. And that was the last news of the model. During its short life it turned in 29 flights under a wide variety of flying conditions. Fortunately, complete data and photos had been kept of the ship.

Specifications of the model are: span 10 ft.; length 8 ft.; weight with Brown Jr. (ready-to-fly) 4 lbs., 12 oz.; and a wing loading of about 5.85 ozs. per sq. ft.

The glide was considered flat by modelers who watched its performance. The ratio was about 12 to 1—a conservative estimate which falls somewhat below the astounding ratios credited to other models. However, the Valkyrie was well able to match the glide of other championship models, proving builders are prone to misjudge glide ratios.

Spiral stability was excellent because of the high center of lateral area. It showed the highest resistance to spiral diving, never going beyond a moderate bank. Notice that in the take-off photos, the wing tips are level in spite of the gusty wind.

Directional stability was good with a rudder area of only 6 per cent. Undercambered stabilizer worked like a charm! The more power developed by the motor, the better it held the model under control.

Modelers who watched the Valkyrie at Detroit last year might wonder why it stalled so much during the glide. The explanation fixes the blame on the flyer, since the model was adjusted with the center of gravity at 55 per cent back from the leading edge of the wing instead of the 45 per cent previously found best. But even this bad adjustment couldn't make it stall during the climb. The undercambered stabilizer did its work effectively. However, after the power cut off, the model stalled almost two hundred times during the 53-minute flight. After every two or three stalls, it would make a tight circle and come out of the stall, gliding fine for a while until the bad center of gravity

By Carl Goldberg

in collaboration with Gordon S. Light

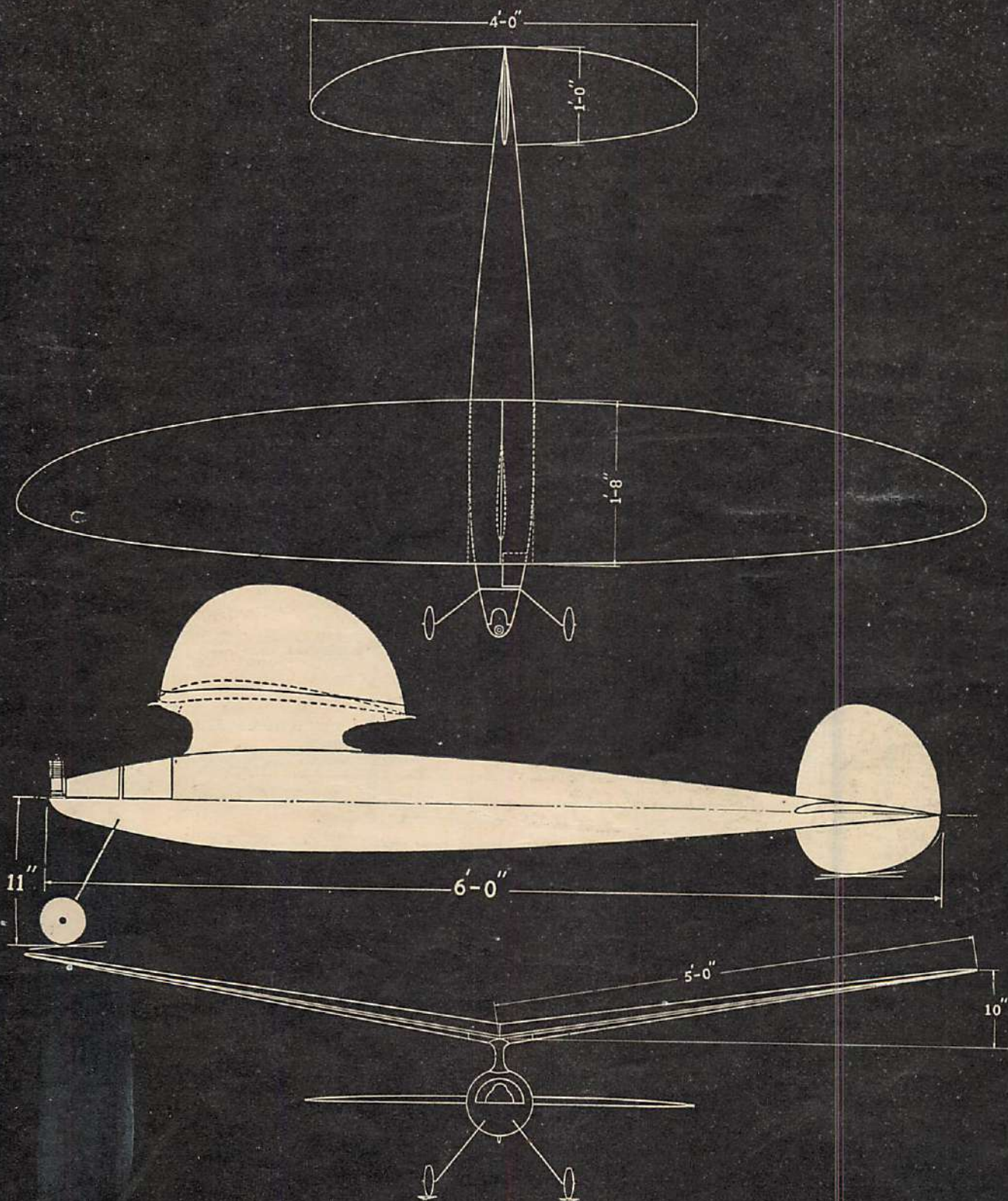
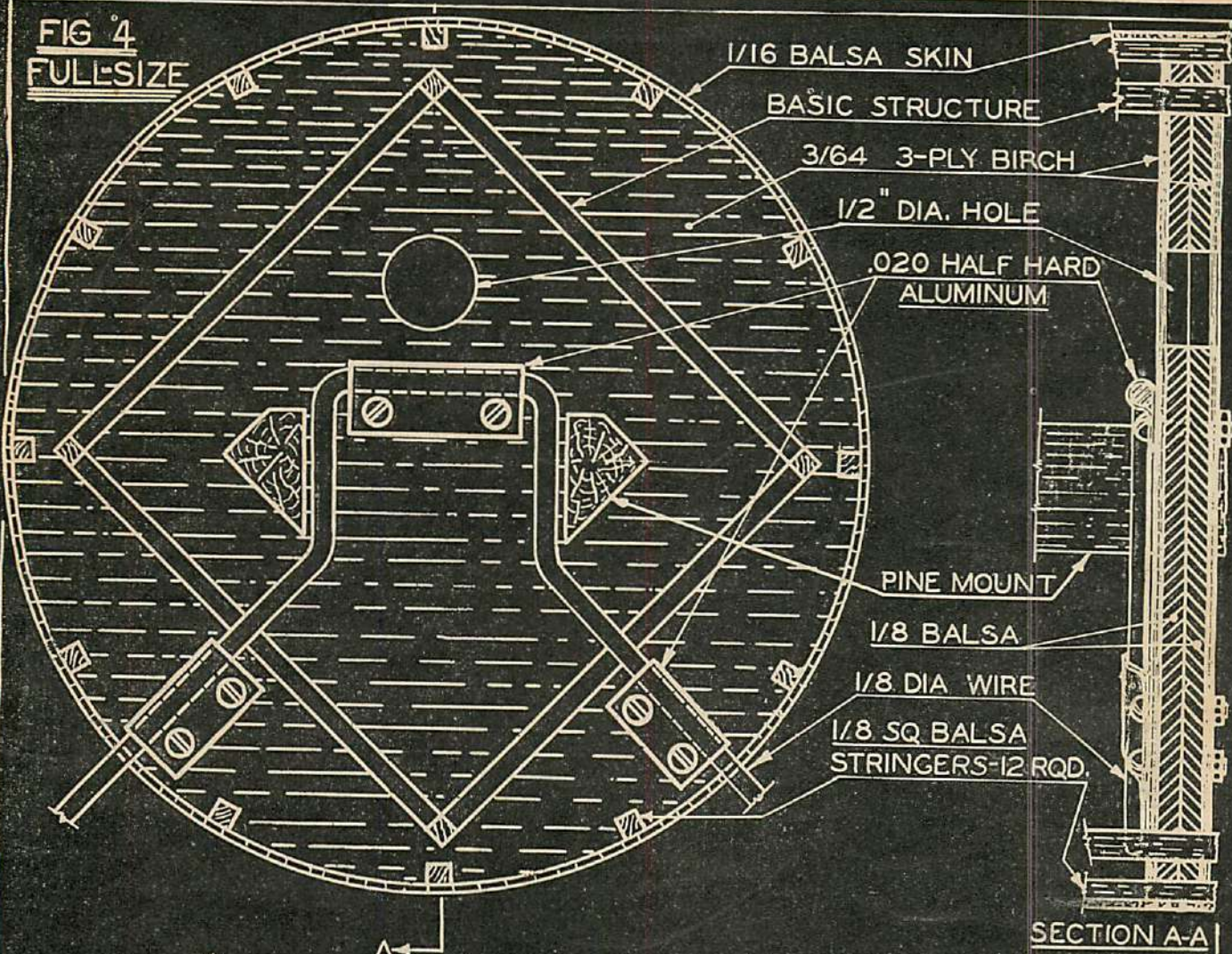
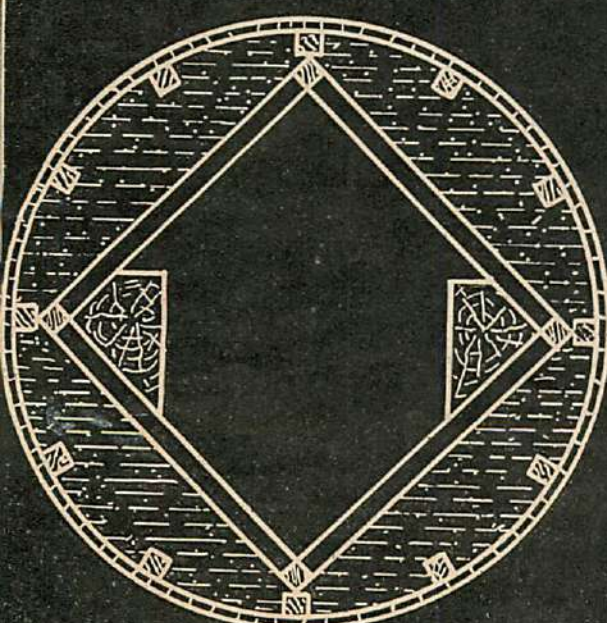


FIG 4
FULL-SIZE



BULKHEAD 2 SHOWING LANDING GEAR AND MOTOR MOUNT



BULKHEAD 1 - FROM 1/8 Balsa

TWO VIEWS FRONT NOSE BLOCK

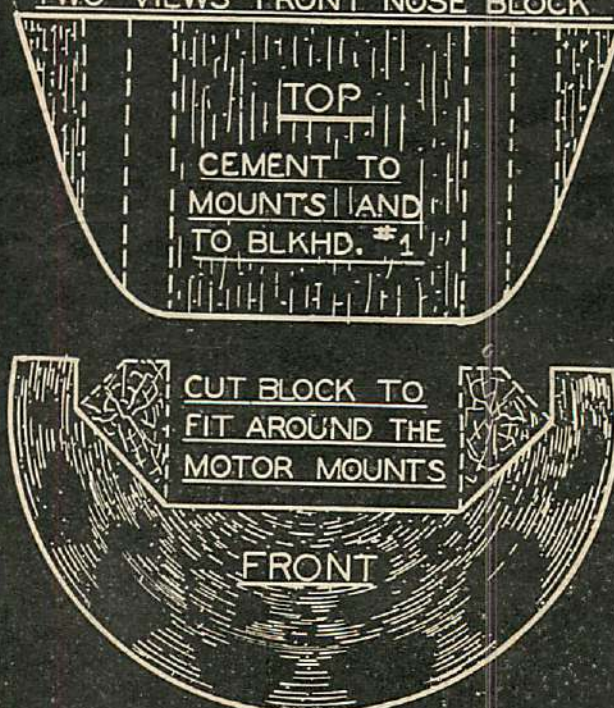
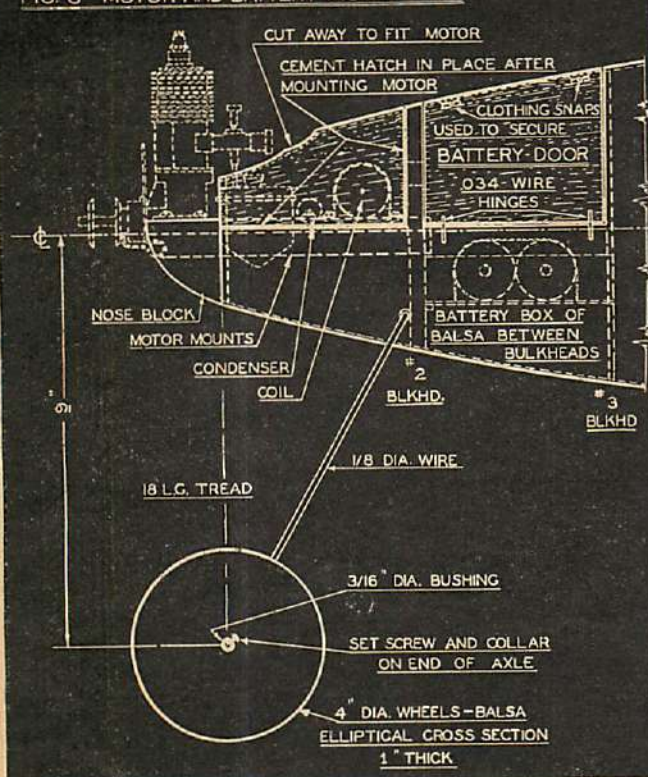


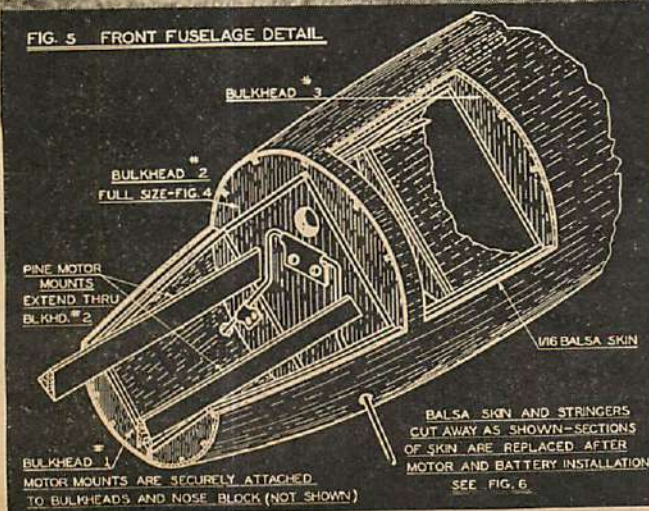
FIG. 6 MOTOR AND BATTERY INSTALLATION



The smooth launching technique of the designer of the famous Valkyrie is shown in this interesting take-off shot of the sensational model during a recent meet.



FIG. 5 FRONT FUSELAGE DETAIL



also shown in Fig. 4. All other bulkheads with the exception of #2 follow this type construction.

Figure 3 shows the stringers ($\frac{1}{8}$ " sq. hard balsa) added to the fuselage structure. Twelve stringers are evenly spaced around the bulkhead and set in notches. At the rear of the fuselage the stringers are joined to form the rear tip of the fuselage, which extends $4\frac{1}{2}$ " back of the box framework.

About Carl Goldberg

For the last eight years Carl Goldberg has been at the top of the model hobby. And this grip on the top rung is as firm now as ever. Up until last year he was content to dominate indoor flying with only an occasional try at the outdoor events. But last year he built the Valkyrie. And like most of his models it was of championship stuff. It won second place in the gas event of the 1937 Nationals with a flight of 53 minutes.

Listing Carl's contest records is a tedious job. Since 1930 he's placed high in every national and sectional meet. He enters every contest he possibly can. His contest technique is smooth and efficient, yet he's never too busy to help out a fellow contestant. Carl's ideas on model design are exceptionally sound, and he has the ability to work them out to a successful conclusion.

Goldberg is 25 years old. He was born in New York City. Started modeling in 1928 and has been active ever since. Several years ago he left New York for Chicago. Model records were not long in moving with him. Much of the success and enthusiasm of the Chicago builders in recent years can be traced directly to his influence. At present he operates a model shop and is helping advance the model hobby among Chicago boys.

Chicago modelers are to be envied. The chance to work with Carl is the shortest way to modeling success we can imagine. Knowing him has been one of the most pleasant features of the sport. And in presenting the Valkyrie, department readers have the benefit of an outstanding model airplane designed, built, and flown by the hobby's most outstanding member.

WING MOUNT FLOOR

Flooring is a piece of balsa $\frac{1}{8} \times 1\frac{1}{2} \times 16\frac{1}{2}$ " which runs through the top-center of the fuselage. It is anchored with $\frac{1}{8} \times \frac{1}{4}$ " balsa running across the bulkheads. After the fuselage has been sheeted, holes are drilled through the skin and floor to take the wing-mount spars. (To be described next month.)

LANDING GEAR

A single piece of $\frac{1}{8}$ " diameter wire is bent to the shape indicated in Figs. 4 and 6. It is bolted to bulkhead #2. Fittings are bent from .020 half-hard aluminum. Use $\frac{3}{32}$ " diameter machine screws.

Wheels are turned to elliptical cross-section from hard balsa 1" thick and 4" diameter. Insert $\frac{3}{16}$ " diameter aluminum tube bushing through the center. Collar with set-screw fastened on each axle-end. (Turn to page 84)



CHAMPIONSHIP STICK MODEL

Detailed plans and directions for duplicating a high-performance contest ship—a Scripps-Howard champion.

By JERRY KOLB

THE Junior Aviators held their 1937 national meet at Akron late last summer. This annual competition brings together some of the country's most outstanding builders. Invariably records are made. 1937 was no exception. The model described in this article turned in the longest flight of the meet which included gas-powered as well as other rubber-powered events.

This stick model has many design features in common with the Korda fuselage model (Air Trails, February, 1938), another championship model. These models are representative of the designs which Richard Korda, myself, and other Clevelanders have flown with such telling results in recent contests.

Simplicity of construction and flying are the outstanding design features. In the hands of an experienced flyer, consistent results are assured. Typical case is the slightly modified version of this model built for the 1938 contest season. Shortly after we posed for the photo showing us winding the model, I launched the model for an out-of-sight flight of 18 minutes. This happened during January when thermal currents are mighty few.

Only one fundamental change was made in the design when preparing it for the present contest season. The fuselage was turned on edge and the wing was mounted on a bamboo-wire saddle instead of resting flat atop the fuselage. These changes are not included in this article, however. Plans included in this article show the model exactly as it was on its winning flight last year.

CONSTRUCTION

Bend the $\frac{1}{8}$ " square longerons to the outline—which can be drawn up full size using the dimensions given in the reduced size drawing. The dimensions given in the side view of the fuselage extend from the outside edge of the longeron to the reference line. Build up two identical side-panels. Cut the fuselage upright-braces and insert them between the longerons.

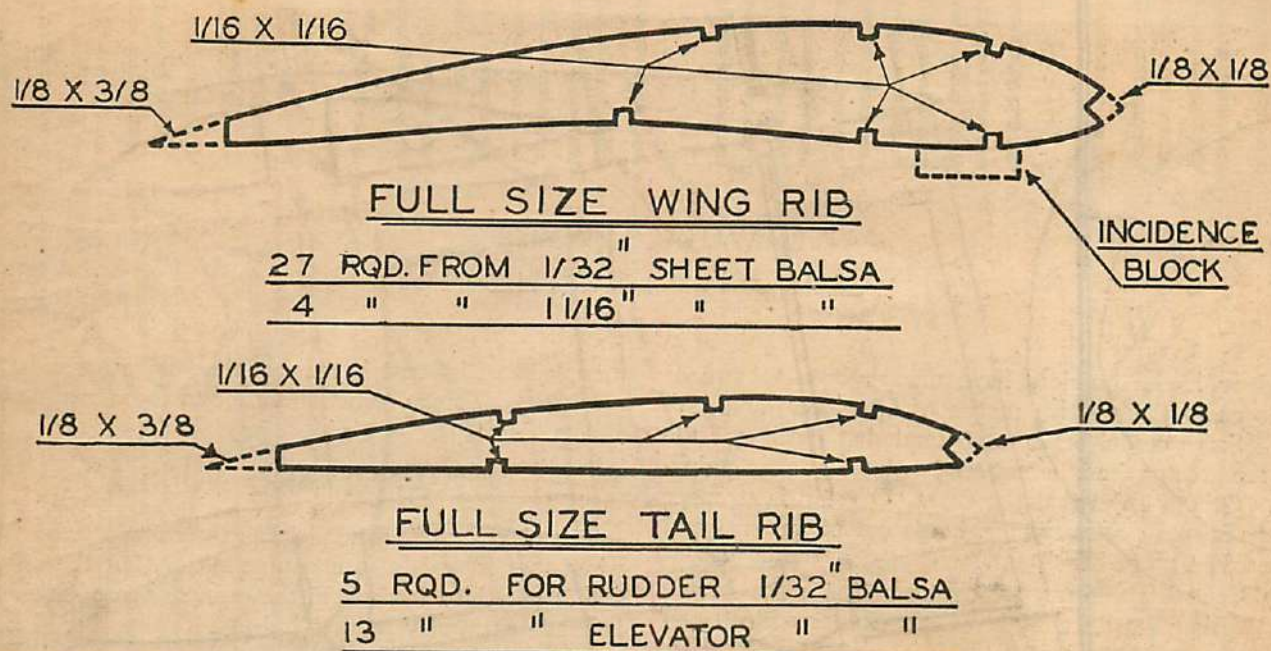
In joining the two side-panels, note that the width is given at only four points. (Top view). Hold these dimensions but allow the panels to take a natural curve between these stations—filling in the cross-braces to fit.

