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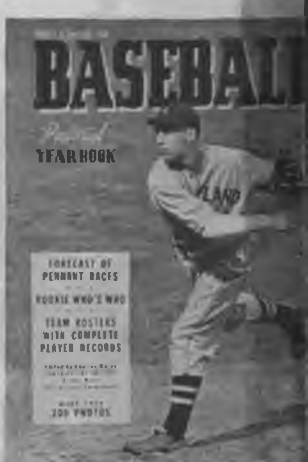

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OUTSTANDING FEATURES: Maps, different projections, how to use; Dead Reckoning; Piloting; Aerial Astronomy; Practice of Navigating Aircraft.

From all points of the compass come interesting items of aviation. This page is reserved for a cross section of them.

RECENTLY in Toronto, as a guest of Trans-Canada Air Lines, we visited "Little Norway" where the Norwegians are being trained. We were much impressed by the completeness evident, from the Fairchild training planes, P-36s, and Douglases, right down to the pretty Norwegian nurses in the infirmary. The earnestness of the officers and men was most impressive, and particularly their appeal for our help in letting it be known that they are still taking in young Norwegians interested in joining the Royal Norwegian Army Air Force.

The Royal Canadian Air Force field at Malton Airport was a fascinating place, too. Here under the guidance of members of Dominion Skyways (Training) Limited, the R. C. A. F. cadets are being rushed through their training period in DeHavillands and Avro Ansons. The streams of yellow training ships, slightly reminiscent of the Jennies of 1917-18, made the field look warlike indeed. A grim reminder of training incidents was the pairs of showshoes still lashed to the rear of the twin-engined Ansons. It is here the Elementary Flying Training School and Air Observer School is maintained, according to the huge signboard at the entrance to the field. We noted that the red, white and blue air corps insignia on this sign had been changed so that a red maple leaf formed the bull's-eye in the center.

It is from Toronto that Trans-Canada Air Lines operates its new nonstop route to New York, and we mean *nonstop*, for we came from Toronto to LaGuardia Field in one hour and thirty-nine minutes, the new Lockheed Lodestar hitting over 260 m. p. h. some of the way.

One incident at Malton Field was indicative of the stringent rules in force. We were being conducted through by genial Captain E. B. Woollett, operations secretary, when one of the group asked if he might look at a computer being used by one of the cadets. The cadet, wary, asked the captain if there were any regulations about that particular instrument being seen, and the captain gravely assured him it was not too hush-hush. The gang took a look and then broke into a grin—the computer had the familiar trademark of Air Associates, U. S. A.

★ ★ ★

A few days ago we were invited to Stratford, Conn., to take color movies of Igor Sikorsky's amazing helicopter. After having seen it fly, taken pictures of it, looked at them on our own screen, and reading all about it, we still find it hard to believe! As Mr. Sikorsky says, "It does not go *almost* straight up—it goes *straight* up!" It can hang still in one spot for hours, fly in any direction, and we mean just that. Equipped with the flotation gear it wore the day we were at the plant, it can take off from land, descend upon water, and then return to land. Wheels are only needed for returning it to the hangar, for it has no take-off run. Castered cradles solve the taxi problem when floats are used. See the two-page spread by Rolfe in this issue.

★ ★ ★

Two copies of the British *Aëro Modeler* just came in and it is interesting to note that the R. A. F. runs a full-page recruiting advertisement in the magazine. Apparently English model builders are recognized as more than just small boys. The sooner it is generally realized that the majority of the model builders of America are a serious group of young men actively engaged in the study of aviation, the better it will be for both builders and the industry. Where else will the industry find its future designers and engineers, and where else could the U. S. army air corps find a likelier bunch of cadets?

★ ★ ★

Writer John R. Hoyt ("You Try Dive-bombing!", "Interceptors Up!", et cetera), dropped into the office a few days ago. While here he took Editor Winter up in a navy job he was ferrying back to Michigan where he is a navy instructor. The flight took place at Floyd Bennett Field, which is a hop, skip and jump from the Atlantic on one side and Brooklyn on the other. Pilot Hoyt seemed fascinated with the sandy shore line below and, the better to see, went round and round in a tight turn. After landing said Hoyt, "That's the first time I've seen Coney Island."