After the cement joints are firm, round off the outside edges of the fuselage with sandpaper. Fill in the front and rear ends of the fuselage with $\frac{1}{8}$ " sheet balsa—as shown by the shaded portions in the drawing.

The tail boom joins the fuselage with a plug which fits inside the fuselage. The plug is cemented inside the longerons of the tail boom. The other end of the plug fits inside the rear of the fuselage. The boom is kept in place with strips of Scotch tape.

The nosing is cut from a block $1\frac{1}{8} \times 1\frac{1}{4} \times 1\frac{3}{4}$ ". It fits inside the fuselage in pluglike fashion. It is held in place with a rubber band which fits through a notch in the nosing and is fastened to wire hooks on each side of the fuselage at the third upright brace.

Propeller bearings are made of sheet brass. The ends are pointed and bent to a U-shape. Bearings are pressed into both the outside and the inside faces of the nose



plug. These bearings should be set to hold the propeller shaft at 2 degrees negative thrust and 1 degree right.

WING

The wing is made in three 14" sections. Each section is completed ready for covering before joining. The center section is flat. The two outboard sections are raised 4 1/2" at the tips. Note in the drawing the outer section has been shortened to meet space requirements. Dimensions supply all the necessary information, how-

ever. 1/32" ribs are used throughout with the exception of the end ribs of each section—where the extra strength of 1/16" ribs is necessary for joining the wing sections. For additional strength, balsa triangles of 1/8" sheet are cemented inside the end rib. Note that the 1/16" square spars are curved back at the tips. This strengthens the tip and makes covering easier.

ELEVATOR

Construction follows that used in the wing. The sizes of spars and edges are the same. The drawing gives the full-size rib shape.

RUDDER

The lift section used in the elevator is used in the rudder. The flat surface is on the right side (looking forward). By using the airfoil in the rudder it is possible to set it at zero degrees and still obtain the necessary turn.

(Turn to page 98)

About Jerry Kolb

Jerry Kolb is one of the Cleveland group whose work at contests has earned these flyers national rating. He is fully able to uphold his honors among such distinguished modelers as Richard Korda and Chester Lanzo—with whom he is closely associated. Kolb has been building for three and a half years. Rubber-powered models are just one branch of his work. Last year he was named as Cleveland's glider expert. His best time with hand-launched gliders is 14 minutes and 59 seconds (out-of-sight). In tow-line his best flight was 8 minutes and 42 seconds, also out-of-sight. He has built and flown gas models with no little success. He placed high in this event at Akron last year in addition to winning the senior outdoor stick event. His models help continue the long list of championship designs which have been coming out of Cleveland workshops.



STOUT INDOOR TROPHY WINNER

By WALLACE SIMMERS

in collaboration with Lawrence N. Smithline

Indoor model builders have always been at swords points as to the relative merits of Class "C" and "B" jobs. Some model builders contend that the larger the ship the greater the inherent tendency for greater endurance. Others claim that the Class "B" ship is stronger and, as it also circles tighter, keeps out of mischief and is therefore more consistent.

This consistent flyer, which took first place in the 1937 Nationals with a flight of 21 minutes and 30 seconds, was built to Class "B" size because of the rules of a previous contest. These rules also restricted Wally Simmers to using a solid stick and, as other models had to be built for the Nationals too, he had no time to make a hollow one.

The model is built to general construction rules, and the wood should be of the finest four-to-five pound variety.

WING

The wing outline is a double ellipse, which is practically exactly the same as a swept-forward ellipse. The centerline of the wing is 20% of the center chord from the leading edge. An extremely high wing was used in order to raise the center of resistance. The solid stick bends down so much that a diving tendency is produced under power at the start. By raising the center of resistance a counteracting stalling tendency is introduced to overcome this excessive down-thrust. A fur-

ther point of interest is the fact that the wing stilts are offset $\frac{1}{4}$ ". This is sometimes done to counteract torque effects.

ELEVATOR AND RUDDER

The elevator of the model has the same shape as the wing, that is, it is also a double ellipse, but the centerline is one-third back from the center chord. It should be made extremely light to aid in recovery should it hit a light or other obstruction. It has $5\frac{1}{8}$ " dihedral under each tip and this is given by moistening the under-side of the spars after the stabilizer is covered. The rudder is made in the conventional way and has the same shape as the outer portion of the tail.

MOTOR STICK AND BOOM

The motorstick and boom used on the original model was solid. The motorstick was taped from a strip $\frac{1}{4} \times \frac{1}{8}$ " to $\frac{5}{32} \times \frac{3}{32}$ " at the ends. The wood used was quarter-grained stock sanded smooth. A rear hook, can and thrust bearing, which is made from .016 wire, should be cemented on. The boom is tapered from $\frac{3}{32}$ " round to $\frac{1}{32}$ " round at the end of its 10" length. Cement it to the motorstick at 0° incidence and then cement the covered elevator and rudder to it, making sure that the rudder is perpendicular to the elevator.

PROPELLER

The propeller is carved from a block $14 \times 1\frac{1}{2} \times 1$ ". It should be quarter-sawed so that the full quarter-grain is obtained about $2\frac{1}{2}$ " out from the hub. Under power the propeller flairs quite a bit. Less cut-back should be used on a high-flying ship so that the propeller is not slowed up too much at the start.

ADJUSTING AND FLYING

Clip the wing to the fuselage about $3\frac{1}{2}$ " from the nose. Insert the propeller shaft through the thrust bearing, after having put a washer on it, and hang a loop of $\frac{5}{64}$ " rubber 19" long on the shaft and rear hook. Make sure of the wing setting by gliding the model and making proper adjustments if necessary. Capacity winding is 2700. However, at the Nationals, 2500 turns were used on the winning flight. If a low-ceiling job is desired a $\frac{1}{16}$ " rubber loop, $16\frac{1}{2}$ " long, should be used.

The model is a very consistent flyer and will always give satisfying results even under the most adverse conditions.

ATTENTION TO LIGHT PLANE ENTHUSIASTS!

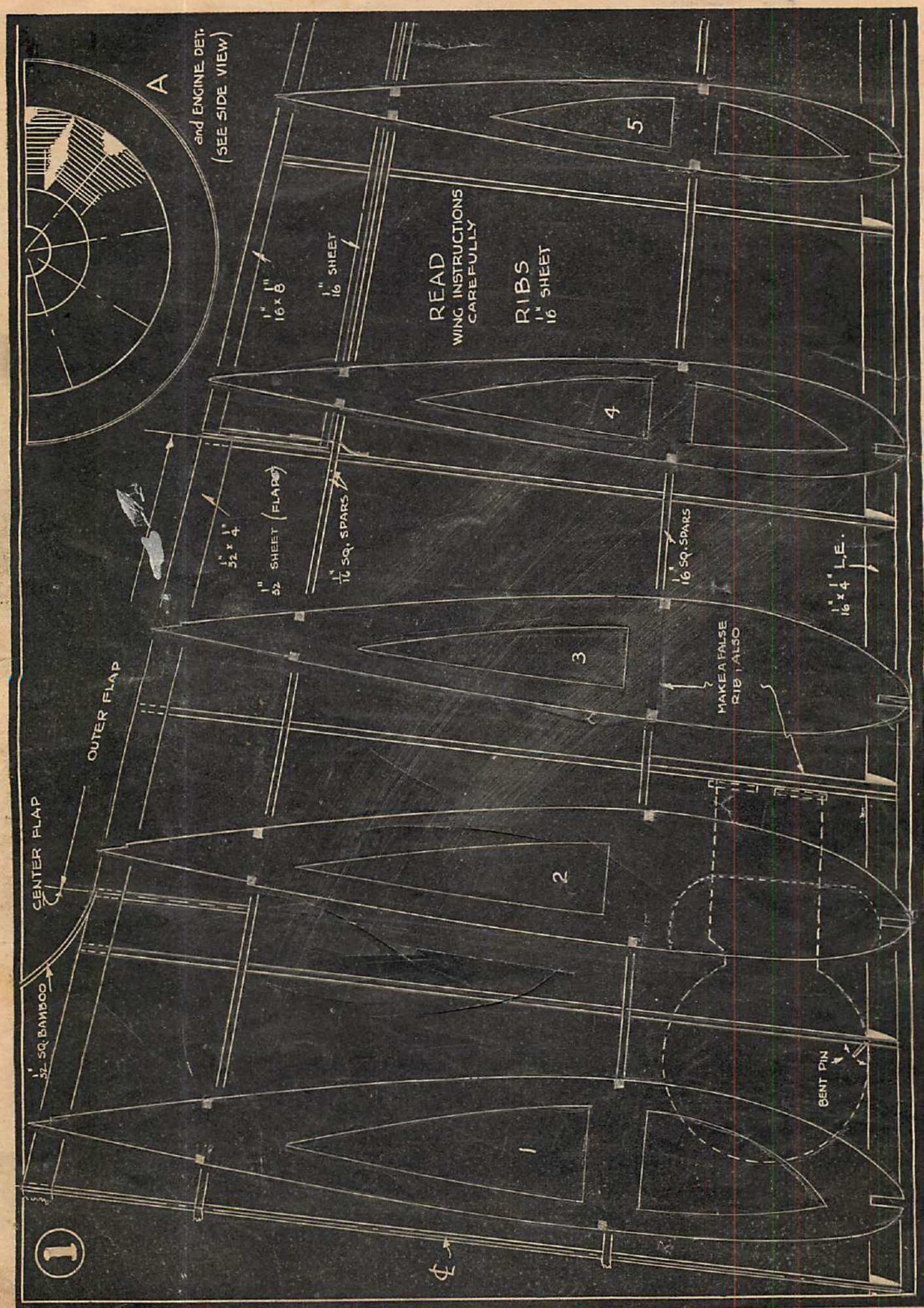
In response to many requests, and in keeping with our aim to further the sport of light plane flying and the forming of light plane clubs, we offer the following service to our readers.

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

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

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

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



EXECUTIVE

A high-performance flying scale model of the Spartan.

By ALAN D. BOOTON

THE SPARTAN EXECUTIVE was recently released for export, and has already seen service in China, with only minor military conversions. This new model shows graceful design from any angle and yet lacks nothing in engineering. It is claimed that the Executive handles smoothly at speeds up to its top of 216 m.p.h., which is available from the 450 h.p. P&W, Jr.

The model design retains all the prototype's appearance and flying qualities and yet the structure is comparatively simple when tissue covering is employed. The accompanying drawings make it possible to choose between three building methods, in keeping with the builder's ability.

First, the plans and instructions can be followed to the letter; second, the model can be completely covered with $\frac{1}{32}$ " and $\frac{1}{64}$ " sheet balsa; third, the fuselage can be hollowed to a thin-walled shell from solid blocks, with a choice of balsa or tissue covering for the remainder, or a combination of both.

A novel feature included is the "wing seat" designed into the fuselage, eliminating the tedious lining-up job.

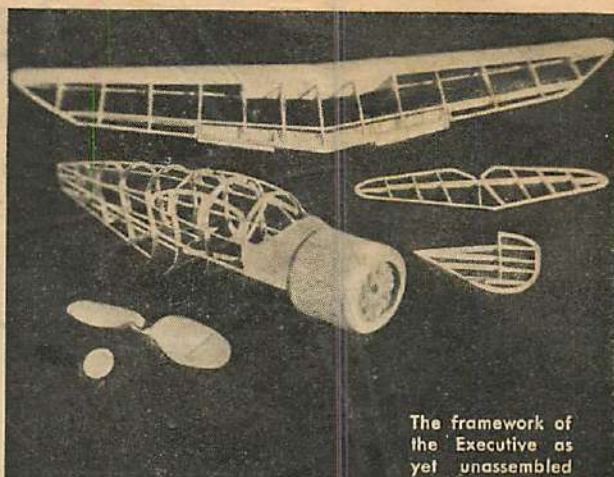
The following instructions will deal with the simple, light, tissue-covered model. Make a 6x8" sheet of $\frac{1}{16}$ " balsa plywood by cementing $\frac{1}{32}$ " sheets together, cross-grained. Place books or flat weights on the plywood for several hours while studying the drawings and tracing the extra wing and stabilizer patterns.

From the prepared sheet of plywood, cut pairs of the formers, except those noted. The formers are closely grouped on the drawing for material economy.

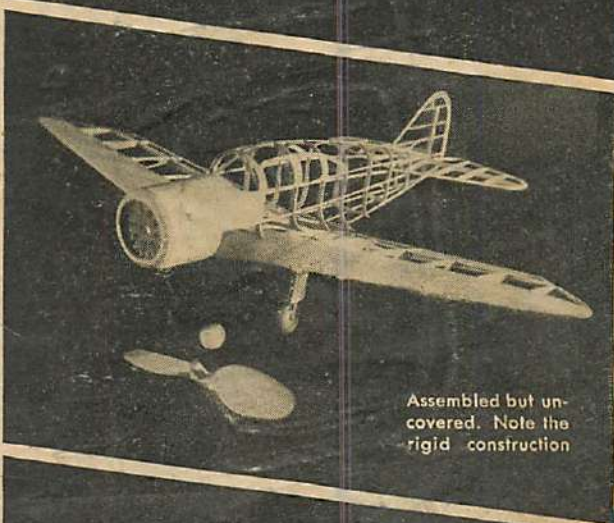
The method employed is to build one-half of the fuselage on the drawing, as shown in the photo, and then build the other half onto the first half. Pin the top and bottom longerons and wing seat, also the short longerons of the cowl, to the drawing. The cowl front (A) and aBb should be finished as shown before installation in the frame. Prebend the two side longerons and cement them in the slots. Do not force any member into place, because it will surely warp the frame when it is removed from the board.

After both sides are assembled, add Bt, the cabin window frames, then cover the cowl and front portion of the frame as noted. Cement the rear hook hangar and tail wheel on as shown. Cement the windshield celluloid on, to the outside, but cement the cabin windows to the inside in separate sections.

(Turn to page 84)



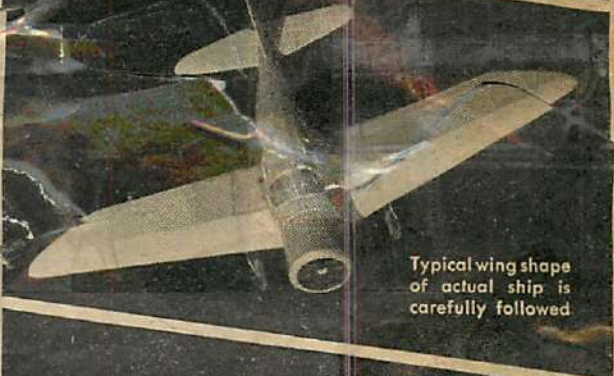
The framework of the Executive as yet unassembled



Assembled but uncovered. Note the rigid construction



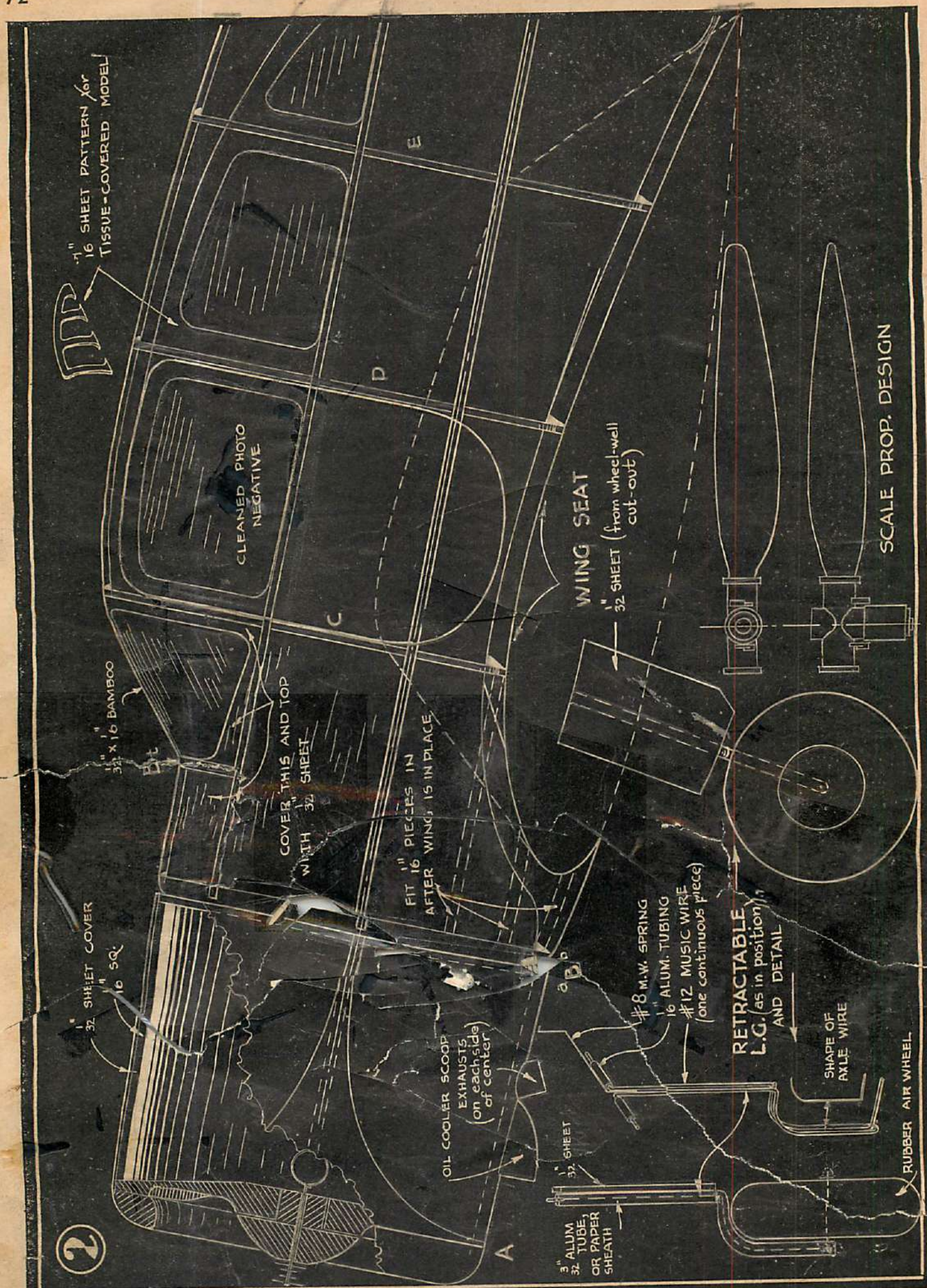
The completed ship ready for the dope. Note accurate lines



Typical wing shape of actual ship is carefully followed



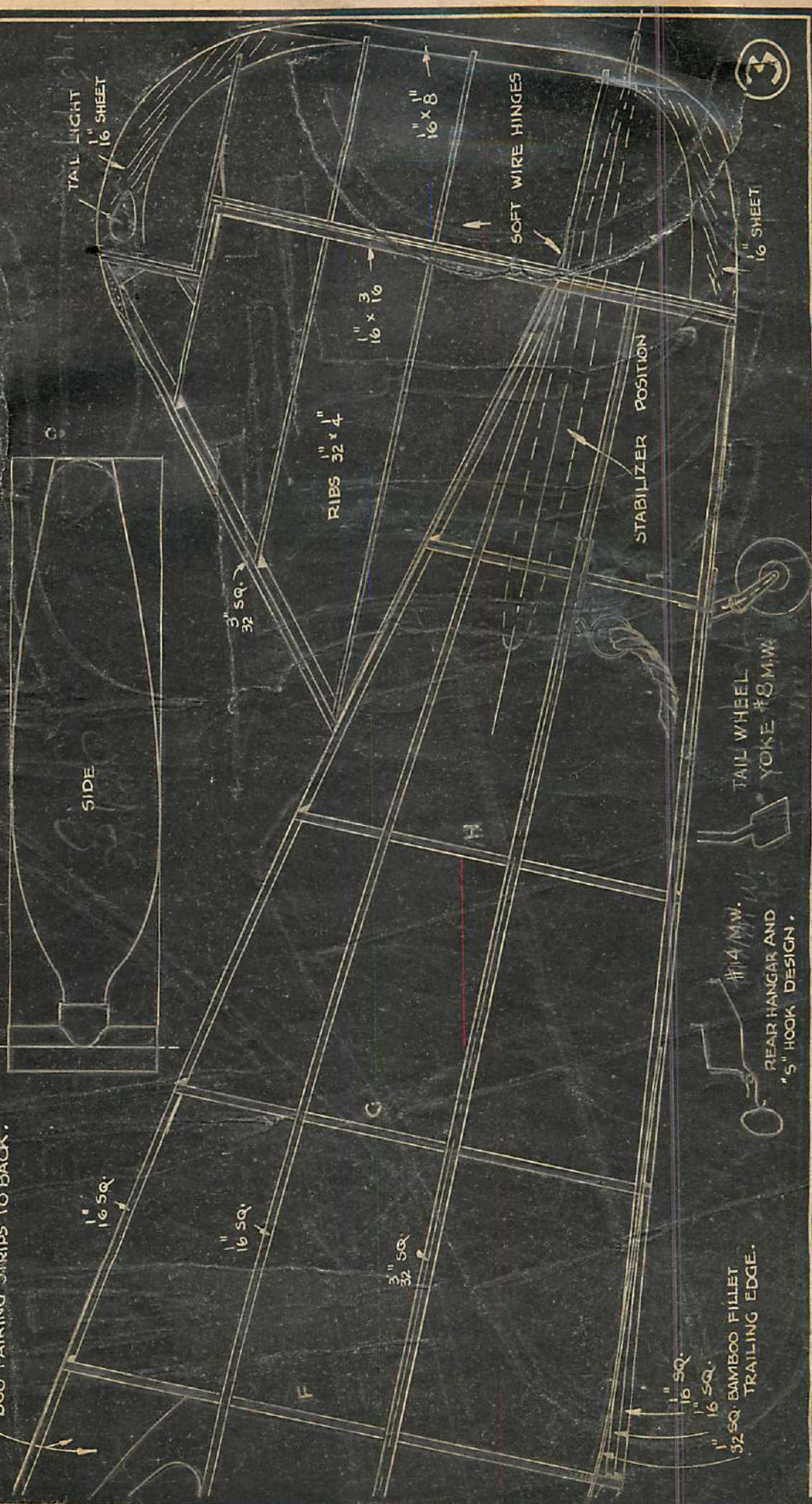
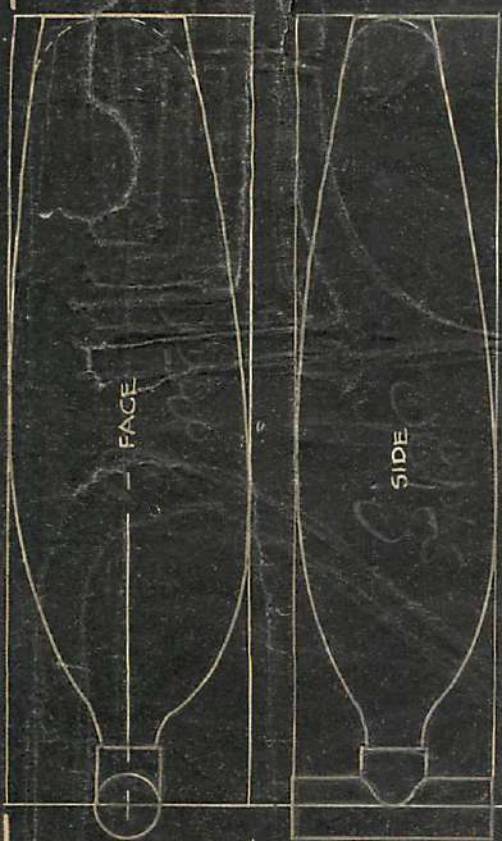
Build first one of halves of fuselage then add opposite



FLYING PROPELLER

BLANK AND CURVE
FROM 1" x 14" x 8" BLOCK.

IF MODEL IS TO BE TISSUE-COVERED,
CEMENT EVENLY SPACED 32" SQ. BAM-
BOO FAIRING STRIPS TO BACK.



3

PRO

The thrust line should pass approximately through or slightly above the center of gravity. For streamlined models such as those with elliptical fuselage sections, the wing should be well faired into the fuselage, thereby lowering the center of resistance and in turn less thrust will be required to prevent stalling.—PEYTON AUTRY, Boonville, Indiana.

High thrust line relative to the profile view of the model is best. The combination of high thrust line and low center of lateral area obtained by "bellying" down the fuselage so that there is a great amount of profile or lateral area below the center of gravity, affords excellent stability. It is my opinion that general flight characteristics can be improved by having the center of gravity located at a point on the thrust line so as to reduce nose-up or nose-down couples. Tendencies to spiral instability are eliminated by locating the center of lateral area on or near a line running longitudinally through the center of gravity.—PETER SLAP, Far Rockaway, N. Y.

Common sense proves that a model to be stable should have the line of thrust located as high as possible—possibly two-thirds the depth of the fuselage from the bottom line of the body. The model should perform best with the line of thrust running, if possible, through both the center of gravity and the center of resistance.—TED BUOZIPISKI, Wyandotte, Mich.

The following thrust line arrangement excels any other force arrangement I have tried: (1) Locate thrust line as high as possible relative to profile view of model. This keeps center of gravity low, which in turn helps keep center of lateral area low. This arrangement decreases tendency to spiral tightly into ground after a fast turn. (2) Keep thrust line as far above center of gravity as possible. Distance is usually about 1/20 tail moment arm in fuselage models. (3) Locate thrust line 1/10 to 1/12 of tail moment arm below line of resistance.—J. WARREN KILPATRICK, Hamilton, Montana.

Unwinding of the rubber motor changes the thrust of the model continually. To minimize the effect of the constantly changing force arrangement in order that one balance setting will be effective over the whole flight range, the center of gravity and the center of resistance should be as nearly as possible on the thrust line.—H. K. WEISS, Lawrence, Mass.

CON

Common sense is sufficient in laying out the profile view of the model. It seems fairly obvious that any builder who is at all familiar with force arrangements in designing his model would be observing all requisites, perhaps not realizing it. Why complicate matters with needless details?—JOHN MARVIN, Boston, Mass.

The position of the thrust line relative to lateral or profile area hardly merits consideration. Of course, extremes must be avoided since a design that brings nearly all the lateral area above the center of gravity would naturally tend to spiral instability. Any current design practice automatically brings the center of lateral area near enough to the vertical location of the center of gravity to eliminate any "bugs."—JOE MORAN, Chicago, Ill.

No, it is foolish to attempt to prove that the theory of the precise location of the center of lateral area and the center of gravity materially affects stability. Variations in modern designs certainly do not exhibit dangerous tendencies to tight banks and spiral dives. Only the occasional model so far removed from common-sense design that it is a chronic spiral-diver creates the fallacy that lateral area is the first-ranking bug-bear. Let's first solve more evident failings.—WILLIAM STEFANSON, Duluth, Minn.

No, generally speaking, the thrust line location relative to the profile view of the model does not materially affect stability. However, general flight characteristics are slightly improved when the thrust line is well above the center of gravity. The trophy-winning models that have had set records, in almost all cases, have had to use down-thrust. This, naturally, detracts from flight efficiency.—EDWARD LINFANTE, Jersey City, N. J.

Thrust line need not be worried about in relation to profile. The thrust must, of necessity, be applied at definite distances above the center of gravity and below the center of resistance. The proper aerodynamic setup would insure the proper location of thrust in respect to lateral area. It seems foolish indeed to make design requirements conform to profile when the designer should concern himself with essentials.—ARTHUR MORGAN, Seattle, Wash.

THE DISCUSSION CORNER

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: What do you consider to be the best location for the thrust line relative to the profile view of the model? Can general flight characteristics be improved by locating the thrust line definite distances from the centers of gravity and resistance?
NEXT MONTH'S TOPIC: 7/8" versus 5/8" bore motors.

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.

FOR DECEMBER: What is the chief objection to the contest rules as they were followed during the early season? Should the 30-second motor run for gas models be continued, extended, or reduced? Answers must reach us by September 20th.

FLIGHT RECORDS AND CONTESTANTS IN COMPETITIONS.

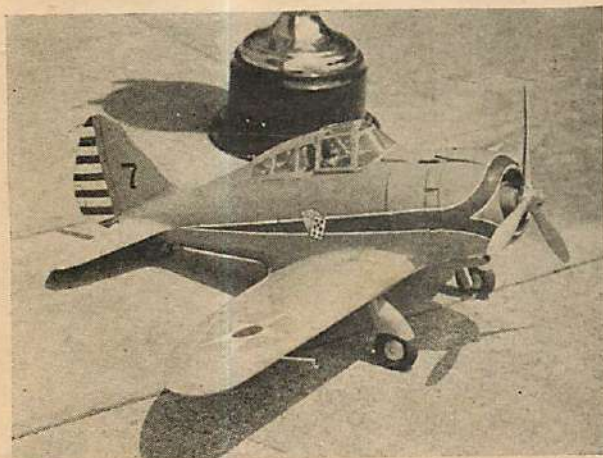
model



Winners in the Kresge gas model contest held at Hadley Field. L. to R.—G. Murray, H. Johnson, L. Schulman, C. Kinney, F. Ehling, G. Tabery, A. Block.



The Beshar showrooms located in New York City. Here are made the Beshar precision propellers, well-known to every modeler. Trade-ins on gas engines.



Seversky P-35, built by Carl Baum of Patchogue, Long Island, won scale prize. Engine contains 700 parts. Landing gear, flaps and even radio is duplicated.

M.A.E. OF CONN.

The Model Aero Engineers of Hartford lived up to its reputation of being the most active model group in Connecticut. They took 12 out of a possible 24 prizes at the 10th Annual Connecticut Model Aircraft Meet, sponsored by United Aircraft Corporation and held on Rentschler Field adjoining the Chance Vought Aircraft factory in Hartford. One hundred and twenty contestants entered. Edward Rosen, president of the M.A.E., set a new state record of 2:57 with an outdoor fuselage model, another state record of 1:45.2 for tow-line gliders, and won the major award in the senior division—the George S. Wheat Memorial Trophy. Irwin Goldenberg of the M.A.E. set a new state record in the junior outdoor stick event with 1:47.8.

M.A.E. was organized in September, 1935. Alfred W. Schmidt is club director as well as N.A.A. contest official. Recently the club obtained permission from the Hartford Aviation Commission to use Brainard Field for contests and other activities. M.A.E. is a Junior Chapter of the National Aeronautic Association. All model builders living in greater Hartford are invited to contact Alfred W. Schmidt, 29 Vernon Street, Hartford, Conn. Last year at the 9th Annual Connecticut Model Meet the club practically made a clean sweep of the prizes—14 out of 18. In July last year they took 7 out of 8 awards in a city meet.

ELMIRA, N. Y., CONTEST

Edward F. Ruch of Hornell, N. Y., won the senior stick event at the Elmira contest, June 12th, with 16:08.6. Robert Dillman of Syracuse took the senior fuselage event with 3:22 (out-of-sight). Ninety-four contestants were entered—48 of them in the gas model event. Rubber events were run off in the morning in gusty air and poor visibility. Rain throughout the afternoon caused postponement of the gas event to a later date.

Harry C. Copeland directed the meet, which was sponsored by the New York State Exchange Clubs, holding their state convention in Elmira during the week. Copeland has done good work in getting Exchange Club sponsorship for model activities. The New York State group held their first contest in 1936. Since then the project has been taken up by the national organization. Sponsorship of this year's national meet in Detroit as well as contests throughout the country are an outgrowth of this early work by Copeland and the New York clubs. The Exchange Club claims recognition as America's foremost air-minded civic organization.

Other high-place winners were:

Senior Stick

Wayne Fulmer, Syracuse	4:16.6	2nd
William Hayes, Syracuse	2:56.2	3rd

Senior Fuselage

Phillip Fritz, Hornell	1:43.1	2nd
Clement Buell, Binghamton	1:42	3rd

Junior Stick

Donald Jochem, Syracuse	2:23.3	1st
Patsy Finmano, Syracuse	:59.6	2nd

Junior Fuselage

Weston Jenkins, Elmira	1:32.5	1st
William Lacey, Syracuse	:47.8	2nd

matters

CLUB NOTES AND
NEWS OF MODEL
ORGANIZATIONS.

Mrs. Robert Horton of Syracuse was one of the two women entered. She flew her gas model on several exhibition flights Sunday morning.

On Sunday, June 26th, the postponed gas event was held at Syracuse airport. Edward Guth of that city took first with 1:53.3. Ira J. Fralick, also of Syracuse, was 2nd with 1:46.6. Mrs. Horton turned in the official time of 1:20 to win 6th place. The entry of Mrs. Guth, the other woman contestant, turned in several creditable flights. However, she had finished it only a short time before the contest and a few more trial flights were necessary to make final adjustments.

CHICAGO AERONUTS

Chicago Aeronuts took high places in the Gary, Indiana, contest on June 5th. Dennis Turner took 1st in the rubber event with 3:55. Gerald Ritzenthaler won the gas event with an average time of slightly more than 5 minutes. Club qualifying trials for prospective members have been completed. It is necessary for a prospect to make 3 flights of 2 minutes with a fuselage model and 3 flights of 3 minutes with a stick model. Members must requalify yearly. Qualifying times are 3 and 4 minutes respectively for fuselage and stick. Several veteran members turned in outstanding flights during these trials. Wally Simmers made a 20-minute flight out-of-sight with a class C fuselage in the evening, Ed Lidgard flew his fuselage model 8 minutes and then did 5 and 17 minutes with a 12-ounce Wakefield model. The 'Nuts are all primed for the national meet.

C.G.M.C. OF TORONTO

Modelers from all points in Ontario were in Toronto June 4th for the T. Eaton Co. Department Store Contest. Directed by Frank E. Lucas, this was the first Canadian contest to enjoy such luxuries as a sound car, roped-off flying field, police supervision of traffic and identification numbers for models. The contest was run in two heats—cash awards being made in each.

Cliff O'Reilly took the first heat—2 to 3:45 p.m.—when he lost a model of his own design after 5:04.6. In the second heat—4 to 5 p.m.—cash awards were won by Les Racey, 3:19, and Howard Adams, 3:11.1. O'Reilly's time was high for the meet. He won the extra \$10 award, the T. Eaton Co. Gas Model Trophy, and an all-expense trip to the national meet in Detroit.

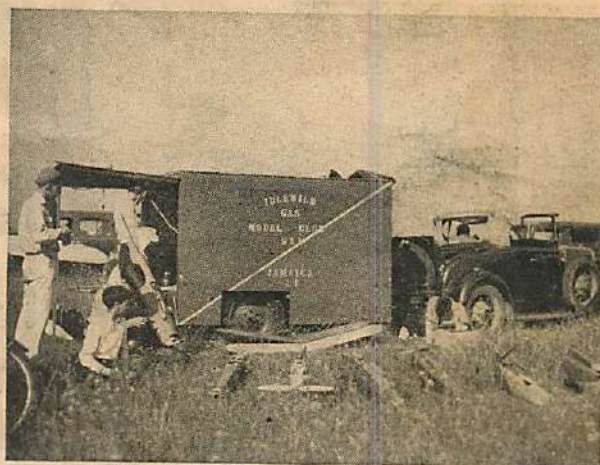
Rules of the contest called for 1/16 ounce per pound fuel allotment with a maximum of 7/16 ounce. However, there seems to be little doubt that the 30-second motor run rule will be adopted for future Canadian contests, since models wandered too far away—three being lost.

Cliff O'Reilly is secretary of the Canadian Gas Model Club with headquarters in Toronto, Ontario. Membership in this society is welcomed from all parts of the dominion. Last May O'Reilly set a new Canadian record of 9:38.4. Fuel allotment was based on the 1/16 ounce rule. However, timers were restricted to a 200-foot radius from the point of take-off without binoculars. The full length of flight was 18 minutes and the model was recovered undamaged three and a half miles away.

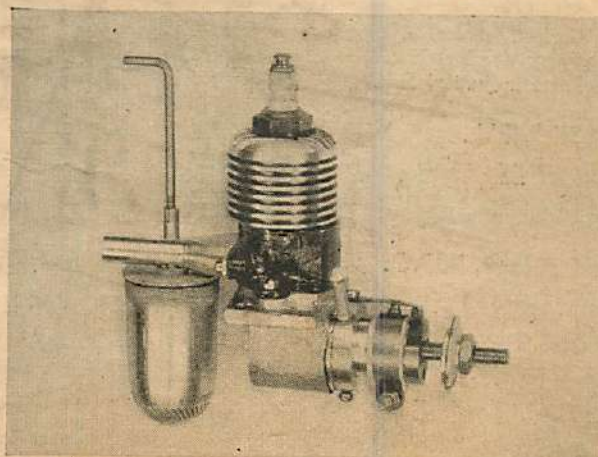
C.G.M.C. has a membership of about 60. Canadians will do well to contact this club and learn more about its model work. The address is Cliff O'Reilly, secretary, Canadian Gas



Frank Ehling, Jersey City, receives first place at Hadley Field. Frank prepared contest-winning gas model plans for Air Trails in the September 1937 issue.



The Idlewild Gas Model Club's trailer at Hadley Field gas model contest in New Jersey. Many clubs have elaborate trailers; are seen at major contests.



The Trojan Junior, a 5/8" bore gas engine, is manufactured to perfect precision so that replacements can be made without trouble. Flying weight is nine ounces.

Model Club, 815 Gerrard Street, East, Toronto, Ontario.

About fifty students of the King Edward high school in Vancouver, B. C., have formed a model club. It is under the leadership of Peter Tees. Meetings are held every Thursday afternoon in the school. Some very attractive and successful models have been brought out by club members. Nathan Mann and Del Froine were winners of contests held early this spring. Bryan Kershane sent the report of his club's activities. We hope he'll continue to keep us informed on future happenings in western Canada.

"LITTLE NATIONALS"

Hewitt Phillips of Belmont, Mass., was declared New England Champion following his splendid performance in the New England Championship Meet June 4th and 5th. Roy Carlson of Springfield was runner-up. This annual contest—known as the "little nationals"—was the most successful ever conducted. Following are the winners:

INDOORS

Gliders

- | | |
|--------------------|-------|
| 1. Marchi (open) | :44.2 |
| 2. Cain (senior) | :43.1 |
| 3. Golden (senior) | :39.6 |

Stick, H.L.

- | | |
|-------------------------|---------|
| 1. H. Phillips (senior) | 16:01.5 |
| 2. W. Tyler (open) | 14:48.2 |
| 3. Cain (senior) | 13:42.3 |

Fuselage, R.O.G.

- | | |
|----------------------|--------|
| 1. Stanwick (senior) | 7:47 |
| 2. Hammer (senior) | 7:38.1 |
| 3. Brand (senior) | 5:54.3 |

Stick, R.O.G.

- | | |
|-------------------------|---------|
| 1. Domohowski (junior) | 10:16.7 |
| 2. Wallerstein (senior) | 9:20.5 |
| 3. Carlson (senior) | 9:06.8 |

OUTDOORS

Gliders

- | | |
|--------------------------|--------|
| 1. Carlson (senior) T.L. | 1:13.8 |
| 2. Gorrin (senior) H.L. | :52.8 |
| 3. Lorman (junior) H.L. | :50.4 |

Stick, H.L.

- | | |
|-------------------------|------|
| 1. Hammer (senior) | 5:25 |
| 2. H. Phillips (senior) | 2:39 |
| 3. Cade (senior) | 2:14 |

Fuselage, R.O.G.

- | | |
|---------------------|--------|
| 1. Carlson (senior) | 3:16 |
| 2. Chapman (junior) | 2:17.5 |
| 3. Hammer (senior) | 2:14 |

Original Event

E. Whitton Vacuplane

TRENTON PETROLEERS

One week after winning the contest in Philadelphia, Harold Johnson again took first in the meet at Trenton, N. J.,

on June 18th. John Findra, Sr., a fellow club member, also repeated his performance of the previous week by taking second place. Both are members of the Queen City Gas Model Club of Plainfield, N. J. Their flight times were 6:25.2 and 3:45.

The meet was held at Mercer County Airport and sponsored by the Trenton Petroleers under the supervision of the Mercer County WPA Recreation Divi-

sion. Mickey DeAngelo officiated as contest director. He presented the Richard J. Hughes Trophy to winner Harold Johnson. The presentation was broadcast over station WTNJ (Trenton).

John Findra, Jr., of the Queen City Gas Model Club, won first award in the Design and Workmanship event with a beautifully finished model.

(Turn to page 92)

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.

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.

NORTHERN NEW YORK MODEL AIRPLANE MEET, August 16th, Sandy Creek Fairgrounds, Sandy Creek, N. Y.; rubber-powered and exhibition scale. Separate awards for juniors and seniors. Entry blanks from Harry C. Copeland, Sandy Creek, N. Y. No registration fee.

GAS MODEL CONTEST, August 21st, Suffolk Airport, Riverhead, Long Island, N. Y.; N.A.A. requirements to be observed; entry fee 25 cents to form prize fund. For information address Robert Sanford, Box 31, Southold, New York. Entries should include entrance fee.

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.

FIRST ANNUAL OPEN MEET, Hadley Airport, N. J., September 17th. Sponsored by Queen City Gas Model Club of New Jersey. Will be held under N.A.A. rules and all entries must be N.A.A. licensed. For application and information write Frank Boyd, Queen City Gas Model Club, 1800 Myrtle Avenue, Plainfield, N. J.

NORTHERN INDIANA CHAMPIONSHIP MEET, September 18th. Sponsored by Northern Indiana Gas Model Association, N.A.A. rules. Limited Engine Run Consistency Event. Entries limited to N.I.G.M.A. members. For information address Bob Roberts, Contest Director, 4490 Broadway, Gary, Ind.

FIRST ANNUAL TRI-STATE MODEL AIRPLANE CHAMPIONSHIPS, Pittsburgh-Butler Airport, September 24th. Sponsored by Tri-State Model Association, N.A.A. sanction. Events include Gas Models, fuselage type, and Rubber-powered Fuselage Models. Prizes consist of trophies and valuable merchandise awards, including motors, kits, magazine subscriptions and model supplies. Wing loading of gas models must be 10 oz./sq. ft., and for rubber-powered models 3 oz./100 sq. in. of projected wing area. Maximum weight of gas models, 7 lbs. Rules, regulations and entry blanks may be secured from Tri-State Model Association, 524 Griffin Street, Pittsburgh, Pa.

GAS MODEL CONTEST, October 2nd. Sponsored by the Trenton Petroleers. Flying site is Mercer County Airport. Information from WPA Recreation Division, 212 Centre Street, Trenton, N. J.