★ ★ ★

A much delayed letter from a member of the staff of *The Aëroplane*, British air magazine, recently arrived. A few excerpts might be interesting:

". . . the candid opinion of British pilots on American aircraft. Although there has been a bit of trouble with some of them and others have not been adequately armed or armored, in general they do seem to be making a very favorable impression over here. Of course, the Lockheed Hudson has done magnificent work and the Boston is also doing very well, and its derivative, the Havoc night fighter, is now helping to cope with these night bombers, the sound of which I can hear overhead as I am writing this at the moment. In fact we have just had a couple of bombs very close to this office since I started this letter, but so far we have escaped, thank goodness.

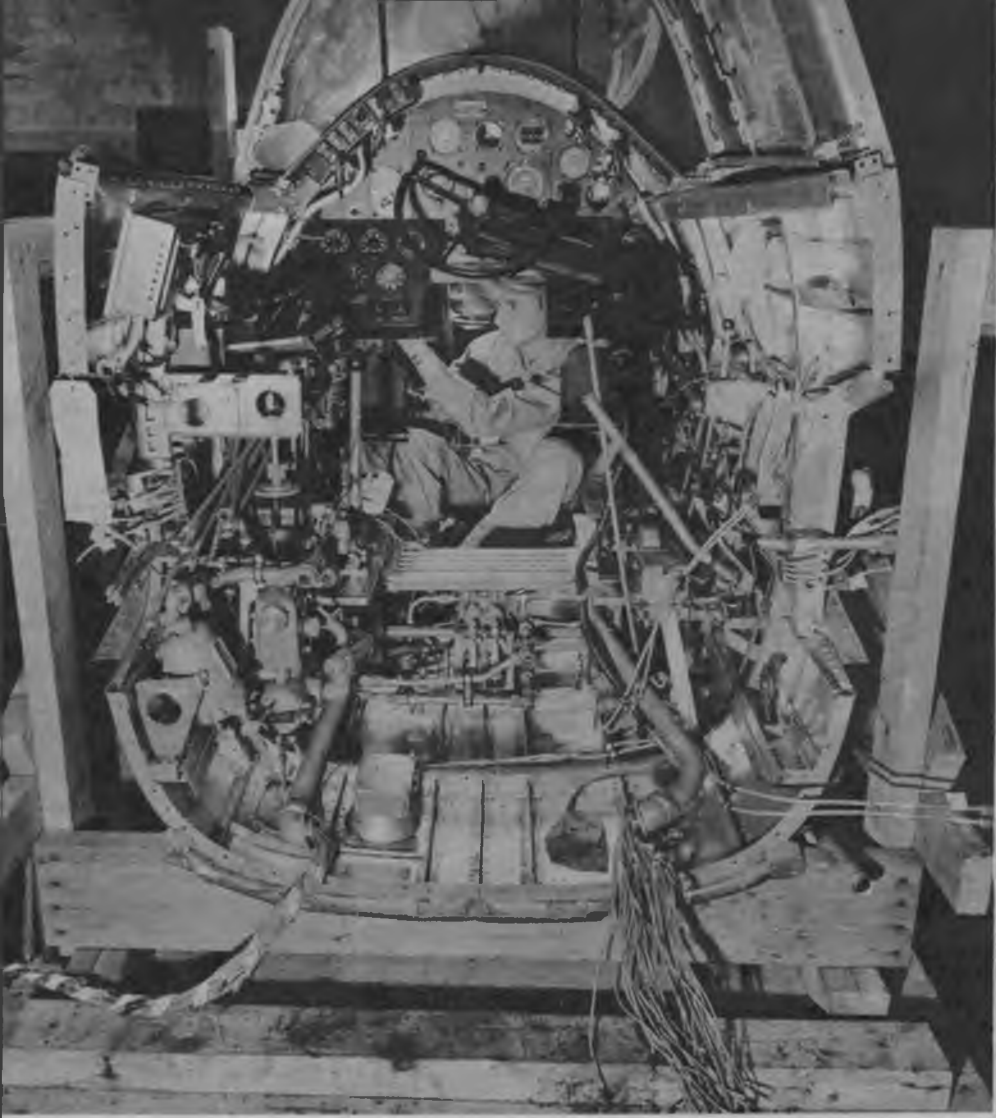
"Your April issue of Air Trails has just arrived. I have not had time to look through it in detail, but the 'Prone Pilots' article looks particularly interesting as we learn that a new German fighter (Heinkel) is being produced on those lines. Boeing B-17C's and Consolidated Liberators are now reaching this country after making exceptionally fast time across the water. They will certainly prove useful. That life line across the Atlantic is vital to our cause."

The B-26, air corps medium bomber, climaxes 32 years of manufacturing for Glenn Martin.

BOMBERS BY MARTIN


Glenn L. Martin, with models of B-10 and post-war Martin bomber.

BUILDERS of dependable aircraft since 1909, Glenn L. Martin's first airplane was made in an old church. The latest Martin planes, British Marylands and Baltimores, army B-26s and navy PBMs, roll off the production lines in the giant Baltimore plant where approximately 17,000 workers are now employed. By 1942 a new bomber assembly plant in Omaha and further plant additions at Baltimore will boost the pay roll to 42,000 workers and floor space to 5,192,725 square feet—equivalent to twenty-four square blocks in Manhattan. Martin, one-time barnstormer, has followed the up-and-down manufacturing trail for thirty-two years from California, to Cleveland, to Baltimore. The post-war Martin bomber and recent B-10 were marvels in their day. Now under construction is the greatest of Martin ships, a four-engine navy flying boat rumored the biggest ship in the world.



Planes aren't autos. Strength, light weight, and the complex gadgets of war make a light bomber a machine of 25,000 individual parts and some 150,000 rivets. This is nose of British Maryland.

CRATING A BOMBER

Nose, center section and tail section of Maryland come apart for shipment for Great Britain.

Bundles for Britain. Nose section of a Maryland attack bomber being loaded into packing crate.

Off to the wars. Every day a trainload of airplanes in packages departs for points unknown.

Design at Martin is a never-ending job for many hundreds of engineers and draftsmen. Note small mock-up of a bomber section in the lower right corner.

(Continued on Next Page)

Toolmaker's craft is one of oldest in the industry. This expert is measuring to extreme tolerances a tool intended for a Martin bomber. Skilled toolmakers are much in demand.

Worth their weight in gold, these highly flexible machine tools in the Martin shops machine castings and forgings to the thousandth of an inch.

Sawyer, modern style. Richard A. Pilling sets up one of the band saws which cuts heat-treated aluminum alloy as easily as it does wood.

BOMBERS BY MARTIN

(Continued from Preceding Page)

Jaws of metal-stretching press hold metal sheets; forms press up against them to form sections of covering.

Punch press. One of a battery of powerful presses which form out metal parts rapidly. An operator sets a die for the job. Acres of machines of every description work right around the clock at Martin.

Intricate shapes are cut by power router. Eight to twelve sheets aluminum alloy are sandwiched between wooden patterns to serve as guide.

"Oldsters" like this make all sorts of wood patterns, forms, "mock-ups" before production.

Drop hammer. One of thirty-odd power drop hammers in Martin drop-hammer department smashes out a section of airplane contour.

Finishing touches. A plaster mold gets final polish before being turned over to the sand molds to be made into a drop-hammer die.

Man from Mars? A melter pours hot metal to be transferred to small sand molds for drop-hammer dies.

High shine. Zinc die destined for the drop hammer is ground to closer dimensions and polished for contour.

Skilled operator trims sheet metal part. Many manufacturers encourage special aviation training in local schools.

Wheel of fortune. Here a rib for B-26 is formed on a wheel fixture that permits men to work at any elevation.

Sub-assembly. Hundreds of such operations form 25,000 parts into sub-assemblies which ultimately come together as finished B-26.

Pinions. Wings for the B-26 are assembled from many sub-assemblies and the smooth metal skin is fitted on. Installation of control wires, electric wires, "plumbing," and so forth, goes on from this point.

Gadgets. Miscellaneous equipment is fitted into the tail section of the B-26. Well in top foreground is for a power turret. Tail turret can be seen in the far rear.

Modern Jonah emerges from the metal maw of B-26 tail turret section being readied for its turn on assembly line.

Mass production. A line of B-26 noses moves toward final assembly. This gives some idea of quantity of bomber production. The trick in mass production of airplanes is to complete smaller assemblies as far as possible before bringing them together.

Swarm of workers put the finishing touches on a flock of B-26s on final assembly floor. Here are installed 2,000 h. p. Pratt & Whitney Double Wasp air-cooled engines. Martin B-26 was one of first American types bought off the drawing board.