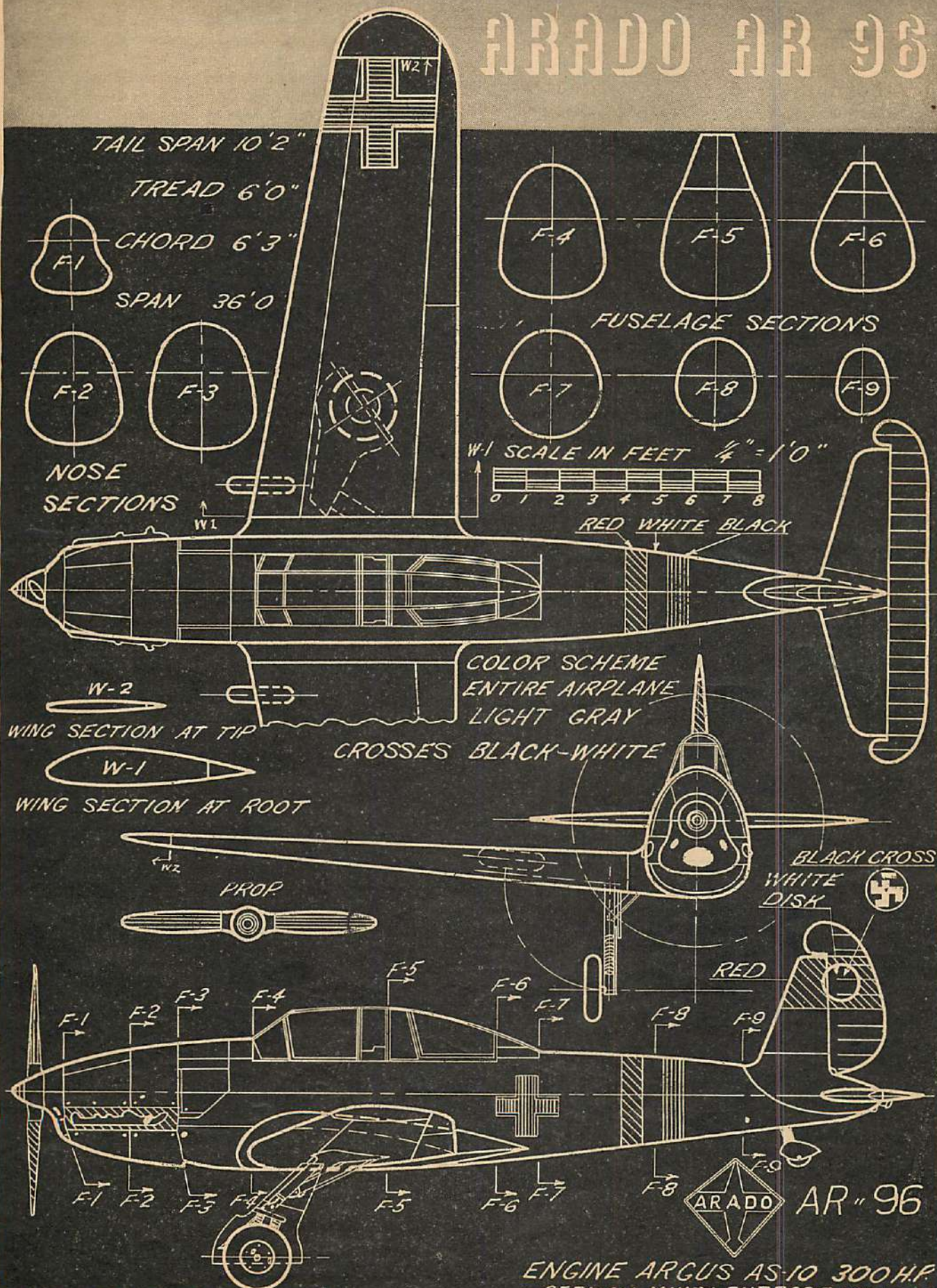
THE QUESTION MARK

All questions pertaining to model construction problems should be addressed to Gordon S. Light.

Answers will be given promptly by mail, thus avoiding delay.

Enclose self-addressed stamped envelope to insure answering.

ARADO AR 96



LEVIATHAN OF THE AIR

(Continued from page 25)

much like ordinary boats, and the section of the factory where six of these giant clippers are taking shape reminds one more of a well-equipped shipyard than an airplane plant. Due to the bulkiness and weight of these ships, they have been designed to remain in the water, anchored like ordinary boats, between flights, and will only be drawn on shore for periodic inspection and maintenance. Complete work platforms are built into the engine nacelles, and the wing walkways enable the mechanics to carry out ordinary servicing and inspection without the aid of ladders, scaffolding and such paraphernalia.

The engine nacelles, incidentally, of full monocoque type, completely do away with former cluttered-up mountings, and all pumps, outlets, and accessories are conveniently grouped so that engineers can remove and repair any such parts, even while the ship is in flight. Full-feathering Hamilton hydro-matic propellers enable the engines to be stopped completely. The 314 has been designed to fly on any two engines even with full load. In case of starter failure, hand cranks, located wholly inside the nacelles, can be used.

Regular shipbuilding technique had to be used on the 314's. So large is the square section tubing that forms the backbone of the hull that a vertical traveling drill was designed and built for the important drilling jobs. Rather than use large and unwieldy hand drills or bench drills some distance from the construction floor, Boeing engineers decided that they could save much time and do a better job with a power-driven unit from overhead that would always be in proper alignment, and that could be moved about with ease. In this manner, heavy tubing is drilled and fitted right in the jigs, and all main hull bulkheads have been made in this manner. This machine is also being used to drill the bulkheads for the models 307 and 307-S Stratoliners, now nearing completion in another part of the factory.

Ordinary engineering blueprints have been supplemented largely in actual construction work by immense sheets of white lacquered dural. After laying out templates on the loft floor, much like shipbuilders, the drawings are transferred to these dural sheets. After master holes are drilled out for alignment purposes, these sheets are filed away on the construction floor for ready reference by workmen. Not only may these drawings be made quickly and accurately on metal sheets, but workmen find them easy to handle and much more readable.

Boeing carpenters have developed an ingenious system of scaffolds and ladders for assembly work. These are strong and rigid, but are fastened together almost wholly with bolts and may be knocked down and moved to another hull in only a few hours' time, thereby speeding assembly.

The sturdy sponsons or "sea wings" enable these ships to ride out heavy seas with none of the dangers experienced by planes with the more usual wing tip floats. These sponsons are in themselves interesting and unique from the engineering standpoint, as they are the first cantilever structures of their type to be built. Of semimonocoque construction, each sponson has two Duprene sealed compartments for carrying gasoline, some 1500 gallons in either sponson. The use of Duprene compound enabled the engineers to entirely do away with separate gas tanks, the skin itself doing the double duty of gas tank wall and structural member. This constitutes definite advancement.

Another advantage of the sponson type of hydro-stabilizer is that they provide excellent loading platforms for passengers and freight, and also help carry part of the ship's weight by virtue of their airfoil shape. Pumps located beneath the cabin floor force the gasoline from sponson tanks to two 600-gallon wing tanks. From here fuel is fed to the four 1500-h.p. Wright Twin Cyclones.

It will be noted that all gas tanks and lines are located well away from the passengers' cabins. Another notable feature is the fact that gas tanks and the main cargo holds are on or near the center of gravity of the ship, so that differences in load do not seriously affect either the ship's trim or flying characteristics. A large hatch, in the middle of which is a navigator's "turret," folds up to provide access to the main cargo and mail compartments, which are located in the wing stubs and top deck.

Forward of this section is the spacious control bridge, with its orderly array of instruments and gadgets of all sorts, each having its own part to play in the safe and efficient operation of the ship. A master flight engineer sits at his control board on the starboard side, and at a moment's notice can change engine and fuel controls either singly or in groups. On either side of the rear part of this cabin small doors lead off into the wing and to the two port and two starboard engines. Also in the control bridge are a large navigator's table, indirectly lighted, the captain's room, the radio desk, and farther forward on a

raised portion of the floor, the twin pilot seats.

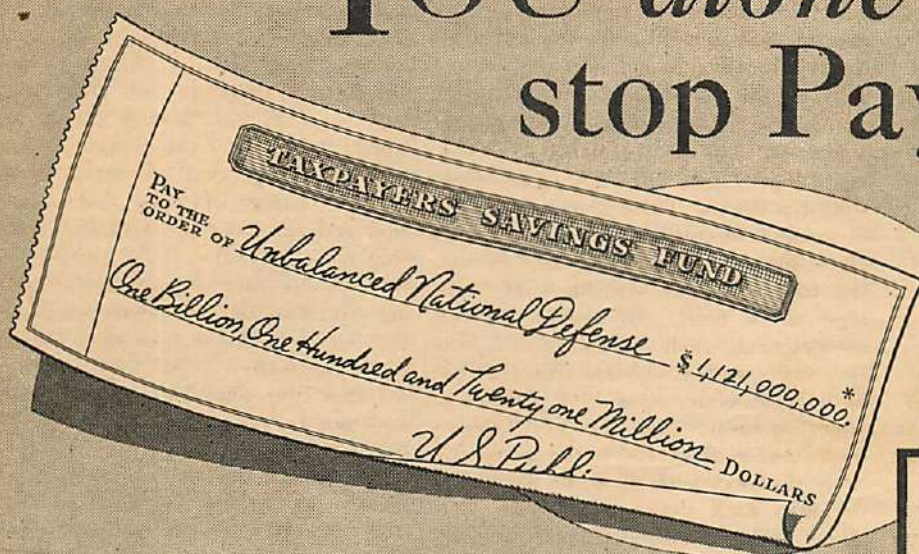
The pilots are equipped with all the very latest instruments known to flying, and have duplicated flight instruments, throttles, and of course, actual flight controls. A large trimming wheel, for the stabilizer tabs, is located on the right side of the master pilot's seat, while overhead is an ingenious retractable spotlight that folds down into the cabin roof when not in use. Just back of this is the radio direction finder antennae. Throttles, of the "yoke" type used in the Boeing Flying Fortresses, are so arranged that engines may be easily controlled in groups or singly. Large windows and a long, sloping bow make the visibility in this ship really sensational. A hatch in the forward compartment opens for mooring, and two retractable mooring posts slip out through the nose once the ship is on the water.

Other interesting features of this ship may not be gone into at this time due to restrictions of the Boeing Company and Pan-American Airways. But such features as the stainless steel water rudder, entirely enclosed controls, double ailerons, 40-foot wing flaps and the like make the 314 truly "Tomorrow's Airplane Today."

As the Boeing factory is not located directly on Elliot Bay, Seattle's harbor, each ship must be towed almost two miles down the Duwamish waterway before test flying. After preliminary taxi-testing each ship will be taken aloft and flown for some three miles to twenty-five-mile-long Lake Washington which borders Seattle on the east. On this lake, at the Sand Point Naval Air Station, each clipper will be put through its test and acceptance flights before formal delivery to Pan-American Airways. The Boeing test pilot on these ships will be the famous Eddie Allen, ace American pilot-engineer who also flew the huge Boeing XB-15 Super Fortress in 1937, and the Sikorsky XPBS-1 four-engined boat.

Even as the first of these 41-ton giants is being tested, the Boeing Company has already run extensive tests on models of an ultra-modern flying boat which might be described as a "flying liner." Although information on this interesting project has not been officially revealed, it is known to have six engines and a gross weight of well over 150,000 pounds—more than 75 tons! Predictions of Captain Gray, of Pan-American, and others well-versed in oversea air transportation, point to flying boats for these services in the 400 and 500 passenger class within the next twelve or fifteen years. The age of the super-flying boat seems definitely to have "arrived," and Boeing intends to keep America in first place in the race for ocean air supremacy.

YOU alone can stop Payment!



*Amount originally appropriated by the House of Representatives.
This figure was subsequently increased through Senate action.

DOWN in Washington the so-called Naval Expansionists have just drawn a check on our savings for \$1,121,000,000. They say we need extra battleships to make a more impressive showing in national defense. They want to add a few carats to "the Gem of the Ocean" so that Columbia will dazzle the world with a sparkling sea show, and they have decided we tax payers won't object if they spend our savings and earnings to do it.

Well, we of the Air Defense League do object—strenuously. And you will too when you know the true and enlightening facts.

We object to spending an extra penny on our

already powerful Navy while our air defense force is pitifully lacking both in adequate equipment and adequate personnel. We object that America rates last in air strength among the world's major nations. And we demand that when the tax payers' money is spent on national defense the development of an adequate air defense program be the first consideration.

The Air Defense League is for peace just as you are, but it is also for economy. That is why we, as thoughtful citizens, are interested in aviation in national defense. Our program is simple and direct. The League's accomplishments to date are a matter of noteworthy record.

We solicit your interest and support toward the realization of maximum peace protection at minimum cost to you through adequate air defense. Mail the coupon today.

Join The AIR DEFENSE LEAGUE



Through Maximum Defense Per Tax Dollar

The membership of the Air Defense League, a non-profit organization, is composed of patriotic citizens who believe that through adequate air defense the peace of our country will be most effectively and economically protected.

The League collects factual information on aviation in air defense and disseminates this information to legislators and the thinking public.

All funds received by the League from memberships and contributions are devoted to the effective furtherance of maximum peace protection at minimum cost to the tax payer.

No person who is an officer or employee of an aircraft manufacturing company, an aircraft engine company, or a company whose principal business is the manufacture of aircraft accessories may become a voting member of the Air Defense League.

Army and Navy officers may not hold office or voting privilege in the Air Defense League.

Address all inquiries to the Air Defense League, 310 Bellevue Stratford, Philadelphia, Pa.

Kern Dodge
Kern Dodge, President

AIR DEFENSE LEAGUE
310 Bellevue Stratford
Philadelphia, Pa.

I am interested in maximum peace protection at minimum cost to the public. I also believe that an adequate air force is the best way to secure this result.
Enclosed find _____ to enroll me as a _____ member of the Air Defense League.
(\$5.00 Active Member—Voting \$1.00 Contributing Member—Non-voting)

Name _____
Address _____
City _____ State _____

No person who is an officer or employee of an aircraft manufacturing company, an aircraft engine company, or a company whose principal business is the manufacture of aircraft accessories may become a voting member of the Air Defense League.

N.A.A. NEWS

(Continued from page 49)

has the best planes and really deserves the title of "First in the Air" an entirely simple problem.

With all the complexities of size and type, however, the F.A.I. gives us an unusually thorough and effective yardstick for authentic measurement in a large number of officially recognized world records which cover thoroughly and comprehensively the widely varying aircraft categories. Through precise evaluation in terms of speed, altitude, distance and load, these various official records register performance impartially and technically, yet in the understandable terms of world's best.

Record flights which result in new and greater marks for speed, endurance, distance and altitude have proven their value in accelerating aeronautic progress. Particularly have such flights centered public attention on flying, a fact which is possibly best exemplified by the tremendous increase in public appreciation of the possibilities of aviation which followed Colonel Lindbergh's historic flight to Paris.

WHAT THE N. A. A. MEANS TO AVIATION

The N. A. A. is the largest aeronautical organization in America. It is non-political and non-commercial, with membership open to all who are interested in promoting aviation.

Its activities cover a wide field, among which are included national defense, legislation, private flying, public education, national planning, youth education, coordination conferences, and air meets and record trials. Through its many branches and affiliations, N. A. A. is constantly working toward an increased air-consciousness in the United States. It faces important issues in aviation squarely, and endeavors to coordinate the efforts of those concerned toward obtaining the desired ends.

A typical instance of this is the work now being done in support of private flying. Although this is one of the most important branches of aviation, it was long unorganized. Many private flying groups are in existence. N. A. A. has never tried to supersede the work of these specialized groups, but instead it has worked sincerely to bring about concerted thought and action on the part of N. A. A. and all such groups. Several of them are definitely affiliated with the N. A. A., including the Soaring Society of America, the Private Flyers Association, and the National Intercollegiate Flying Club. N. A. A. cooperates with these groups toward attaining their objectives. A noteworthy example of our combined efforts is found in the

increased attention that is given to private flying interests by Federal supervising bodies.

Another example of N. A. A. activity is found in national planning. Aviation's ever-widening front has meant a constantly increasing diversity of interests within aviation. The need for wise national planning to coordinate the many varying interests in support of a broad nationwide program for advancing aviation has been increasingly felt. Thus, at the First National Aeronautic Planning Conference, held at Cleveland in January and sponsored by N. A. A., representatives of twenty-two national aviation organizations met and adopted a comprehensive development plan. Since, N. A. A. has joined in the establishment of the permanent agency to foster joint study and action recommended by the conference. Among the leading organizations which joined with N. A. A. in establishing this important joint board are the Aeronautical Chamber of Commerce of America and the National Association of State Aviation Officials.

It is from the rising generation that aviation can expect to obtain the majority of its new customers, new technicians, and new private owner pilots. Although there has been much interest in aviation among the youth of the nation, there has been no broad nationwide plan for acceleration of this interest and for more intensive aeronautic education. To fill this need, N. A. A. during recent months has developed a National Air Youth Program in co-operation with the Academy of Model Aeronautics, the International Gas Model Airplane Association, the Soaring Society of America, and the National Intercollegiate Flying Club. This program fosters step-by-step training, model building to ground-school training, to gliding and light plane flying. By more contests, by club activity aids,

by progressive memberships supplemented by proficiency ratings and record recognition, the great youth interest in aviation is being accelerated and directed as a constructive force of vast potentiality to aviation.

The many aviation conferences and meetings that have been held throughout the country have been highly beneficial. The greatest need is to coordinate such conferences, to distribute them logically throughout the nation, and to achieve an intelligent fixing of dates, so that national and government leaders may attend them with the least possible outlay of time and expense. N. A. A. feels justified in taking leadership, not to participate in the affairs or deliberations of these conferences, but to endeavor to distribute them logically in seven principal zones of the nation, with such a mutual agreement as to dates as will be the most satisfactory to all concerned and, so far as it can, to assist in consolidating and organizing the sum total of information which these conferences supply.

N. A. A. sanctions the chief air races in the country, as well as model contests. It has qualified contest officials in every principal city of the country. These men are carefully selected, and numbered among them are many of the finest exponents of American aviation. The National Air Races at Cleveland, the Pacific International Air Races, and the International Aerobatic Competition and St. Louis Air Races are all under N. A. A. sanction. N. A. A. is the official representative (as the United States member) of the Federation Aeronautique Internationale, and as such is the authoritative body for all recognized air records.

These are some of the important activities undertaken by N. A. A. Its members are distributed in every state and territory of the country, including about 2,000 private flyers; a large percentage of members of the aviation industry; state and governmental officials including congressmen and officers of the Army and Navy; and thousands of others who are not employed in aviation but who are interested in seeing America first in the air.

DICK DUPONT, N.A.A. GOVERNOR FOR DELAWARE

Dick duPont is recognized as one of the foremost sailplane pilots in this country, and one of the greatest exponents of the art the world over. He began riding the wind in motorless craft when he was 16 years old, and has been making and breaking records ever since.

Although his career has been spectacular, what really interests him is advancing the science of gliding and soaring, for he believes that it is one of the greatest of sports and that it

HILLSON PRAGA

(Continued from page 52)

Span	36'
Length	21'
Height (in flying position)	7'
Height (on ground)	5'
Maximum Wing Chord	5'
Wing Area	164 sq. ft.
Landing Gear Tread	5' 2"
Empty Weight	630 lbs.
Gross Weight	1080 lbs.
Gasoline	8.5 gal.
Oil	1 gal.
Wing Loading	6.75 lbs. per sq. ft.
Power Loading	27 lbs. per h.p.
Top Speed	92 m.p.h.
Cruising Speed	81 m.p.h.
Landing Speed	38 m.p.h.
Climb to 1,000 ft.	3 min.
Service Ceiling	7,500'
Take-off Run	260 ft.
Landing Run	460 ft.
Cruising Range	290 mi.
Fuel Consumption	34 miles per gal.
Price (approximately)	\$2,100

offers young men and women a short cut into aviation.

About ten years ago, when duPont was spending the summer on Cape Cod, he became interested in watching a group of Germans soaring over the wind-swept sand dunes. A little later that summer, a friend of his built a glider, learned to fly it himself, and taught duPont. Then duPont bought the machine and took it home to Delaware with him.

That was the beginning of an interesting and useful career. In 1930 he learned to fly powered planes. Then he went to California and entered the Curtiss-Wright Technical Institute,

where he specialized in airplane design.

One of his instructors was the famous sailplane designer, William Hawley Bowlus. They teamed up, forming the Bowlus-duPont Sailplane Company which Dick financed. In 1933 they produced two high-performance sailplanes, the Albatross and the Dragon Fly, and Dick entered them in the National Soaring Meet at Elmira, N. Y.

The following year, Dick was back at Elmira with the Albatross II, which he and Bowlus had built. He set two American records in short order, an altitude mark of 6,223 feet and a distance record of 158 miles.

Dick duPont has probably done more

than anyone else in this country to popularize gliding and soaring. Several years ago he and his wife, who incidentally is also a glider and airplane pilot, went to Germany to study German methods. They brought back to this country three gliders and two sailplanes, which represented the latest in German design. DuPont is president of the Soaring Society of America and finances the monthly magazine *Soaring*. He is one of the ten Silver "C" pilots in the United States.

Long active in N. A. A. affairs, Dick is now a member of the Executive Committee as well as the Association's governor for Delaware.

AIR ADVENTURERS

(Continued from page 57)

Albany, Ind., which wins him his Craftsman award. Alfred sends in a good picture of the weather tower at Bowman Field, Louisville, Ky.

Albin Bogusz of Evanston, Ill., has passed his Photographer's test with a good shot of a Douglas DC-3 taken at Evanston. Albin uses a Falcon Jr. camera and Agfa Plenachrome film.

Larry Miller, who has passed his tests for a Flight Lieutenancy, is all pepped up about Air Trails and Air Adventurers in particular. He believes we can expand further and build up a chain of flying clubs, run much on the Army system. Larry also sent in a long descriptive account of a day at Floyd Bennett Field, which brought him his Observer's award.

Mitchell Waurzonek of Omaha, Neb., likes Air Trails but wants more pictures and more articles on military aviation.