SUPERCHARGED PILOTS

BY JOHN R. HOYT

Fighting face. The Mayo mask devised by Drs. Lovelace and Boothby of famous Mayo Clinic enables our fighters to work at five and six-mile altitudes.

High-altitude fighting is bringing about new technique, equipment and even diet. Today's war pilot must know how to handle himself in two places—up and 'way up.

FROM sea level to 30,000 feet is no slight jump. Yet a modern interceptor fighter takes a pilot up there at a mile-a-minute clip; that means an upward speed faster than any elevator, airplane or balloon can ascend, of such a rate that the blood commences to liberate nitrogen bubbles.

So great is the change in pressure at 25,000 feet that a glass of ordinary drinking water bubbles like soda water as the gases are freed. A similar change is taking place in the veins of the pilot, who begins to feel like a diver who has been brought to the surface too rapidly. As everyone knows, this is called the "bends," or caisson disease, and is extremely painful. But, unlike the diver, a pilot cannot be decompressed at 30,000 feet, and therefore suffers from two things—nitrogen in the blood stream and lack of air to breathe.

How little air is present at altitudes about 10,000 feet, or about two miles, is scarcely realized until one tries to move or exercise at high altitudes. In fact, the very lack of oxygen is so insidious that one doesn't realize that anoxia (oxygen starvation) is going on until it is too late to do anything about it. Of course, many of us have tried to climb at 8,000 feet and noticed how short of breath we were, but very few have sat in an airplane and climbed to altitudes of such height that insufficient oxygen was present to accommodate normal needs.

The lack of air at 25,000 feet is such that a candle cannot burn. The flame becomes so small that it is just a shadow, becoming extinguished at 26,000 feet. As a pilot climbs his fighter to such heights, he notices no lack of air, and absolutely no choking or smothering is felt. Most laymen believe that lack of air would cause one to die a horrible death, with all the symptoms of being choked into insensibility. Nothing could be further from the facts.

The first thing a pilot notices is a lightheadedness, a kind of incoherency. Things happen in a sort of daze, and there are endless moments between the inception of a thought and the act itself. The lack of oxygen is insidious because the pilot cannot tell that he is going to pass out! The fact is that there is a diminishing amount of carbon dioxide present, and the lack of this gas tends to decrease automatic breathing. The pilot therefore breathes less rapidly, less deeply, and does this in spite of the fact that he should be breathing more rapidly, because there is less air to breathe.

To illustrate the point, read the following account of a pilot who actually lost consciousness at 25,000 feet:

"We took off in formation. Pilot A led, he in his Grumman fighter and I in mine. Fastened to the top wing of each plane was a camera gun, loaded with a few feet of film. Each picture represented a shot, and each shot could be fired by squeezing the trigger on top of the stick, just as we fired the machine guns. Inside the camera was a tiny clock that was photographed when the picture was taken; this indicated which pilot fired first, and eliminated any argument about who shot down whom. The object was to do unto him as I would be done by, only to do it first.

"We climbed to 10,000 feet, where I started taking oxygen. We had only the old-fashioned pipes, that is, a tube leading to an oxygen tank. We held the mouthpiece or pipe between our teeth, which was not only very tiring, but very wasteful of oxygen. It has been proved that we consume only a small portion of the oxygen we inhale.

"I regulated the oxygen valve to give me a generous supply, as I knew I'd need it when I began the fight with Pilot A, who before. He was boring up toward me, climbing at full throttle, trying to diminish the altitude between us. I knew that if he did so, I was licked.

"An idea came to me that if I changed my pace, cut the engine, stalled and mushed down on him, I would be able to overcome the disadvantage! I did so, closing the throttle slowly, then starting a turn. As every pilot knows, a plane turns more rapidly when it is slower, and therefore I was able to turn inside of Pilot A. At the same time I was flying so slowly that I lost altitude quickly, and the first thing A knew, I was directly behind him taking pictures of his plane from about fifty yards' distance. His plane loomed in my sights like a barn.

"I then picked up the microphone to speak, to tell him that it was his turn to fly above me. But in doing this I took the pipe from my mouth, and as I talked to Pilot A I must have dropped the pipe. I vaguely recollect making a mental note to finish my statement to A, and then to reach down for the pipe. I finished my remarks, or thought I did, and reached down for the pipe.

"It seemed a long way down there, and very dark. Then it

Test run. Before an actual strato-hop crews must exercise for thirty minutes breathing pure oxygen. This washes nitrogen away, preventing "bends."

With nitrogen removed from systems pilots in Boeing altitude chamber are "flown" to 35,000 ft. Complete flying equipment is used in tests to simulate real flight.

was supposed to have a very good reputation as a dogfighter. We passed 15,000 feet, and I felt normal. At 18,000 feet, I adjusted my controls and checked all the pressures. The engine was operating beautifully, and everything seemed in order. The air was cold, but not too penetrating. Pilot A led well, and the sun glinted on the yellow top wing with its black chevron and squadron marking. The two red, white and blue stars on each tip, the yellow tail, the black nose cowling were some of the last points I remembered.

"At 22,000 feet Pilot A signaled to break up. I nodded and turned to the right. He kept on going, while I climbed to 23,000 feet, at which altitude I would fly over him and begin our mock engagement. Being the higher plane I was supposed to have an advantage, although Pilot A had defeated several other pilots the day before who had flown from higher altitudes.

"At 23,000 feet I turned back. The oxygen regulator was giving me ample oxygen, the engine turning up full power, and camera gun ready. I looked down, picking up Pilot A directly under me. I wiggled my wings to signify I was ready, pressed the trigger to take a photograph of the clock and register the time our engagement started. Then I dipped my wings and rolled down at Pilot A.

"Like the canny dogfighter he was, A turned and circled against me. That constituted a 'scissors' movement and ended with me directly above him and in the same relative position as seemed as though I was being pressed down hard in my seat, and my head weighed a ton. After a minute I could lift it, and did so. Everything was very hazy, and the motor was turning up 3,000 revolutions per minute. The altimeter read 10,000 feet, and there was smoke coming from the engine. The air speed was dropping off from 300 knots, and through my befogged mind came the realization that I had dived off *three miles of altitude.*

"The radio was full of voices. I concentrated real hard, and finally knew it to be Pilot A, calling me frantically. I answered something, which he later told me was this: 'Doan feelsa hot . . . gonnalandnow . . . berrrgrrrump O. K.!' That was how intelligently I was thinking. On the way back things cleared up a little. I found the field, circled it, and was about to land when a voice repeated over and over, 'Wheels down . . . wheels down . . . wheels down—' Dully I seemed to sense that something was not all right, so I gave the gun to her and went around. Halfway around I realized that my wheels were still up, so I lowered them after five minutes of effort. I took five minutes to do what ordinarily takes ten seconds.

"I landed normally, taxied to the line and stumbled out. The $10,000 engine was a wreck, but the plane O. K. I took the rest of the day off, although things got back to normal within twenty-four hours."

The whole point to the narrative is this—one *(Turn to page 33)*

Loading up. Gun tests are a regular part of Wright Field routine. These experts are loading fifty-caliber guns in Curtiss P-40 for fire test.

Fire! With tail lashed down in flying position, experts and observers gathered about, even lying on wing, P-40 cuts loose with all guns at once. Target in sandpit beyond.

SERVICE TEST—Rush!

At Wright Field the army is packing a year's worth of test flying into 150 dynamic hours. Hear those engines roar!

BY DOUGLAS INGELLS

THE real test of air power is using it. You can't measure a nation's strength in the air by its capacity for production. You've got to "get 'em into the blue." Good ones, the best that man and machine and science can produce. Planes that fly high and fast and far. Ships that can take it. This is the task facing Uncle Sam today. Our airplanes are being built to last. American pilots shouldn't fly in anything but the finest and safest aircraft that money can buy. This is the way of a democracy that places life and the chance to live and enjoy it as an individual above all else.

The job is far from being an easy one. Planes are material things built from thousands of parts; put together from a plan. Like boats or automobiles, some of them are good, some not so good. They need the "bugs" taken out of them. And the big problem is to decide which ones are best. It must be done quickly. Labor, raw materials, facilities, machines, money—these things are plentiful here. But time is more precious than gold because bombers, pursuits, fighters are needed now.

At Patterson Field in Dayton, Ohio, only a few miles from the location of the bicycle shop where the Wright brothers built the first airplane, the army is evaluating its new warplanes. That roar you hear in the sky is the noise of wings under test.