One of the most interesting contributions by a member comes from Godfrey Howard of Brockville, Ontario. Godfrey sent in two maps of what he terms unidentified areas suitable for emergency landings. Both fields are near Brockville, and Howard has added all the necessary detail as to slope, obstructions, wind-indicators in the way of smoke, and the dimensions of the available landing area. Good stuff, Howard, you get your Topographer's ticket.

R. Richardson Meyers, of Allentown, Pa., is a new member who has sent in some remarkable photos of planes belonging to the 13th Attack Squadron taken at Allentown. We are going to try to print one or two if space will allow.

Another member who is getting worried about the number of air-line crashes is Bill Martin of Indianapolis. Bill has an idea for a special electrical beam which could be thrown across the mountains at the danger points and which could be picked up by passing planes. This beam would be transferred to a

visual instrument so that the pilot could tell at a glance how high he was above the peaks below. It's a good idea, Martin. Why not work on it?

Another air field map comes this month from Lindsay Barnett of Broken Hill, New South Wales, Australia. The field is known as Broken Hill Aerodrome and Barnett has done a smart job on his map, showing the clubhouse, hangar, windsock and boundaries. At one side of the map he has included all important details as to distances, surface conditions, prevailing winds and navigation aids. Has been awarded his Topographer's award on it.

We have a member in the Army Air Corps at Rizal, Philippine Islands. He is John P. Lisack, who has been through the Army technical school and has passed as an Airplane Mechanic and now wants to take a crack at some of our tests. John said he stacked up on issues of Air Trails to read while on the fifty-day trip out to the islands by way of New York, Panama, San Francisco, Honolulu, Wake Island, Guam and Manila. All tests are being sent to him.

HONOR ROLL FOR SEPTEMBER

FLIGHT CAPTAINS

Clyde Wallace, Madison, Indiana
Bill Armstrong, Toronto, Ont., Canada

FLIGHT LIEUTENANTS

Betty Ball, Berkshire, N. Y.
Fred Hamburg, Verdun, Que., Canada
Chas. Genuit, Toronto, Ont., Canada
James Phillips, Guelph, Ont., Canada
J. Filby, Toronto, Ont., Canada
Fred Kelly, Toronto, Ont., Canada
Gerard Deschenes, Lewiston, Me.
Herman McBroom, Dallas, Texas
Russell Louis Metz, Connelton, Indiana
Alan B. Thayer, Athol, Mass.
Robert F. Steuding, Kingston, N. Y.
John Dancy, Fort Erie N., Ont., Canada
John Wotherspoon, Toronto, Ont., Can.
Johnny Hill, Dayton, Ohio

Harry Emmons, Highland Park, N. J.
Jack Cashmore, Sherridon, Man., Can.

TOPOGRAPHERS

Fred Schilling, Vancouver, B. C., Can.
Walter Dinteman, Martinsburg, W. Va.
Don Smith, Dillon, Montana
John McDougall, Minneapolis, Minn.
Stuart Radzom, Minneapolis, Minn.
Harold Tauss, Chicago, Illinois
Charles Rudloff, Houston, Texas

ENGINE MECHANICS

Henry Triwush, Chicago, Illinois
John Quirk, Vernon, B. C., Canada
Godfrey Howard, Brockville, Ont., Can.
Henry Silhan, New York City
John N. Rossi, Phippsburg, Col.
Edward Dumas, Old Forge, N. Y.
Frank M. Allen, Dillon, Col.

PHOTOGRAPHERS

Cliff Carter, Victoria, B. C., Canada
Richard Jesson, Cuyahoga Falls, Ohio
Robert Forrest, E. Hartford, Conn.
Erlon Johnson, Buffalo, N. Y.
B. E. Bewell, Victoria, B. C., Canada
Randal W. Corran, Oliver, B. C., Canada
Willard McCaffrey, St. Stephen, N. B., Canada
R. G. Lambert, Woodstock, N. B., Can.
Lorne Barclay, Montreal, Que., Can.
D. J. Sampson, Auckland, N. Z. Australia.

OBSERVERS

Raymond Fisk, Prince George, B. C., Canada
Jackie Burda, Cleveland, Ohio
Don M. Krumm, Cedar Rapids, Iowa
Walter C. Pacholko, Willowbrook, Sask., Canada
Max O'Starr, Newark, California
Jack Maloney, St. Thomas, Ont., Can.

AIRPLANE MECHANICS

Edwin Moore Higgs II, Hudson Falls, N. Y.
Harry Levington, Lidcombe, Australia
Joseph Edward Howe, Boston, Mass.
Merwin Andrews, Millerton, Pa.
Bob Weaver, Greenville, Ohio
Richard Needham, Chicago, Illinois
Louis Ambrozy, Oyster Bay, N. Y.

VALKYRIE

(Continued from page 64)

The tread of the landing gear is about 18" and the centers of the wheels should fall directly below bulkhead #1.

COVERING

Cover the entire fuselage with balsa planks $\frac{1}{16} \times \frac{1}{2}$ ". Cement the planks to the bulkheads and stringers. Match the edges of the planks to make a tight fit. Toward the ends of the fuselage it will be necessary to taper the width of the planks. The list of material calls for 36"-length planks. When joining the planks lengthwise, put the joint at a bulkhead and make sure the curve of the fuselage is not interrupted.

After planking, the edges can be rounded off with sandpaper until the covering is smooth and symmetrical. Treat with several coats of dope to protect the wood. A more detailed description of the methods of finishing will be described next month.

HATCH AND DOOR

Figure 5 is a sketch of the front part of the fuselage showing the portions which are cut away. The hatch is the upper half of the fuselage between bulkheads #1 and #2. The door is be-

tween #2 and #3. (It can be put on either side).

A battery box is built between #2 and #3 bulkheads. This installation as well as the motor installation will vary with the type of equipment used. A typical method is shown in Fig. 6. $\frac{3}{16} \times 1$ " balsa is used for the battery box, and the batteries extend across the fuselage.

The battery door is hinged to swing down. Hinges are .034 piano wire. Clothing snaps are used to fasten the door at the top of the fuselage. Batteries are accessible through this door.

MOTOR INSTALLATION

Sugar pine motor mounts are cut to the shape shown in Fig. 4. They extend through the holes cut in bulkhead #2. In addition they are cemented to #1. A balsa nose block (shown full size in Fig. 4) rounds out the front of the fuselage. It is notched to fit up underneath the motor mounts. It is cemented to bulkhead #1 and to the motor mounts.

The hatch is cemented back in place after the motor is mounted. Cut away the top portion to allow access to the needle valve, air intake, gas tank, etc. If it is necessary to service the coil and condenser mounted directly behind the motor on the motor mounts, the hatch can be removed by cutting the cement with a sharp knife.

Next month we'll continue the construction of the Valkyrie. In the meantime finish up this month's work so you'll be all set to start wing construction.

MATERIAL REQUIRED

(Balsa unless otherwise noted)

- 12 pcs. $\frac{1}{8} \times \frac{1}{8} \times 71$ ", stringers (hard)
- 4 pcs. $\frac{1}{8} \times \frac{1}{8} \times 66$ ", box framework (hard)
- 9 pcs. $\frac{1}{8} \times \frac{1}{8} \times 24$ ", bracing (hard)
- 16 pcs. $\frac{1}{8} \times 2 \times 18$ ", bulkheads
- 1 pc. $\frac{3}{64}$ " 3-ply birch 6×12 ", bulkhead #2
- 1 pc. $1\frac{3}{4} \times 1\frac{1}{2} \times \frac{1}{16}$ " $3\frac{1}{8}$ ", front nose block
- 2 pcs. $\frac{1}{2} \times \frac{3}{4} \times 6$ ", pine motor mounts
- 1 pc. .020 1×4 " half-hard aluminum, landing gear attachments
- 6 $\frac{3}{32}$ " diam. $x \frac{1}{2}$ " machine screws, landing gear attachment
- 1 pc. $\frac{1}{8}$ " diam. $x 36$ " music wire, landing gear
- 8 pcs. $\frac{1}{8} \times 1\frac{1}{4} \times 18$ ", flooring supports
- 1 pc. $\frac{1}{8} \times 1\frac{1}{2} \times 16\frac{1}{2}$ ", flooring
- 2 clothing snaps, door fasteners
- 1 pc. .034 diam. $x 6$ " music wire, door hinges
- 1 pc. $\frac{3}{16}$ " diam. $x 2$ " aluminum tubing, wheel bushings
- 2 collars and set screws to fit $\frac{1}{8}$ " diam. axles
- 2 pcs. $\frac{3}{16} \times 1 \times 18$ ", battery box
- 70 pcs. $\frac{1}{16} \times \frac{1}{2} \times 36$ ", fuselage planking

EXECUTIVE

(Continued from page 71)

WING

Build the wing as a unit with the aid of a right half tracing. Due to the fact that the bottoms of the ribs are curved, the wing parts must be assembled dry and held in place with pins. The rear ends of the ribs can be held up the right distance by inserting a strip of $\frac{1}{16}$ " under the rear at an angle similar to the taper of the trailing edge. After a final check-up, cement all the joints. Note that the aileron spars are omitted from the rib drawings. It is simpler to cut the ribs and insert the aileron parts after the other wing parts are cemented firmly.

Cover all the top of the leading edge from the $\frac{1}{16} \times \frac{1}{4}$ " strip to the first top spar with $\frac{1}{64}$ " sheet, but do not cement to rib 1. Remove all pins except those holding rib 1, loosen all spars at the center, then raise the tips $2\frac{1}{8}$ " for the proper dihedral angle. Trim the overlapped parts and recement at the center. When thoroughly set, remove from the board and cover the bottom of the leading edge with $\frac{1}{32}$ " sheet, out to rib 3 only.

LANDING GEAR

The retractable landing gear requires no special tools or talent to make. Form the wire parts and cover them with

paper wraps or $\frac{3}{32}$ " aluminum tubing. If tubing is used, the axle and hinge pins must be bent over after the tubing has been forced over the wire. The spring to hold the L.G. down is merely a piece of #8 music wire bent as shown. Insert one end in the top of the strut between the two larger wires and cement the other end to the rib, on each assembly.

Cut out the L.G. well in the bottom of the leading edge and cement the upper halves of the cutouts to the struts as shown. Cut rib 3 for the wheel and cement bent pins to the leading edge sides so they can be turned to lock the wheels up.

TAIL SURFACES

The tail surfaces are also pinned in place dry and then cemented. Use plain stock in the assembly and streamline the parts after they are taken up. Build the stabilizer as a unit.

FINISHING THE MODEL

Cover the wing and tail surfaces completely, but leave the lower sides of the fuselage open until the wing is cemented on, then add the bamboo fillet trailing edge and finish covering, including the cowl and wood covering. Add the scoop, exhausts, lights and other protruding detail. If desired, apply a coat of aluminum dope before lettering, or striping.

Make a 12-foot length of $\frac{1}{8}$ " flat rubber into a four-loop motor and attach

the "S" hook. Watch through the windshield to catch rear hangar, then attach propeller shaft. The nose plug should be a snug fit to prevent the prop from dangling when the power runs out.

Either test the model to perfection in tall grass, or gradually increase the power on repeated take-offs from some smooth area free from obstacles. The large size and lighter proportionate weight of this model furnish longer, more graceful flights, and it is amazingly stable, considering that it is a low-wing. With more power and a larger contest type propeller, the time can be increased—maybe too much!

LIST OF MATERIALS

Miscellaneous	Blocks
2 oz. tube cement	1 $1 \times 1\frac{1}{4} \times 8$ "
2 oz. clear dope	1 $\frac{1}{2} \times \frac{1}{2} \times 6$ "
1 oz. silver dope	
2 sheets silver tissue	Sheet
1 pr. $1\frac{1}{4}$ " air wheels	3 $\frac{1}{64} \times 2 \times 18$ "
12 ft. $\frac{1}{8}$ " flat rubber	10 $\frac{1}{32} \times 2 \times 18$ "
	4 $\frac{1}{16} \times 2 \times 18$ "
	1 $\frac{1}{8} \times 2 \times 6$ "
	1 $\frac{1}{4} \times 2 \times 12$ "
2 ft. # wire	Strips
1 ft. #14 wire	10 $\frac{1}{16} \times 1\frac{1}{2} \times 18$ "
2 ea. of $\frac{1}{8}$ " and $\frac{1}{4}$ " washers	4 $\frac{3}{32} \times 3\frac{1}{2} \times 18$ "
1 ft. $\frac{3}{32}$ " alum. tubing	4 $\frac{1}{16} \times 1\frac{1}{2} \times 18$ "
3 in. $\frac{1}{16}$ " alum. tubing	2 $\frac{1}{32} \times 1\frac{1}{2} \times 18$ "
	2 $\frac{1}{16} \times 1\frac{1}{2} \times 18$ "
	1 $\frac{1}{16} \times 3 \times 16 \times 18$ "

THE DIESEL IN AVIATION—Part II

(Continued from page 29)

difficulty and proving that the North Atlantic, like the South Atlantic and the Pacific, could be conquered by air. These small Dornier Do.18 flying boats with their Junkers Jumo 205 Diesels were making survey flights for Deutsche Lufthansa, the well-known European air line. When Deutsche Lufthansa first started its bi-weekly airmail service between Germany and South America in 1934, gasoline planes were used exclusively. It took almost five days for the long trip of nearly 9,000 miles from Berlin to Buenos Aires. Land planes and seaplanes carried the mail from Berlin to Bathurst, on the west coast of Africa. Sturdy, twin-engined flying boats were used for the over-water flight to Natal, in Brazil. For the remainder of the trip, seaplanes operated by a subsidiary company, the Sindicato Condor, carried the mail southward to Rio de Janeiro and Buenos Aires.

After the Diesel had been successfully adapted to aircraft, it was only natural that the original ten-ton Dornier "Wal" flying boats with their gasoline engines, used for the ocean crossing, should be replaced by more up-to-date Diesel-powered planes as soon as these became available. Dornier Do.18's, equipped with Junkers Jumo 205-C Diesels, were chosen for this task. Not only were the new planes faster than their predecessors, but since they had Diesels they were much more economical to operate. Thanks to the new equipment and other improvements, the time for the trip was reduced to less than three days. It was in this service that the *Zephyr* and the *Aeolus* first made their airmail flights across the ocean, so that when they appeared over the North Atlantic they were already veterans. It was in this service, too, that they were first catapulted from the *Westfalen* and the *Schwabenland*, the converted cargo ships stationed at each end of the crossing.

Few airplanes have such graceful lines as the Dornier Do.18. The hull has sponsons or "sea wings" built out on each side to help balance the plane while it is at rest on the water. The tapered wing, of semi-cantilever construction, is attached to a streamline turret on top of the hull and is braced by struts to the sponsons. The turret also serves as a support for the engine nacelle containing the two engines. The hull itself is divided into eight watertight compartments, with a gangway from bow to stern. In the bow, ample space is provided for storing the marine equipment, such as anchors and tow lines, carried on all flying boats. Next comes the pilots' cabin, equipped with dual controls and all the latest flight

instruments. Directly behind this is the radio and chart room, containing the radio and direction-finding apparatus, the master compass and a table for maps and charts. Aft of the radio room is the tank room, and toward the stern a compartment for mail and express.

The tank room contains four 185-gallon aluminum tanks, two on each side of the gangway. Here, too, are tanks for cooling water and lubricating oil for the engines which can be pumped up to the service tanks in the engine nacelle overhead. Fuel is also carried in the sponsons, which are equipped with dump valves to jettison it and so provide additional buoyancy in the event of a forced landing on the ocean. The total capacity of all the tanks is about 1,000 gallons under normal flying conditions.

As has been mentioned before, the power plant of the Do.18 consists of two Junkers Jumo 205-C water-cooled Diesels, mounted in tandem along the axis of the plane. This arrangement has the advantage that the plane can be flown on only one engine without throwing it out of balance or imposing undue strains on the structure. By mounting the engines back-to-back, the propellers revolve in opposite directions, and so their torque or twist is neutralized. A third advantage is the very low frontal area of the engine nacelle made possible by this arrangement, as it can then be streamlined to the nth degree. It will be noticed that the front engine projects ahead of the wing, while the rear one has an extension shaft so that its propeller will clear the trailing edge. The two radiators for cooling the engines are placed, one above the other, in the leading edge of the turret supporting the engine nacelle, where their head resistance is negligible. The engines are equipped with three-bladed Hamilton Standard propellers, 11 feet, 6 inches in diameter, built by Junkers under license.

Prior to the transatlantic survey flights of 1936, the range of the Dornier flying boats was carefully determined over the Baltic Sea. There, 30-hour test flights were carried out and it was found that the Do.18 had a maximum range of 3,400 miles, while for distances up to 3,000 miles, an average cruising speed of 130 to 140 m.p.h. could be expected under favorable conditions. These tests also showed that there was a saving of 25 per cent in the weight of the fuel that would have to be carried, compared with gasoline operation. This low fuel consumption made the flights possible, for the route surveyed by Deutsche Lufthansa was one of necessity rather than choice. Pan-

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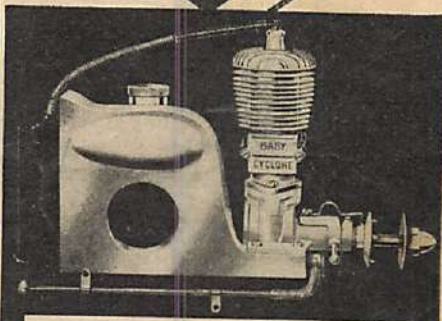
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American Airways and Imperial Airways had a monopoly on the northern route via Newfoundland and Ireland, and on the southern route via Bermuda and the Azores. This left only the central, or direct route to Europe, for Deutsche Lufthansa. From New York to the Azores is 2,400 miles, and from there to Lisbon is another 1,000 miles, so it was certainly fortunate that Diesel-engined planes were available.

Horta, on the Island of Fayal in the Azores, was chosen as the eastern base for the eight scheduled flights across the ocean. There the *Zephir* and the *Aeolus* and the catapult ship *Schwabenland* assembled for the initial flight. On September 9th, the *Zephir* was catapulted with Captain Blankenburg at the controls. On September 10th, twenty-two hours later, it arrived at Port Washington, fifteen miles from the heart of New York City. All kinds of weather were encountered, and for eighteen hours the crew had to fly blind. In spite of head winds, however, there was sufficient fuel left in the tanks of the *Zephir*, when it landed, for a further nine hours' flight. This surplus fuel weighed about 2,800 pounds, so, you see, there was plenty of margin for a 1,000-pound payload on this small Diesel-engined plane, even on its first trip made under adverse flying conditions.

The *Aeolus*, piloted by Captain von Engel, was catapulted a day later and followed a more southerly route via Bermuda. From there it was only a short hop of 770 miles to Port Washington. It was indeed a thrill to see these sleek gray flying boats come into sight and circle overhead before landing. Most impressive of all was the powerful beat of the exhaust, much faster than on our gasoline engines and more like that of a racing car. Then followed six more flights across the ocean, while the floating base *Schwabenland* followed its protégés to catapult them. On one of the eastbound flights the *Aeolus* averaged nearly 140 m.p.h. from New York to the Azores, which was an exceptionally fine performance considering that the total maximum power of its engines was only 1,100 h.p. On another occasion the *Zephir* was catapulted at night to gain experience. During the months of September and October of that year, over 17,000 miles were flown by these Diesel-engined planes over the ocean without mishaps of any kind.

Meanwhile, Deutsche Lufthansa had not been idle. Profiting from the experience gained during 1936, larger and more powerful equipment had been ordered for 1937. This time, four-engined twin-float seaplanes were specified, which were built by the Hamburg Aircraft Co., a subsidiary of the famous shipbuilding firm of Blohm & Voss in Hamburg. The Hamburg Ha.139, as the type is known, is quite large, having

a wing span of 88½ feet and a gross weight of 37,500 pounds, compared with a span of 77½ feet and a weight of 20,300 pounds for the Dornier Do.18. Like its predecessors, it was designed for catapulting—which is quite an achievement for a plane with an all-up weight of nearly 20 tons. Its construction is unique in that it uses a monospar wing built around a tubular member of large diameter, with flanges for attaching it to the center portion of the spar integral with the fuselage. While the portion of the spar in the wing is constructed of duralumin, the center portion is of steel and is provided with bulkheads so that it constitutes the fuel tanks. This center portion is of inverted "gull" design, so that the fuselage and tail of the plane are carried high above the water to facilitate take-off. The fuselage is of conventional monocoque construction, while the floats each have twelve water-tight compartments. Built into the leading edges of the supports for the floats are the radiators for the engines.

As the Ha.139 was specifically designed for mail and freight, it was possible to keep down the cross-section of the fuselage so that it presents a very small frontal area. There is ample room for the crew of four, however, as the fuselage is 64 feet long. In the front of the cabin are two seats and dual controls for the flight captain and the assistant pilot. Directly behind these are the instruments and controls for the four engines, under the supervision of the flight engineer. Here, too, is the equipment for the radio operator and navigator. All the pilot has to do while flying the plane is to watch the flight instruments and regulate the throttles.

The engines used are Junkers Jumo 205's, identical with those on the Dornier planes except that their power output has been stepped up to 600 h. p. Powered with these Diesels, the Ha.139 has a maximum speed of 185 m.p.h. and cruises at 155 m.p.h. Its range, with 1,750 gallons of fuel on board, is 3,100 miles. Thus, with a slight overload, it can fly non-stop from New York to Lisbon without landing at the Azores. The Ha.139 is the largest seaplane ever put into service, and judging from its performance it has amply justified the faith placed in its design.