The latest pursuit planes, and bombers, Lockheed's twin-engined interceptor, the P-38; Lawrence Bell's Airacobra, the P-39; Republic's 2,000-horsepower Thunderbolt, the XP-47B; Curtiss' YP-42 with the air-cooled twin-row Wasp experimental engine; the North American B-25, Consolidated four-engined B-24 with the Davis Airfoil; Boeing's latest B-17D Flying Fortress; the Douglas A-20A and Glenn Martin's fast, heavily armed and armored B-26—all of them are undergoing a rigid, exacting and accelerated test program by Uncle Sam's flight test experts. Special crews from various tactical squadrons—pursuit pilots, bomber pilots, bombardiers, machine gunners, and mechanics—have been brought to the field to fly the ships through 150-hour test trials. Night and day the motors roar.

The army has been forced to cram engineering, design and experimental development into a much shorter period than ever before. As soon as the first three types of a new plane are delivered three crews are assigned to the ship for accelerated service testing. They keep it in the air constantly for 150 hours, day and night. This is to take the place of the former service test period of one year. Now it takes three weeks or less. In addition, the airplane manufacturer, the engine builders, the propeller and accessory people are represented at the proving ground to see if anything goes wrong with their respective units. If the slightest trouble occurs, they get in touch with their factory engineers by telephone and it is soon ironed out.

According to Brigadier General George C. Kenney, assistant chief of the air corps materiel division at Wright Field that has jurisdiction over the testing of all new equipment, the two or three-year experimental stage needed to develop a new airplane from blueprint to getting it into the air has been slashed to eighteen months. "I know of one plane, the Martin B-26 bomber," Kenney says, "that was on the back of an envelope less than a year and a half ago. Army engineers took one look at the blueprints and told the manufacturer to go ahead as fast as possible with mass production."

This is an example of how rapidly the U. S. aircraft manufacturers are "getting into the stride" for turning out airplanes by the thousands. Kenney predicts that by early spring of 1942 America's goal of 50,000 planes a year will be surpassed. In order to do this it is necessary to speed up the testing of new models; hence the accelerated tests at Patterson Field.

Planes are outmoded quicker than automobiles, because there are so many factors about them we don't know until they are brought out in actual tests. For instance, added strength means added weight; more weight means less lift which in turn means limited altitudes. On the other hand, if you cut down on weight you lose strength; lose strength and you lose combat effectiveness, lose this and you stand to lose both plane and pilot. It is a case of six of one and half a dozen of another—a continuous

New British Spitfire III is a result of improvements learned from combat use of earlier models. Note square wing tips. American tests speed up improvements.

cycle of problems that create other problems that make the airplane an intricate, delicate piece of machinery.

There are three types of airplanes in use by the air corps: standard service airplanes, those in actual use by the various tactical organizations, in wings, groups and squadrons throughout the United States; service test airplanes of somewhat improved designs, and finally experimental airplanes of still better performance than the service test equipment. The latter group are the planes that "get the works" at Patterson Field.

Pursuit ships get different treatment from bombers. The big ships are treated more gentle, because pursuit planes cost from $35,000 to $76,000 apiece; bombers from $257,000 to $2,000,000. Pilots take the pursuits and interceptors, race them across the field and literally "yank" them upward to altitudes of ten, twenty, thirty and even forty thousand feet. Straight up they climb at 5,000 feet a minute. Up to the sky where the air is thin and scarce, where it's cold and clear and the universe lies at your feet. Here, in this vast arena of space, Uncle Sam's test pilots learn the real worth of America's new warplanes.

Banks, snap rolls, dives, Immelmanns, spins, every conceivable maneuver is tried at terrific speeds. Engines whine and propellers scream. The sky is rent with the staccato blasts of horsepower on the loose. Can they take it? Will the wings shear off at 600 m. p. h. straight down? How high, how fast and for how long will they fly? How much fuel does the engine burn? What about prop manipulation and adjustment at high altitudes? Maneuverability? Egress—can the pilot get out if something goes wrong? The army wants facts for the answers and only by actual flying, hard grinding hours of it, can the results be satisfactorily obtained.

Each test produces definite results. For instance, the army learned that pilots flying in the fast pursuits like the P-38, Airacobra, or the P-40, when they banked the ships at high speeds suffered momentarily a blackout. That is, for about thirty seconds the pilot couldn't see because blood rushed to his head and blotted out his vision. He could feel and move and co-ordinate his muscles on the controls, but actually he was blind. (This happens to pilots who fly the fast ships in the European skies, and apparently it can't be licked.) But accelerated tests at Patterson Field produced a new idea.