On August 11th, 1937, the transatlantic flights commenced once more when the Ha.139 *Nordmeer* took off from Luebeck, near Travemuende on the Baltic Sea. Following a direct route overland, it covered the 1,750 miles to Lisbon in 9½ hours at a speed of 184 m.p.h. The second stage of the flight, from Lisbon to Horta, took 7½ hours, and the last leg of the journey, from Horta to New York, another 16½ hours. Thus the 5,150-mile flight from the northern coast of Germany to New

York took 33½ hours flying time, which works out at an average speed of 154 m.p.h. During the flight from Horta to New York, thunderstorms and head winds up to 40 m.p.h. in velocity were encountered, so it was a pretty fair test of the plane under adverse conditions which might be encountered. Captain Blankenburg, who piloted the *Zephir* on its first transatlantic flight, had the honor of piloting the new four-engined plane across the ocean. The success of this trip proved, beyond a doubt, that regular 30-hour airmail service to Central Europe, or 24-hour service to England, was feasible.

During the period from August to November of last year, the *Nordmeer* and her sister ship, the *Nordwind*, completed 14 trips between New York and the Azores. This involved more than 33,000 miles of ocean flying, compared with 8 trips and 17,000 miles for the smaller planes during the previous year. Two catapult ships were used this time—the *Schwabenland* and a new addition to Deutsche Lufthansa's fleet, the *Friesenland*. The new planes demonstrated even more strikingly than before the advantages of the Diesel for long flights across the ocean.

During these trips it was found that the fuel consumption of the Diesels was so low that a saving of over 79 pounds of fuel per hour for each engine was possible, compared with gasoline engine operation. Thus, for the 16½-hour flight between the Azores and New York, the saving in fuel amounted to the astonishing total of more than 5,200 pounds. This saving of more than 2½ tons in dead weight is available, of course, for additional payload apart from the nominal payload of 1,000 to 1,500 pounds which the plane is designed to carry. Regular transatlantic airmail service could readily have been put into operation by Deutsche Lufthansa last year, and on a profitable basis too, had permission to do so been granted by our government. The reason that this was refused was that neither the United States nor Great Britain had any equipment to compete with the German planes and their highly efficient Diesels.

Activities with Diesel-engined planes have not been confined to over-water flights, by any means, although little is heard over here about the operation of land planes on the air lines in Europe. The first two planes of any size to fly with the Junkers Diesel were Junkers G88 airliners. These huge planes, which had accommodations for thirty-eight passengers, were equipped with four 750 h.p. Jumo 204 engines. Following this, the Jumo 205 was tried out in the trimotored Ju.52 airliners with great success. Then in 1935 came the Junkers Ju.86, which was the first airliner specially designed for Diesel engines. This

up-to-date twin-engined plane is of the very latest construction, being comparable to the twin-engined Lockheed in design and general appearance. The Ju.86 is a ten-passenger, all-metal plane which weighs 17,300 pounds fully loaded. It is powered with two 600 h.p. Junkers Jumo 205-C Diesels, which give it a top speed of 200 m.p.h. and a cruising speed of 175 m.p.h. Its ceiling is 22,000 feet, its range 1,200 miles. A military model of this Diesel-engined plane, known as the Junkers Ju.86 K fighter-bomber, is used in large numbers by the German Air Corps.

Many famous flights have been made with the Junkers Ju.86. One of the most outstanding was the flight of the mail plane *Buckeborg* from the factory at Dessau to Bathurst, in British Gambia. This fine flight, which took place nearly two years ago, involved a non-stop trip of 3,600 miles, which was accomplished in 20 hours at an average speed of 180 m.p.h. A crew of three was carried, and when the plane landed there was still sufficient fuel in its tanks for another 1,400 miles. Subsequently, this flight was repeated a number of times without difficulty. Then there was the flight by another plane, named the *Lawrence Hargrave* after the famous Australian pioneer, from Germany to Australia, which caused great excitement at the airports en route as it was the first Diesel-engined plane to visit them.

Another thrilling adventure was when the *Kismet*, after winning the international Oases Circuit Competition in Egypt in 1936, was flown by Captain von Sternberg to Kabul, in Afghanistan. He had no difficulties on the way, but on arriving at Kabul he learned that there was no Diesel fuel on hand for his plane. This would have been a terrible predicament for a gasoline-engined plane under similar circumstances, but it did not bother him. He found that there was plenty of kerosene available, and he tried it in his engines: they ran fine. So he had his plane tanked up with kerosene and continued on his way, flying the 950 miles to Jask on the Persian Gulf with this fuel without incident.

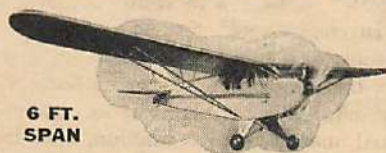
While spectacular flights such as these attract considerable attention, the regular everyday flights of Diesel-engined airliners pass practically unnoticed. How many of you know, for instance, that a year ago Diesel-engined planes were flying more than 60,000 miles a week, and that since then this mileage has been rapidly increasing? Such is the case, however, as you can see for yourselves in any comprehensive European air-line timetable. There you will see that all the large cities of Germany, and Amsterdam, Geneva, Vienna, Warsaw and Copenhagen as well, have up-to-date Diesel-engined airliners servicing them. Then, too, you will find that Deutsche

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Lufthansa's air mail service across the South Atlantic is in full swing, with the *Zephyr* and the *Aeolus* and two more Diesel-engined Do.18 flying boats, the *Zyklon* and the *Pampero*, carrying the mail with clocklike regularity. Meanwhile, the United States does not have even one modern Diesel-engined plane with which to gain experience before making the change-over to the Diesel, which is inevitable if we are to keep abreast of European development!

Fine flights have been made with the Diesel in other countries, too, so there is no excuse for this backwardness on our part. When the Packard Diesel was in production here, there was the flight of Walter Lees and Frederick Bossy in a Bellanca Pacemaker at Jacksonville, Florida, when they established the world's non-refueling duration record. Taking off with 481 gallons of fuel, they remained in the air for 84 hours and 32 minutes—and this record of May 28th, 1931, has never been equalled. Then there was the flight of E. J. Penrose with the Bristol Phoenix Diesel in England, when he reached a height of 27,453 feet to establish the world's Diesel altitude record. This flight was accomplished on May 11th, 1934, with the engine installed in a standard Westland Wapiti two-place observation plane belonging to the Royal Air Force. While the engines used for these flights were far from perfect, and were criti-

cized for being messy and noisy to operate, nevertheless it would not have taken a great deal of effort to have brought them up to par with the gasoline engine as far as their mechanical excellence was concerned.

Now that you have read about the flights of these planes, perhaps you would like to know something about the fuel which is used in their engines. Well, it is very different from highly volatile gasoline, or the thick bunker oil used for heavy, slow-speed Diesels on ships. Airplane Diesel fuel is similar to furnace oil used for heating purposes, and in appearance looks something like kerosene. It is refined from petroleum and is graded according to its cetene rating, just as there is the octane rating for gasoline. There is this difference, however, that while in good aviation gasoline the ignition point is delayed as much as possible to prevent pre-ignition and piston knock, in good Diesel fuel there should be as little ignition delay as possible so that combustion will take place quickly and evenly during the moment of fuel injection. With regard to price, while 87 octane gasoline costs about eleven cents a gallon in tank car lots at refinery, Diesel fuel for airplane use should not cost more than five cents a gallon in this country, once there is a sufficient demand. To these figures, of course, must be added transportation charges and taxes, which vary.

Please mention AIR TRAILS when answering advertisements.

Another important characteristic of Diesel fuel, at least for airplane use, is that it should have a "pour point" of at least -30° F., at which temperature it should flow freely without freezing. Furnace oil is quite satisfactory for low altitude flights in temperate weather, but its pour point is too high for use in engines which must operate at medium or high altitudes, in every kind of weather. Then it should also have a "flash point" of at least 115° F., below which temperature it does not give off any inflammable vapor. This characteristic is of great importance, as one of the outstanding advantages of Diesel fuel is that it has no inflammable vapor to catch fire at ordinary atmospheric temperatures, as has gasoline.

One interesting point to remember is that although Diesel fuel is far more economical, it actually weighs more than gasoline. A gallon of Diesel fuel weighs about 7 pounds, compared with about 6 pounds for a gallon of gasoline. This is not a disadvantage, however, as it is the fuel consumption of the engine that counts, particularly on a long trip. An airplane Diesel engine consumes only 0.36 pound of fuel per h.p. per hour, compared with 0.46 pound for a gasoline airplane engine. Consequently, by dividing the weight of a gallon of fuel in each case by the weight of fuel that its respective engine consumes, you will

find that from a gallon of Diesel fuel 19.4 h.p. can be obtained, compared with only 13.0 h.p. from a gallon of gasoline. In other words, Diesel fuel is 49.2 per cent more potent than gasoline on a power output basis, while the Diesel engine itself is 21.7 per cent more economical on a fuel consumption basis. This is something to be pondered.

Now you may wonder, after reading about all these advantages of the Diesel for aviation, why it is not used more extensively for this purpose in the United States. Well, there are several reasons for this. For one thing, we have such an abundance of petroleum within our borders that little thought is given to economy, nor is there any appreciable desire on the part of the oil companies to encourage the use of Diesel fuel for aircraft while they can sell such large quantities of aviation gasoline at a much higher price. Then again, our airplane-engine manufacturers are tooled up for the mass production of radial, air-cooled gasoline engines, and neither they nor their stockholders relish the idea of changing their production to an entirely different kind of engine. The air lines would welcome the Diesel if they could get it, but so far no one here has produced an engine suitable for their needs. Our air forces too, would find the Diesel a blessing, particularly the brave fel-

lows who have to fly in the planes and who often get burnt to death, but red tape prevents their views being heard. As for the politicians at Washington who are entrusted with our welfare, they are so absorbed in other things that a matter of this sort receives but scant attention. It is the old, old story of "passing the buck"!

In conclusion, I would like to quote from the address of Charles F. Kettering, vice-president of General Motors, which he gave at Carnegie Hall on March 2nd, 1938. Mr. Kettering said: "There are just two kinds of minds in the world, those that are not afraid to look forward and those that are always looking backward." This applies very aptly to the Diesel, which has solved so many of our transportation problems on land and on the water, and is now ready to do so in the air. The only way that we can get what we want in these days, though, is to keep plugging for it. So if you agree with what you have read in this and the previous article, and realize how much the Diesel will mean to aviation in this country, do not hesitate to speak up and try to hurry it along. Remember, the sooner we have an adequate Diesel airplane engine development and production program in the United States, the better will it be for our aviation and our national defense!

FLYING HOTEL

(Continued from page 21)

scaffolding and jacks already mentioned. The scaffolding was so placed that pulleys and cables could be hooked to the leading edge and upper skin of the wing. Beneath the inner portions of the wing the hydraulic jacks pushed up at tremendous pressure. At given signals, twelve men, by block and tackle, gradually increased the upward pull or "suction." Simultaneously, the jacks were operated in unison from a central control board. The total stress exerted on some of these tests reached 180,000 pounds, approximately three

times the loaded weight of the ship. Deflection readings were taken at 201 stations on each successive test.

Down-load conditions were produced by a dead weight of pig lead and hydraulic jacks that pulled against the engine nacelles. Again, the maximum stress was 180,000 pounds.

A special inclined rig—down which the wheels traveled on their side, backed by a monstrous weight—created both side-load and impact conditions. Each wheel withstood 42,000 pounds up-load and 35,000 pounds side-load. Even the nose wheel was subjected to a 10,000-pound side-load.

Expressed in actual mileage, these load and vibration tests would have

been sufficient to have taken the plane nearly three times around the world.

At this writing the DC-4 has undergone its initial flight tests. Intended for experimentation only, this first DC-4 will be put through every test conceivable in the air just as it was on the ground. If successful—and success on such a meticulously scientific project seems assured—the production models of the DC-4 will be cabin-supercharged for passenger comfort at high-altitude operation. Once in service these ships are expected to reduce to a minimum the already remote hazards inherent in any man-made transportation system—on the ground, on the water, or in the air.

ANNOUNCEMENT

Because of the many complications and details attending the design and plans of the NEW BILL BARNES SHIP, we were forced to postpone their publication until the October issue of AIR TRAILS so that a more complete presentation would be possible.

PLAINS SOARING

(Continued from page 15)

the wind had increased and was now blowing due north. Thermals were stronger now and more evenly spaced, so I had little difficulty in staying above 3,000 most of the time. As I flew silently along I realized quite forcibly two great advantages of level country soaring in this part of the world. The first, and most important, is the safety, as at no time did I have the slightest worry about landing with half-mile fields everywhere. The second is the ease of navigating where most of the roads have been laid out along section lines and therefore run either north and south or east and west.

As I passed halfway between Chickasha and Purcell about 85 miles out, I could see far ahead the skyscrapers of Oklahoma City. I also saw ahead a thinning of the clouds which had become smaller and rather ragged. Chances did not seem to be too good for making my announced goal of Tulsa, so I headed for the airport southwest of Oklahoma City, where I knew a prize of \$100 awaited the first pilot to fly this distance of 106 miles from Wichita Falls.

Crossing the Canadian River east of Newcastle, I hit a very strong and turbulent upcurrent. Turning immediately to spiral within it, I found myself climbing upward at 10-14 ft./sec. Up and up I went until I entered the base of a large cumulus at 6,100 feet above the surface. Pumping with my left hand the atomizer bulb actuating the Minimoa's turn indicator, I continued up into the cloud. It became more and more turbulent. One second the air-speed would show a dive of 65 m.p.h. and then a gust would hit the ship and we would be quivering in a stall at 35. Finally, at 6,500 feet, I decided it was getting far too rough for comfort or safety, so held the compass steady at E and dived out.

This was the highest altitude I reached during the flight. It was 6,335 above the take-off field, 6,700 above the ground at this point and 7,200 above sea level. The press got hold of the latter figure and promptly claimed a new altitude record which was impossible, as there still had to be deducted the 925 feet of the winch tow.

With this great boost I was encouraged to continue on to Tulsa although I realized it would be a battle flying cross to the south wind, which was now blowing at least 35 m.p.h. at this altitude. Before long the sky was once more full of good-sized cumulus clouds to the north as well as northeast, and I was greatly tempted to give up my

goal and fly with the wind into Kansas on what I now know might easily have been a flight of over 300 miles. However, the achievement of attaining a preannounced goal as well as the possibility of winning the Fiduciary Counsel prize of \$1,000, which would go a long way toward making possible a continuation of soaring experiments the rest of the year, made me stick to my original course.

As I continued from cloud to cloud, sometimes flying straight for five to ten minutes, but usually spiraling upward most of the time, I noticed the country now had more patches of woods and more rivers. The latter I knew would be a help, because for some reason which I cannot readily explain, all the really strong thermals I hit seemed to originate along rivers. Despite this slightly wilder aspect of the country, there were still plenty of possible landing fields.

Beyond Chandler I made a wide detour to the north toward the most

promising clouds before continuing on ENE. At 3:00 p. m., as I passed south of Cushing, I jotted in my log: altitude—4,900', temperature—61°, relative humidity—88, climb—3 ft./sec. These figures I kept throughout the flight in carrying out the scientific research angle of the expedition. At 3:15 I passed just south of Drumright and I now knew that I could be sure of a new American distance record, as I was over 170 miles from my starting point and still had 4,000 feet altitude. Far ahead Tulsa's skyscrapers gleamed in the afternoon sun as if beckoning me on.

My next check point was the junction of the Cimarron and the Arkansas Rivers, which I crossed with only 1,500 feet altitude. Flying along the north bank of the Arkansas with the nose pointed southeast, I caught a succession of fairly strong (8 ft./sec.) and very turbulent thermals. Passing over Sand Springs I was down to nearly 1,000 and was afraid of having to land short of my goal in a public (Turn to page 91)



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(Continued from page 19)

famous Grumman Gulfhawk for Air Ministry officials.

* * *

The Canadian Car and Foundry Company is planning to build Grumman fighters in Mexico, for the Mexican government, under license.

* * *

A bomber more than twice the size of the Flying Fortress is said to be on the drawing boards of the Air Corps designers. It will weigh more than 75 tons. The Navy is also in the running with a design for a 52-ton flying boat for long-range work. Britain has a 42-ton flying boat, and Russia is said to have one even larger with six engines, but the Army model would no doubt "top" everything in the air so far.

* * *

The Army hopes to add 394 new planes to the Air Corps within the next twelve months and 80 more for National Guard squadrons. There are already fourteen 16-ton Flying Fortress bombers on hand, and 26 more are on order.

* * *

An order for \$1,412,916.80 worth of military equipment was recently given to the Grumman firm of Long Island. The contract is for 26 G-31 short-range amphibian planes.

* * *

The Brewster Corporation was recently awarded a contract for \$1,910,395 worth of new Navy type fighters, believed to be the new XF2A-1 all-metal fighters. The company is building 53 of these models.

* * *

The State Department will protest the sale and export of the 400 planes ordered by the British Air Ministry, according to a statement made in Washington recently. In the last two and a half years \$118,363,700 worth of munitions, mostly aircraft, have been sent abroad by American manufacturers.

* * *

More than ten thousand people have been killed in Loyalist Spain by air raids and more than fifteen thousand have been injured, since the outbreak of the war.

* * *

The Navy is still going ahead with its plans for a \$3,000,000 dirigible, which according to their experts will be the safest ship of its type ever built. Helium will be used, a new and stronger metal will make up the framework, better engines and more numerous gas cells will be incorporated.

* * *

Britain is considering the purchase of a number of new Handley Page Hereford bombers which use the new Napier Dagger H-type engine. It is a revamped version of the Hampden but much faster.

The new Short Sunderland flying boat bomber will have a cruising range of 3,000 miles. It is, of course, a military version (much improved) of the Short Empire flying boats. It has a covered rotating gun-turret in both nose and tail. The engines used are 1,000 h.p. Bristol Pegasus power plants.

* * *

The new Martin 166 bomber, said to be the finest fighting Martin ship ever to come out of the Baltimore shops, is now on the export list and can be purchased by anyone. It has greater range, greater speed and greater striking power than the models now in use in the Army Air Corps.

* * *

The Naval Aircraft Factory has just completed its first 100 per cent government-built aircraft. It is a training plane using the 235 h.p. Wright NAF-R760 engine built under Wright license. The same factory is also making 44 scout-observation planes copied from the Curtiss SOC type.

* * *

The new 19,900-ton aircraft carrier *Enterprise* has at last been formally commissioned at Hampton Roads, and Captain Newton H. White is in command.

MISCELLANEOUS

Professor Philip Siedler of Frankfurt-on-Main, Germany, has demonstrated the possibility of extracting 99 per cent pure helium from the atmosphere. He also believes that vast deposits of helium will be found in Europe.

* * *

American pilots and mechanics who enlist with foreign forces against recognized governments are liable to lose their licenses or commissions, according to a recent report from Washington.

* * *

A new distance record for women was recently set by Mme. André Dupeyron of Paris in a Caudron-Aiglon plane. While flying from Oran to Basra, Iraq, she covered a distance of 2,560 miles non-stop before she was forced down at Tel el Aham.

* * *

Maurice Rossi, noted French transatlantic flyer, set three minor world records recently in a special ship. He covered 3,105 miles in 12 hours, 27 minutes, 38 seconds. The records involved were those with set payloads.

* * *

The United States was well represented at the Belgrade Air Show which was held between May 28th and June 13th. It was Serbia's first international air exhibition.

* * *

Japan is claiming the world's closed-circuit endurance record for the mono-

plane *Wings of the Century*. Twenty-nine laps of a 402 km. course, which amounts to about 7,300 miles, were covered in 62 hours, 27 minutes.

* * *

The new Soviet airship, the USSR-V-10, is now ready for its final test flight. It carries a crew of eight and has two 100 h.p. engines.

* * *

A new speed record for South Atlantic crossings was made by the German Hamburg Ha.139 seaplane, which covered the distance from Bathurst to Natal, a distance of about 1,700 miles, in 11 hours, 11 minutes. The machine is a low-wing monoplane using four Junkers Jumo 205 Diesels.

* * *

The Dutch K. N. I. L. M. air line has received permission from the United States government to operate an air service between Batavia and Manila.

* * *

The new French Loire-Nieuport L.N.20, an all-metal low-wing monoplane transport ship which is now nearing completion, has an estimated top speed of 295 m.p.h. at 15,705 feet.

* * *

The Pan-American Hawaiian Clippers have made more than 200 trans-Pacific flights to date with no accidents of any kind.

* * *

A new British aircraft factory at Shoreham plans to open a factory soon where a low-wing pusher monoplane powered with a converted Ford engine will be built. It is hoped that the ship can be marketed at a price around \$500.

* * *

Intended as flying classrooms for bombing, navigation and gunnery instruction, four new Canadian Nordyn Norsmen high-wing monoplanes have been purchased for the Canadian Royal Air Force.

* * *

The National Steel Car Corporation of Canada has obtained a license to build the British Westland Lysander Army Cooperation machine. Production will start immediately.

* * *

Col. Vincenzo Coppola, the Air and Military Attaché to the Italian Embassy in Washington, has a new Cant monoplane for his especial use. It has three inverted 110 h.p. Fiat engines. It was assembled for him at Floyd Bennett Field.

* * *

CORRECTION

In answer to a recent reader question it was erroneously stated that there was no air mail route between Denver and Salt Lake City. United Air Lines conducts both passenger and mail service between these points daily.

NEW ANNUAL EDITION
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256 Pages—More than 250 Halftone Illustrations and Drawings—11 Chapters



PLAINS SOARING

(Continued from page 89)

park when I caught a good boost which carried me up to 3,500.

At this altitude I flew over the city of Tulsa and I experienced a dream coming true. The Municipal Airport lies six miles northeast, so I continued on with the help of three more thermals. It was now after four and the clouds were few and far between, but the thermals were still frequent and strong, so I might have gone on another 30 miles or so to Claremore.

Actually pushing my way down, I slowly lost altitude and although I had been over the field for twenty minutes, no one saw me until I was down to about 800 feet. Then the Spartan School of Aeronautics stopped work and rushed out toward me as I landed on the runway at 4:35, having been in the air 5 hours and 47 minutes. My distance, as officially computed by the U. S. Geological Survey, was 212.45 miles.

That night a cold front moved in with violent thunderstorms and much rain, so it was mid-morning the next day before I could start my airplane tow flight back. It was a rough ride

I—Adventures Over Land and Sea. II—With the Army Air Corps. III—With the Navy's Air Forces. IV—Coast Guard Aviators. V—Air Lines of the United States. VI—Private Flying. VII—Aerial Service Operations. VIII—Airways and Airports. IX—Training and Education. X—New Things in the Air. XI—Federal Government Activities.

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but an interesting one, as we encountered quite a few thermals on the way. As we stopped at Oklahoma City to demonstrate a bit of soaring, it was late in the afternoon before we landed back at Wichita Falls. James Kimbrell, pilot of the Waco F-3 tow-plane, towed me at 7,500 feet over the city, where I cut off and made a long, steady glide through stable air back to the airport.

The following day we made six flights but found little lift, the longest duration being 7 minutes. On the 22nd, conditions improved and we caught thermals on all flights. On the last one, made at 2:30 p. m. from a 700-foot winch tow, I climbed to 3,600 feet and stayed up an hour and twenty minutes. I landed then purposely to check the operation of a radio meteorograph installed experimentally in the ship by Dr. Karl O. Lange of Harvard's Blue Hill Observatory, who had joined the expedition a few days before to conduct meteorological research with the aid of upper air soundings sent down by his radio meteorographs lifted as high as 65,000 feet on daily balloon ascensions. Dr. Lange, who is also Contest Committee Chairman of the S. S. A. and Technical Director of the National Soaring Contest, expressed himself as very pleased with our definite proof that the level plains offer wonderful soaring.

During the following week we were grounded by several days of storms and

very high winds. However, we put in several hours of local soaring gathering data on thermals as well as winch tows. With a 20-mile SE wind, we could climb to a maximum of 1,200 feet using the 3/8" rope on the winch. By using single-strand wire we increased this to 1,500 feet under identical conditions. With these high winds we were able on several occasions to hold altitude for 4 to 5 minutes while headed into the wind at over 700 feet altitude with an overcast sky—gust soaring?

Now for some statistics and conclusions. Of 19 possible flying days, I soared on 18. Of 81 winch tows, 45 resulted in soaring flights of at least "C" license requirements, an average of 55%. Total time put in came to 29 hours, 9 minutes. First conclusion is that, despite this showing, we hit a run of adverse weather and that conditions average much better later in the year, in June and July. Secondly, soaring possibilities over level plains are now definitely proven. Thirdly, in addition to strong convection prevalent throughout the summer, this is the safest and most practical country in America from the soaring pilot's point of view. Fourthly—and this is the most important conclusion of all—we now know that real thermal soaring can be done from level fields by auto or winch towing nearly anywhere in this great land of ours.

Please mention AIR TRAILS when answering advertisements.

MODEL MATTERS

(Continued from page 78)

An interesting feature of the meet was the aerial camera built by members of the WPA Trenton Aero Club and installed in "Miss Trenton Times"—a 5-foot gas model. Several outstanding aerial photos of the airport were taken from this ship.

Much of the interest in modeling in this section is the result of the increased activity of the WPA Recreation Division along this line. Further information about their program is available from Mary G. Gill, District Supervisor of Recreation, 212 Centre St., Trenton, N. J.

The Paterson Society of Model Aero Engineers holds meetings every Saturday morning at the Y.M.C.A., Paterson, N. J. Members have been particularly active with gas models, getting high places in the Eastern States meet early this spring. A recent guest speaker at a club meeting was Eddie Schneider, who recounted some of his exciting experiences while a flyer in the Spanish war. Future plans call for other interesting guest speakers on various phases of the model hobby as well as full-size activities.

PHILADELPHIA CLUBS

Philadelphia modelers have additional incentive to build and fly models during the 1938-39 season. Four valuable scholarships will be given as prizes to the winners. These prizes are the result of the interest which the Aircrafters have taken in model work. This organization is composed of aircraft employees of the Philadelphia Naval Aircraft factory. At a banquet given in June to the winners of the past season of flying, William F. O'Connell, president of the Aircrafters, announced that a three-year evening course in aeronautical engineering will be given to the 1939 winner by the Pennsylvania State College extension service. Another course in electricity has been offered by the Spring Garden Institute, a ground school course by the Rising Sun Aircraft School, and an aviation mechanics course by the International Correspondence Schools.

Major J. Victor Dallin, commander of the Pennsylvania National Guard Air Squadron, announced a trophy would be offered for the best scale model of the new Douglas O-47 observation plane. The P.N.G. is putting this type plane into service.

The Philadelphia Model Aeroplane Association closed a successful 1937-38 season. There was increased interest in all phases of modeling. Walter Lees, 19, was awarded the A. J. Drexel Bid-

dle Cup for his flight of 22 minutes at an indoor meet this spring. This trophy has been in competition since 1912. David Call was awarded the senior trophy for the highest season score. Irwin Berlin won the junior trophy. Walter Eggert and Douglas McFadden divided the senior scale model award.

P.M.A.A. is the joint work of the Bulletin, Aero Club of Pennsylvania, and the Playground and Recreation Association. They have been doing excellent work in advancing models for the past ten years. The coming season promises to be the most successful yet.

DETROIT MEET

The Department of Recreation, City of Detroit, announces the results of a contest conducted June 10th under the direction of Arthur Vhay, aircraft instructor:

Indoor Events

Duration—Edward Naudzius, Detroit	4:20
R.O.G. stick event—Robert Chase, Battle Creek, Mich.	6:08
Aerona Flying Scale—Frank Franz, Detroit	92 points 00:45

Outdoor Event

Gas-powered—John Maruska, Detroit	2:59.8
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GAS MODEL INSURANCE

Plans are being worked out whereby it is hoped that announcement of an insurance plan for licensed N.A.A. gas model builders can be made during the month of July, possibly before the close of the National Championship Model Airplane Contest, to be held at Detroit July 6-7-8th.

It now appears that it will be possible to offer insurance coverage for a fee of \$1.00. It will be necessary before the insurance becomes operative for a certain number of model builders to sign up. Whether the number will be 500 or 1,000 is still a matter of negotiation.

The insurance will cover both personal liability and property damage. The amounts in each case will be sufficient to cover any normal situation. Here, again, the actual amounts are still a matter of negotiation.

MODEL ACADEMY APPOINTMENTS

The following Academy of Model Aeronautics committee appointments have been made for 1938: Power Plane: Edward Roberts, chairman, Henry Stiglmeier, Joseph Konefes, and Charles Grant; Rubber: Carl Goldberg, chairman, Roy Wriston, and Hewitt Phillips; Scale Section: Paul Garber, chairman, Harry Copeland and Roger Hammer;

National Contest: H. M. Jellison, chairman, Miss Frances Alexander and Arthur Vhay; National Conference: H. T. Sommers, chairman, Victor Fritz and Walton Grubbs; National Awards: Capt. Willis Brown, chairman, Irwin Polk, Ed Clarke, and Charles Grant; International Coordination: Gordon Light, chairman, and Philip Zecchitella; Publishers: William Enyart, chairman, Colin Cameron, Charles Grant, Philip Zecchitella, and C. B. Colby.

NEW CONTEST DIRECTORS

Fifteen new contest directors for model aircraft have recently been appointed by the National Aeronautic Association. Their names and addresses follow:

John L. Scherer, East Rockaway, L. I.; R. D. Blyth, Meridan, Miss.; R. C. Rodolsky, St. Louis, Mo.; Elmer Westerland, Jackson, Mich.; Gaylord H. Webster, Phoenix, Ariz.; Michael Vetrano, Manchester, Conn.; David H. Hunt, Columbia, Conn.; Clyde E. Cole, Flint, Mich.; R. N. McCallam, Binghamton, N. Y.; Arthur Vhay, Detroit, Mich.; Allen Turner, Brooklyn, N. Y.; Elmer Riemer, Milwaukee, Wis.; Claude A. Carr, Washington, D. C.; Theodore Dove, Naugatuck, Conn.; L. B. Bush, Omaha, Nebr.

NEW ZEALAND MODELERS

Vernon Gray sends some interesting news from New Zealand. Gray's modeling ability is thoroughly respected in this country. He won the Moffet International Trophy in 1936 at Detroit. He has competed in our national contests for the last half-dozen years—shipping his models here and having them flown by proxy.

Gray recently visited Australia and competed in the model contests held as part of the celebration marking the 150th year of the founding of Australia. The contests were termed "international," but unfortunately there were no English, American, or other foreign models entered. Running true to championship form, Gray won the Open Outdoor event with a fuselage model. The area was 128 square inches, total weight 5¼ ounces. The flight was 5:05.2 out-of-sight. Then turning indoors, Gray took another first with a flight of 11:28.2, when his model stuck about ten feet from the top of the sixty-foot ceiling. His model was a Class B tractor and had plenty of "stuff" left when it caught. 18 to 19 minutes would have been the length of the flight had it continued free.

The Indoor Fuselage contest was won by an entrant from South Australia with 8:30. Ray Allen, flying partner of Gray from New Zealand, took second with 8:00. Ray also took third in the hand-launched stick event.

Australian modelers won the first five places in the Outdoor Weight Rule Fuselage event. Allen and Gray had intended to fly in this contest exclusively, but when they reached the field the day of the contest, they couldn't resist flying in the Open event. The result is that they practically ruined their models in the Open event and were not prepared for the Weight Rule event. This accounts for their poor showing. The moral is—have a separate model for each contest.

During a flight in the Open event, Allen's model landed in a lake. It had to be retrieved with a fishline. And as if this wasn't enough punishment for the model, a dog on the shore grabbed it and started to play with it. No wonder it wasn't capable of making a good flight in the Weight Rule event.

Gray's letter clears up a geographical problem for us. New Zealand is definitely not a part of Australia. In fact, it's two-and-a-half days' sail away, or a distance of about 1200 miles.

In 1940 New Zealand is holding its Centenary and is planning to welcome a team of six Australian modelers for the battle royal.

Gray is a member of the New Zealand Council for Model Aeronautics. His ambition is to build up sufficient interest in modeling to have New Zealand send a representative to our National meet and the Wakefield meet.

Speaking of international contests, Gray remarks that the boys in New Zealand are disappointed in not receiving their models back from the 1937 Moffett contest. The impression is that one may as well write off his model as lost when entering a Moffett contest in the States. This impression should certainly be cleared up if the United States is to enjoy the continued cooperation from the New Zealanders which has helped make our international contest truly world-wide.

NORTHERN INDIANA RESULTS

The First Annual Northern Indiana Model Airplane Builders Contest, sponsored by Bram's Community Stores, was held at Gary, Indiana, on June 5th. Bob Roberts was contest director and did a capable job. Comments heard from some of the Chicago builders who competed describe this meet as being one of the best organized and smoothly operated ever held.

In the gas model consistency contest, motor operation was limited to 20 seconds. Average of three flights was taken. Gerald Ritzenthaler's model

went out of sight after 16 minutes for an average of 5.49. Other winners in this event were:

(3-flight average)

2nd	Robert Mazel, Chicago, Ill.	1:51
3rd	Alvin Anderson, Chicago, Ill.	1:36
4th	Stanley Michalski, Chicago, Ill.	1:31

Joe Havlik, Jr., of Grand Rapids won the prize for the most complete crack-up. His Aristocrat model was a complete washout.

Rubber-powered Endurance Contest

1st	Dennis Turner, Chicago, Ill.	3:55
2nd	Joseph Krebs, Chicago, Ill.	3:44
3rd	Frank Middaugh, Chicago, Ill.	2:30

Exhibition Contest

1st	Joseph B. Pasko, Jr., Gary, Ind., Boeing P26A Mr. Mulligan
2nd	Robert Kaergaro, Chicago, Ill., Mr. Mulligan
3rd	Julius Yuhasz, Gary, Ind., Aeronca K

An interesting feature of the meet was the souvenir program. It contained a short foreword on modeling prepared by director Bob Roberts, a complete listing of entrants, models, and prizes. Opposite each entry was a place to tabulate flight times, which were announced over the loudspeaker at the completion of each flight. This made it possible for contestants and spectators alike to keep in close touch with the progress of the meet. The program was in booklet form and sold for ten cents.

TOLEDO CONTEST

The Toledo News-Bee model airplane meet was held at the Municipal Airport on June 19th. Detroit modelers invaded their neighboring city and took home seven of the first nine prizes. About 5,000 spectators turned out to watch the model flying. Eighty-nine models were entered from five states. Motor duration was restricted to 30 seconds. However, Leland Sturt of Toledo lost his plane after 1 hour and 6 minutes. His timer didn't operate and the motor ran steadily until the model was high in the sky—finally disappearing behind clouds.

Tom Espenship of Detroit won the meet with 17:06.2. His motor ran 00:29.9. He won \$25 cash and a round trip via Marquette Airlines from Detroit to St. Louis. Other winners were John Olson, Hamtramck, Mich., 2nd, 11:05; Edward Nadzius, Detroit, 3rd, 3:00; and Jack V. Tighe, Detroit, 4th, 2:29.9.

Naval Reserve flyers from Grosse Ile Airport, near Detroit, provided an entertaining climax to the day's events with tactical and formation flying.



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GLIDING

(Continued from page 55)

San Joaquin Valley. Dan Sanborn of the same organization flying his two-place Grunau 8, put in a total of 2 hours and 30 minutes in four flights.

FOREIGN NEWS

The British distance record was broken on April 30th when Philip A. Wills, Great Britain's outstanding soaring pilot, flew in his Minimoa from Heston Airdrome near London to St. Austell, Cornwall, a distance of 206 miles. This smashed the previous record of 144 miles established by J. S. Fox in a Rhoadler on April 18th of the same year.

Flight Captain Hannah Reitsch, the only woman pilot in Germany to hold this rating, established a new international record of 155 miles for distance and return from Darmstadt to Wasserkuppe and back.

UNOFFICIAL NEW ALTITUDE RECORD

(EDITOR'S NOTE: John Robinson of California having been recently credited by the press with new altitude records which were not records at all, it gives us real pleasure to present his own account of the flight which exceeded our present record by no less than 4,000 feet. Although it is unfortunately unofficial it nevertheless dramatically demonstrates the tremendous possibilities of desert thermals.)

As the sun came up on the morning of Sunday, May 8th, we were driving over the desert east of San Diego. The early sky was covered with cirro-stratus clouds drifting eastward. When we arrived at our take-off site on Clark Dry Lake in Borego Valley at 9 o'clock, these clouds were rapidly disappearing and soon the sky was clear.

At that hour it was already quite warm, but when we made our first flight from auto tow at 10:45, it was really hot. Before taking off, it was necessary to keep the cockpit enclosure open until the very last second in order to reduce the painful similarity between the pilot in the cockpit and a roast turkey in an oven.

On this expedition with my new sailplane *Robin*, which I designed and built, I was accompanied by Woody Brown and Dick Essery. Woody made the first take-off and soon caught a thermal which he climbed to 3,000 feet. When he landed after 35 minutes, I made ready to fly the *Robin*.

The dry lake is 400 feet above sea level, and I released from the auto tow

at 400 feet above the ground. Immediately I caught a strong thermal of 10-15 ft./sec. and soon was over 5,000 feet, after which I was no longer bothered by the heat.

As I straightened out I kept a sharp lookout for buzzards, but saw only one during the day. He was at 4,000 and had the thermal first, but he took as much advantage of me as I did of him in staying in the thermal.

The sky was cloudless and the down-drafts were quite strong all day, as were the updrafts. I got used to seeing the needle of my Kollsman sensitive altimeter pass the thousand-foot marks nearly as rapidly as it passes the hundreds while slope soaring on the coast. My average sinking speed between thermals was 8 ft./sec. and my average rate of climb about the same. I also had a Kollsman sensitive vertical speed indicator which I consider as valuable for thermal soaring as the ship itself.

After my first thermal I was down to 3,000 before I caught another which carried me up to 8,000, my best climb being 17 ft./sec. With this altitude I crossed the 6,000-foot Santa Rosa Mountains and headed north for Palm Springs. My altitude varied most of the time between 6,000 and 3,000 feet. At 3 o'clock I arrived over Palm Springs at 5,000 feet.

Proceeding down the mountain range I tried to look around the corner. The terrain didn't look too encouraging and I began dropping fast, so flew back over the town with the intention of landing at the airport. At 1,500 feet over the field I found a thermal, so continued soaring over the city until 4:30, when I was at 5,000 feet very near the San Jacinto mountain range which rises directly behind Palm Springs.

Suddenly I encountered a thermal that took me up at 15 ft./sec. For ten minutes I continued spiraling with the indicator reading over 10 ft./sec. As I was carried up beside the huge, snow-capped top of San Jacinto Peak I began to wish I had brought along a sweater as I shivered in my shirt sleeves. I also wished that I had put the camera in the cockpit as I had intended. That gloriously beautiful sight of the snow-capped peak with the Hidden Lake nestled in the pine trees would have made any photographer's heart jump into his mouth. Never again will I go up without a camera!

As I leveled off from my spiral I was just high enough to see over the peak, which is 10,800 feet above sea level. Gliding past it I entered a downdraft on the lee side. Thinking that I could cross a saddle between the twin peaks and get back into the upwind, I dived for it but lacked just about 10 feet to clear the rocks, so had to turn back into the strong downdraft. With a

sinking speed of 25 ft./sec. I shot down the side of the mountain and soon landed at 5 p. m. at the East Portal Camp of the Metropolitan Water District, which is about 6 miles from Banning, California. I had several witnesses including Mr. R. F. Stringfellow, special agent for the water company.

It is certainly unfortunate that I did not carry a barograph on this flight. My elapsed time was 5½ hours, airline distance about 50 miles, and altitude gained above point of release at least 10,000 feet. Although not official, I think this constitutes a record of some kind, at least for the Western part of the United States.

CHET DECKER, SILVER "C"

Holder of Silver "C" license #240 is Chet Decker, who lives in Glen Rock, N. J. As early as 1929, while still a high school student, Chet was bitten by the glider bug and inflicted the disease on six companions. Using the school shops, the boys set about building a glider, and with it taught themselves to fly. ("Many hair-raising experiences," says Chet.) Eventually the ship was equipped with pontoons and flown from Greenwood Lake by motorboat tow, this being the first experiment of its kind in the East.

In 1931 Chet constructed a utility, which gave him many valuable hours of soaring at Warwick, N. Y. This ship was taken to the Elmira contest in 1933. The following year he and his friends built a two-place fuselage, using the utility's wing, and made many excellent flights in the craft. At that time Chet also bought a Franklin, with which he performed a number of stunting exhibitions. During the winter the "gang" piled up their flying time by taking off from the frozen surface of Greenwood Lake.

At the 1935 Elmira contest Chet made his first distance flight, traveling 17 miles. This gave him the urge to fly the highest performance ship obtainable. Raising the money he purchased from Dick duPont the latter's Bowlus Albatross. "I have never for an instant," Chet says, "regretted my decision in buying that ship." With it, at the 1936 national contest, he not only won his Silver "C" but became National Soaring Champion. On June 23rd he made a flight of 70 miles from Elmira to Honeoye Falls, N. Y. On the 29th he flew from Elmira to Scranton, going 60 miles, and reached an altitude of over 5,000 feet. On the last day of the contest he carried his ship 147 miles, landing at Ottsville, Pa., after staying aloft for 5 hours and 40 minutes. It was this flight which gave him the Soaring Champion title for that year.

LIGHT PLANE FLYING CLUBS

(Continued from page 52)

of high speed, heavy wing loadings—and a certain amount of foul weather.”

The Bureau of Air Commerce has stated in official reports that more than fifty per cent of all commercial air crashes were due to “pilot error,” and not to structural faults or weather conditions.

Still, I maintain that this controversy is healthy. I do not object to being criticised in my stand, if the criticism brings honest rewards. I believe that something can be done about these laws if they actually place a hardship on sincere light plane flying. I do not for one minute believe that the manufacturers of light planes have any particular “pull” with the Bureau of Air Commerce so that laws which prevent the “homebuilder” from following his own particular hobby can be drafted. From past experience, I believe that the Bureau of Air Commerce as a body is fair, broadminded and sincere in its efforts, and can be approached if any reasonable proposition is tendered.

I honestly believe that if organizations such as the Lightplane Association of America or the Private Flyers Association are sincere in their beliefs concerning the unfairness of the Civil Air Regulations, they have every chance to present their views and suggestions. It is not enough to put up a typewritten squawk and attempt to induce aeronautical writers to take up the sword and go campaigning through Washington.

These organizations must first decide just what they want changed, and then they must present actual proof of the conditions they are working on. They should be able to show that a certain number of “homebuilder” ships have been designed, built and safely flown over a reasonable period of years. They must have a true record of these planes, the types, horse power and performances. They should be able to present a blanket description of the methods of building and designing and should be willing to present one or two such home-built planes for government inspection, to prove that they are actually airworthy.

If a stress analysis assuring a reasonable factor of safety—and a government license—costs \$300, we might bring up the point that a good parachute costs about the same amount. Surely a man's life is worth \$300.

Pondering further, I wonder just what would happen if the lid were taken off completely for the “homebuilder.” Suppose the Bureau of Air Commerce suddenly said: “All right, you birds. Go ahead and build all the ships you want and fly them where and when you

please. They must be single-seaters though, for you cannot risk the lives of those who might be fool enough to fly with you.”

Suppose that glorious era came about tomorrow, just what would happen?

In the first place, how many in these United States actually want to build and fly their own planes? How many are actually capable of putting spruce, dural and linen together and making it fly? How many “amateur” planes have been built and flown in the last ten years?

It is true that fully thirty per cent of the enthusiastic readers of aviation magazines fancy themselves as airplane designers. I know that, from the number of drawings sent to me by readers from all over the country. Some of the designs have distinct merit, of course, but most of them are crude affairs in which a bullet-shaped something is given Gee-Bee wings, into which by some fancy legerdemain a very chunky set of undercarriage legs and wheels are tucked away when she is in the air. In most of them, the center of gravity is either three inches behind the prop boss or dancing elfinly somewhere between the tip of the fin and the rudder bar.

But as for the number of home-made ships that have actually been built, the figure must be small indeed. It would be difficult to make an estimate; I wonder if a hundred have been built since 1928.

You see, if we are going to work on the Bureau of Air Commerce and get suitable legislation passed, we must first show the B.A.C. that there is justification for these changes. A dozen would-be builders would not be enough. A hundred *might* make it interesting, but I most certainly would not advise any organization to go ahead with a campaign to rewrite the laws until they could show three times that many.

Then—and this seems very important to me—when this group has completely cut itself off from the strangling bonds of the Bureau of Air Commerce, it must be prepared to be completely cut off. There will be no safety lines included in the parting. Once these “homebuilders” break away from legislated flying, they must be prepared to *continue* on their own.

There can be no half-measures in matters of this kind. If they discard all the laws drawn up for their safety, they must also be prepared to do without the other advantages of the Bureau. They should be prepared to do without government supervision of airports and the safety of government-provided air routes, weather reports, radio directions and the one hundred and one other

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advantages that come to those "within the law."

Just what standing will these amateur-built ships have? Where will they fit in on the present-day aeronautical plan? Would they be able to use government licensed and controlled airports? Obviously not, for they would only become a menace to traffic that is under government control.

Where would it all end?

At first, of course, our "homebuilders" would have a grand time, flitting and flopping all over the place. They would fly out of open fields anywhere. They would build ships that might be very good. I believe a number of worthy models might come out of the great experiment, but when the first thrill had subsided, our amateurs would soon be seeking new fields to conquer. They would soon sense that they were on the outside of something and eventually would want another form of recognition, and we would have to start all over again.

They would build larger and more powerful ships and might want to fly over government routes, and use government radio conveniences. But they would be barred. Let us suppose that one of our "homebuilders" attempted to fly from Portland, Ore., to Chicago next summer for a vacation trip. What would he do for landing grounds if all the licensed fields on the way were barred to him?

No, neither do I know what he would do.

This may be the answer to the big argument, and it might be well if we looked just a little way ahead before we cut ourselves off from the heavy-handed safety of the B.A.C. It's only

an idea, of course, but you can bet a gas pump to a split pin that those on the outside would be kept on the outside.

Of course, after all this, most of our "homebuilders" will say: "Oh, no, you got us wrong. We don't want to fly outside the jurisdiction of the B.A.C. We only want them to let us fly our ships, our way and under our conditions."

So would T.W.A., United Air Lines, Pan-American and American Air Lines. But they can't!

CLUB NEWS

The Gwinn Aircar has just been granted an Approved Type Certificate.

Kenneth Kress and Glenn Englert, test pilots for the Piper Aircraft Company, recently set two new light plane records when they flew a Piper Cub from Newark to Miami and return, non-stop, remaining aloft 63 hours and 54 minutes. Midair refueling was accomplished at Raleigh, Jacksonville and Miami during the course of the flight.

Tom and Bob Bittner, students at Trenton High School, Trenton, N. J., are twins. Recently they decided to take up aviation—the hard way. They traveled back and forth from Trenton to Hightstown and paid for their aviation training by washing ships and cleaning hangars. They both soloed on the same day, but so far Bob has five minutes more time than Tom, and Al Bennett, manager of the airport, is having a tough time keeping them apart.

The Ryan Company has just closed a contract for six new Ryan S-T-M

military trainers for the Republic of Guatemala. Similar planes have also been delivered to Mexico and other Latin-American countries. These S-T-M ships are military versions of the former S-T models so popular with private pilots of advanced means in this country.

An Approved Type Certificate has been granted to the Aeronca KCA, which is using the new Continental A-50 engine.

An aircraft radio beacon receiver weighing only four pounds and three ounces has been designed by the Radio Frequency Laboratories, Inc., of Boonton, N. J. It has a range of from 194 to 420 kilocycles and is sealed and guaranteed for one year.

The Aeronautical Chamber of Commerce is getting up a guide book on trade-in values of second-hand airplanes. Those interested in purchasing a second-hand plane will welcome such a publication, for it will enable them to make a better selection based on actual market value. The book should be ready by the time this appears in print.

Samuel Giamuso of 19 Fair Street, Hackensack, N. J., heads a group of young flying enthusiasts who are trying to broaden their organization. Most of them have been flying since about 1934, but they hope to attract more members. At present they are flying a new 1938 Aeronca. So far they have one transport pilot, two have amateur licenses and one has a private ticket. The latter also has an engine and aircraft mechanic's license.

QUESTIONS

(Continued from page 58)

this company. Issues containing plans of Bill Barnes planes are, in the order named: November, December, 1937; January, February, 1938.

Question: What are the latest accepted airplanes used in the U. S. Army Air Corps pursuit, attack, bombing and observation groups? J. W. S., Forest Grove, Ore.

Answer: In the pursuit groups the Curtiss P-36 and the Seversky P-35 are the latest accepted additions. In the attack groups the Curtiss A-12 and the Northrop A-17 are ranking leaders. In the observation groups the Douglas O-46-A leads, and in the bombing group the Boeing B-17 and the Douglas B-16 are the most recent additions.

Question: I intend to take a course in aviation when I get out of high school and I would like to get into the trans-

port line of the business. Would a private ticket taken now help me much later? Is there really a chance for newcomers in the air-line profession? G. B., Spokane, Wash.

Answer: Yes, of course a private license will help you if you take a transport course later on. You would have to learn to fly something to start with. The air transport business is wide open for good men who are willing to work hard, but it is not an easy business.

Question: I have been having an argument with a school chum of mine concerning the relative merits of the Army and Navy Air Services. I say the Army has the best service while he believes the Navy is tops. Who, in your opinion, is right? D. S., Dillon, Mont.

Answer: It is quite evident that both of you are arguing on the basis of personal preference. One likes the Army, the other the Navy. To attempt even a superficial decision in a matter of this kind would be most unfair and dangerous. Both the Army and the Navy serv-

ices have their particular places in the national defense. (Turn to page 97)

EXPLORER

(Continued from page 27)

wheels, tires and hydraulic brakes are Goodyear and the shock-absorbers are Bendix hydraulic. The nose wheel is covered with streamlined pants and is steerable and swiveling.

Specifications and performance figures of the Explorer powered with the 365 h.p. Whirlwind are as follows:

Span	36'8"
Length	26'6"
Height	6'4"
Wing Area	200 sq. ft.
Empty Weight	2,100 lbs.
Gross Weight	3,400 lbs.
Max. Speed	200 m.p.h.
Cruis. Speed	175 m.p.h.
Land. Speed	60 m.p.h.
Rate of Climb	1,400 ft./min.
Serv. Ceiling	20,000 ft.
Cruis. Range	1,200 mi.

QUESTIONS

(Continued from page 96)

Question: Can a Macchi-Castoldi sea-plane be converted into a fighter and still have a speed of 440.67 m.p.h.? What is the price of Curtiss P-37? How fast is the Boeing YB-15? Where can I get fully detailed plans of the following Army planes: Curtiss P-36, P-37, Seversky P-35, Northrop A-17A, and the Flying Fortress?—T. K., Youngstown, O.

Answer: The Macchi-Castoldi racing plane could not be converted into a fighting ship and still retain its speed of over 440 m.p.h. because it would have to have a larger wing area to carry the equipment necessary to make it a useful military aircraft. The whole ship would have to be redesigned for this purpose, which would naturally cut down its speed. However, with the latest trends in modern aircraft design, the fighting ships will in the near future reach the speeds of the Macchi-Castoldi. I do not know the price of the Curtiss P-37, but I imagine it is over \$30,000. The top speed of a Boeing YB-15 is approximately 240 m.p.h. You cannot obtain detailed drawings of military aircraft in service, outside of those published in aircraft magazines or supplied with model kits.

Question: If I wish to get into Randolph Field do I have to have a college education and do I have to know how to fly?—E. N., Indian Orchard, Mass.

Answer: To enlist as a flying cadet at Randolph Field you have to have at least two years of college education or pass an examination which is its equivalent. Prior flying experience does not count.

Question: I am interested in aviation and would like to know what part of the Army Air Corps I could get into with only a high school education? What training school is nearest to me?—E. R., Downer's Grove, Ill.

Answer: You can apply for training and become either an airplane and engine mechanic, radio operator, maintenance man, parachute rigger, aircraft welder, machinist or photographer. Write to the Commandant, Aircraft Technical School, Rantoul, Ill.

Question: Where is the best place to join U. S. Army Air Corps and what kind of planes have they? Where is the best place to join the Navy air fleet and what planes have they? Do you have to be an American citizen?—P. Q., Toronto, Can.

Answer: To enlist in the U. S. Army Air Corps you have to write to the Adjutant General of the Army, Washington, D. C. If appointed as flying cadet you are sent to Randolph Field,

San Antonio, Tex., for flight training. To join the Naval air force make an application through the Bureau of Navigation, U. S. Navy, Washington, D. C., or enlist at any Naval Air Reserve field. The Army and Navy have so many types of ships that there is not space enough to enumerate them. There are training ships, primary and basic, observation, attack, bombardment, pursuit, transport, utility, torpedo, etc. You have to be an American citizen to enlist in either Army or Navy air force.

Question: I would like to know the requirements to enter Randolph Field, physical education and the cost of getting into this school.—D. C., Cadiz, O.

Answer: To enter Randolph Field as a flight cadet you must have at least two years of college education or pass an examination which is the equivalent thereof. The physical requirements are that vision must be normal 20/20 without glasses, you must have good hearing, a stable and balanced equilibrium, normal color vision and a stable nervous system. If you have all that chances are you will be appointed as a cadet for flight training. It does not cost anything to enter Randolph Field, as you are trained by the Army. As a matter of fact you are paid \$75 a month.

Question: Is the Kinner Navy Envoy still in service? If so, what is it used for? What kind of a plane is featured at the bottom of page ten in the January issue? I have heard that the G.H.Q. Air Force is going to be moved from Langley Field, Va., to Scott Field, Ill. Why are they doing it?—H. G., Norfolk, Va.

Answer: I don't know if the Kinner Navy Envoy is still used by the Navy. I suppose so. Its purpose was transportation of Navy officials. The plane featured on the bottom of page 10 of the January issue is the Curtiss P-36-A pursuit. I don't know the reason why the G.H.Q. Air Force is moving from Langley to Scott Field; as far as I know it is only a rumor.

Question: How may I become an airplane or engine mechanic in the U. S. Air Corps? Must I have my training before I enter? Would this type of training be valuable in getting a job as a mechanic with the air lines?—W. W., Muskegon, Mich.

Answer: To become an airplane or engine mechanic in the U. S. Air Corps write for an application to the Commandant, Air Corps Technical School, Rantoul, Ill. If you succeed in entering this school you will get all the necessary training there, so that no previous experience is necessary. It will help you a lot in getting a mechanic's job with the air lines.

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STICK MODEL

(Continued from page 67)

PROPELLER

The block size is $1\frac{1}{2} \times 2 \times 16$ ". The blank layout is shown in the drawing. The blades are cut to taper in thickness from $\frac{1}{4}$ " at the hub to $\frac{1}{16}$ " at the tips. Each blade is given about $\frac{1}{8}$ " camber in the rear face. The entire propeller is sanded smooth and doped to a high luster. The free-wheeler and propeller hub guard are bent from $\frac{1}{16}$ " sheet brass. The free-wheeler is secured to the front of the propeller. A piece of silk wrapped around the hub will reinforce the cement—holding the free-wheeler firmly in place. The propeller-hub guard fits around the rear of the hub and protects it against wear. The propeller shaft is bent from heavy wire. $\frac{1}{16}$ " diameter piano wire will insure smooth operation.

POWER

Eighteen strands of $\frac{1}{4}$ " flat brown rubber were used. The motor length is 45 inches. Treat the rubber with prepared rubber lubricant—glycerin (drug store variety) can be effectively used.

COVERING

Covering is regular model tissue. After water-doping, follow with one coat of thin dope on the wing and tail surfaces and two coats of heavy dope on the fuselage.

FLYING

First glide the model, launching it from about 6 feet. If the model stalls, move the wing back a slight amount. If it glides too steeply, move the wing forward. The wing position shown on drawing is only approximate—it will

vary with each particular model. Note that a $\frac{5}{32}$ " incidence block is inserted between the wing and the top of the fuselage.

After a satisfactory glide, wind the motor about 100 turns and launch it into the wind at about a 65 degree angle. The model should fly against the torque (right turn) because of the offset thrust and the airfoil shape in the rudder. The model has a steep climb and makes about 25-foot-diameter circles while climbing. In the glide the circles are larger—about 100 feet.

The secret of a long flight is power. The photo very amusingly brings out this point. However, the initial stretch given to the motor is not at all exaggerated. Note, too, that winding is done through the front of the fuselage. The propeller shaft can be bent to fit the winder, making it possible to wind without taking the rubber off the shaft.

On the winning flight in Akron about 1000 turns were stored in the motor. The model climbed at a 45 degree angle for about 1 minute. After the power stopped, the model leveled out and started to glide. But it continued to gain altitude with the help of a thermal current. The model was just a speck in the blue sky after 41:15 when heavy traffic and an unfortunate curve in the road brought an end to the chase which we were staging along the roads outside the city.

The 1938 version of this stick model showed great promise. As mentioned earlier in the article, it turned in a flight of 18 minutes in January. In March it went out of sight again after 34 minutes and 27 seconds. The model was returned after both these flights. In calm March air, it averaged $3\frac{1}{2}$ to 4 minutes on every flight. These flights were in the current-free air of late evening.

MATERIAL REQUIRED

(Balsa unless otherwise noted)

Fuselage

- 9 pcs. $\frac{1}{8} \times \frac{1}{8} \times 36$ ", longerons and bracing
- 1 pc. $\frac{1}{8} \times 1\frac{1}{2} \times 18$ ", fill-in for fuselage ends
- 1 pc. $1\frac{1}{8} \times 1\frac{1}{4} \times 1\frac{3}{4}$ ", nosing
- 1 pc. $\frac{7}{8} \times \frac{7}{8} \times 1\frac{1}{4}$ ", tail plug
- 1 pc. $\frac{1}{16}$ " diam. $\times 12$ " piano wire, shaft and rear hook
- 1 pc. fine wire, nose plug attachment
- 1 pc. $\frac{1}{16}$ " sheet brass, propeller and nosing fittings

Wing

- 18 pcs. $\frac{1}{16} \times \frac{1}{16} \times 14$ ", spars
- 3 pcs. $\frac{1}{8} \times \frac{3}{8} \times 14$ ", trailing edge
- 3 pcs. $\frac{1}{8} \times \frac{1}{8} \times 14$ ", leading edge
- 1 pc. $\frac{5}{32} \times \frac{1}{2} \times 3\frac{3}{4}$ ", incidence block
- 5 pcs. $\frac{1}{32} \times \frac{3}{8} \times 24$ ", ribs
- 1 pc. $\frac{1}{16} \times \frac{5}{8} \times 16$ ", ends ribs
- 2 pcs. $\frac{1}{16} \times \frac{1}{16} \times 12$ " (bamboo), tips
- 1 scrap pc. $\frac{1}{8}$ " flat, end-rib reinforcements

Elevator

- 5 pcs. $\frac{1}{16} \times \frac{1}{16} \times 24$ ", spars
- 1 pc. $\frac{1}{8} \times \frac{1}{8} \times 19$ ", leading edge
- 1 pc. $\frac{1}{8} \times \frac{3}{8} \times 20$ ", trailing edge
- 2 pcs. $\frac{1}{16} \times \frac{1}{16} \times 11$ " (bamboo), tips
- 2 pcs. $\frac{1}{32} \times \frac{3}{8} \times 24$ ", ribs

Rudder

- 5 pcs. $\frac{1}{16} \times \frac{1}{16} \times 8\frac{3}{4}$ ", spars
- 1 pc. $\frac{1}{8} \times \frac{3}{8} \times 10$ ", trailing edge
- 1 pc. $\frac{1}{8} \times \frac{1}{8} \times 6$ ", leading edge
- 1 pc. $\frac{1}{16} \times \frac{1}{16} \times 11$ " (bamboo), tip
- 1 pc. $\frac{1}{32} \times \frac{3}{8} \times 24$ ", ribs

Additional Items

- 3 sheets tissue
- 2 ounces dope
- 2 ounces cement
- 1 propeller block $1\frac{1}{2} \times 2 \times 16$ "
- several washers
- 68 feet $\frac{1}{4}$ " flat brown rubber
- several strips of Scotch or masking tape

WINGS OF MIST

(Continued from page 23)

come on. A cop holding a Tommy gun beckoned him out.

He kept his arms high as he stepped down on the motorboat's bow. The gun prodded him aft.

He stopped short before Mike Merten lying there. The mooring-line noose was tight around Mike's neck. One hand was curled inside the noose, as if Mike had been trying to loosen it.

Mike was dead.

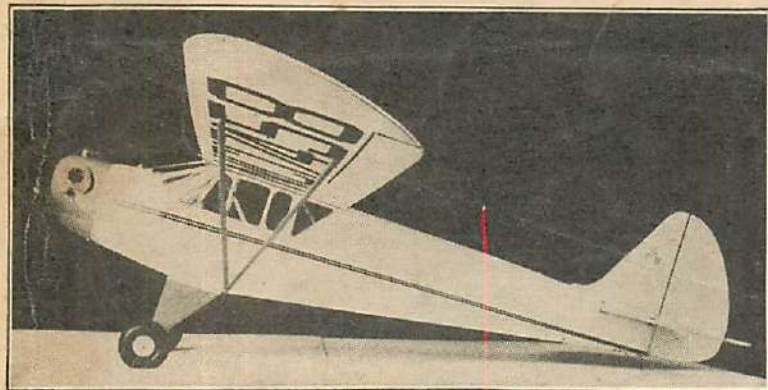
"You gave him as pretty a hanging as ever I see!" a gold badge said. "The state couldn't have broken his neck neater. And with your own rope—what was the matter, didn't you like him?" They all laughed, in harsh, humorless tones.

AIR TRAILS ADVERTISERS—SEPTEMBER, 1938

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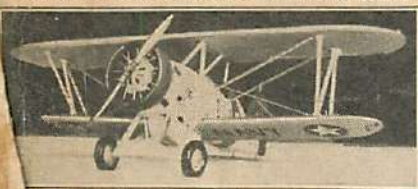
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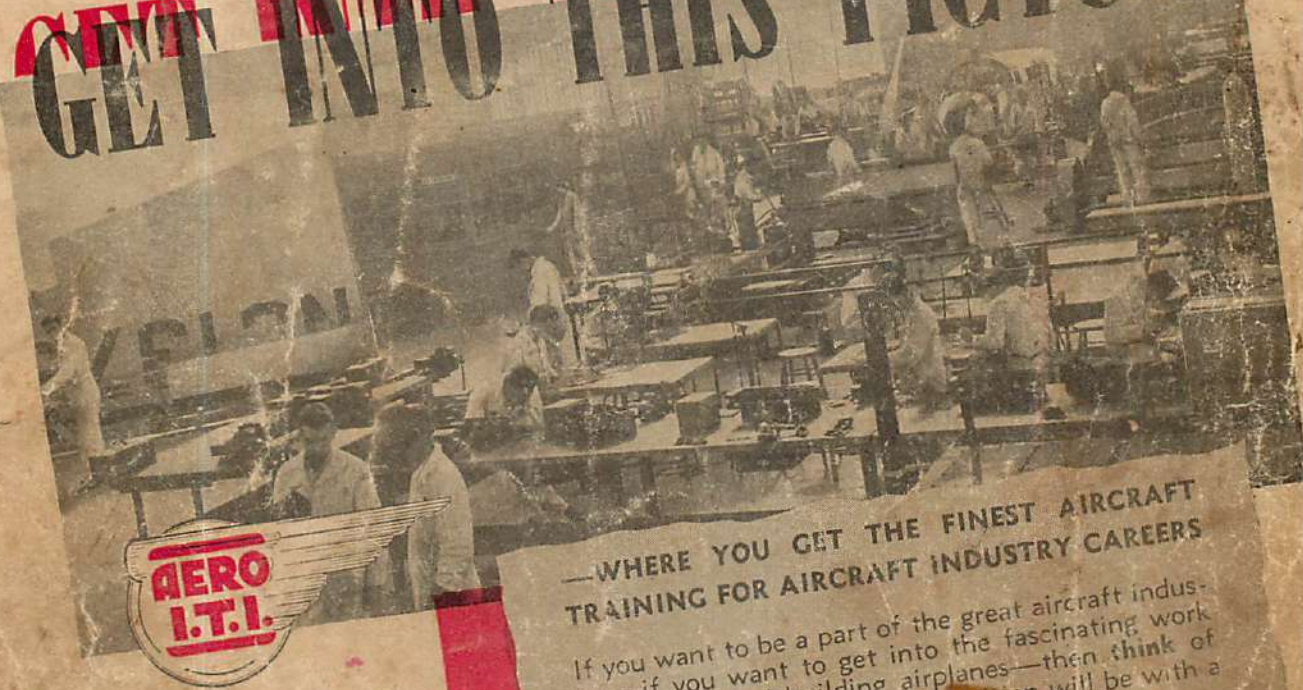
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NOTE. These are actual photographs of models built from AIRCRAFT kits.

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