Think what it would mean if that thirty-second blackout period could be eliminated. In that half minute six guns could pour out 500 rounds of ammunition each into an enemy. Such an advantage would be decisive in aerial combat. Study of reports turned in by pilots who had tested the planes under combat conditions caused army men to ponder the problem. Finally someone suggested that the rudder controls on the fast ships be placed in the roof of the cockpit so that the pilot's legs were propped up over his head, letting a gradual amount of blood rush there and prepare him for the quick blood burst of the rapid bank or turn. It was tried and it worked. The pilot became woozy for seconds, but he kept his vision. There was no complete blackout. *(Turn to page 18)*

Step on it, boys, here's the boss! Major Stanley M. Umstead, Uncle Sam's chief test pilot, emerges from a Flying Fortress after a check flight. He directs all tests.

Hey, no pictures! This half-million-dollar experimental bomber DIDN'T make the grade, although five-man crew escaped. Crashes like this save lives later.

Service Test—*Rush!*

(Continued from previous page)

But there was a catch to it. Experts in the aero medical research laboratory at Wright Field who study human reaction to flight shook their heads dubiously. "It won't work," they said. "The human body can stand only so much. Let the pilot fly in this position more than several hours a month and you'll kill him—his blood cells will turn to water." That is only one of the hundreds of disappointments Uncle Sam runs into when he puts his war birds to test. It is for this reason that millions of dollars are spent each year in an effort to produce the best airplanes possible.

Structural strength is another factor. Airplanes have to be built strong. Pilots take the small fighter ships upstairs and dive them at terrific speeds to see if the wings pull off. Experts on the ground in static test laboratories have set the dive ratio—speed at which an airplane can be dived safely—from compounded figures relative to weight, strength and stress, et cetera. But sometimes they are wrong. Planes don't fly on paper. So test pilots dive them and pull them out and see if they remain whole. Oftentimes they don't; a wing snaps, an engine tears loose, an elevator or aileron develops flutter. Anything can happen, and when it does pilots hit the 'chute. The farmers and civilians in the rich Miami Valley near Uncle Sam's testing center think it nothing unusual to see parachutists in the sky.

When crashes occur, the army has a special crash investigation board that carefully scrutinizes the twisted remains of what was once a P-40, an Airacobra or a new bomber. The experts will tell you that some of the most ingenious devices now on the modern warplanes have been the outgrowth of serious crashes. Somewhere in the wreckage a piece of metal shows signs of having been melted by overheated wires; certain rivets show they couldn't take it, a motor-coolant radiator "gets in the way." Any one of a thousand little things produces changes in design so that it might never happen again. Pilots who are alive today owe their safety to pilots who died another day.

Probably more than any other location in the country, Dayton has its share of plane crashes. They are not normal crashes because airplanes aren't treated normally. They are dived to find the limit of their diving endurance, flown fast to find their maximum speed, turned, yanked, twisted, climbed in a grueling test program. Engineers put water in gasoline to see what happens. They dilute oils. They fly ships until the fuel runs out, then see if the reserve supply cuts in the way it should. In-line motors are tried out in ships designed for air-cooled motors; radials are tried out in planes built for in-line motors. That is the reason for experimental airplanes.

The findings of a crash board are interesting. The reports are confidential, sometimes they get out, however. For instance, in the case of a P-40 crash, the ship was overdived. Tests were being run to see if the canopy that covers the pilot would work when automatically controlled by a new device in a dive. From scattered pieces of wreckage test board engineers learned that the ship had disintegrated in the air. Windstream at 470 m. p. h. had torn loose the canopy, shot it back striking the elevator, ripped off the elevator and jerked the ship into a quick snap roll that tore off the wings. A test pilot was killed, his 'chute failing to open. Another pilot has already tested a new improved device, and it works, because the experts knew what what was wrong, and how to correct it.

With big bombers, it's different. You can't whip bombers around the sky like the small fighters. They are cumbersome things even at 350 m. p. h. Pilots take them aloft and see how far and how high they can fly. Altitude and range are the principal things. The army has its eye on stratosphere bombing. Big Flying Fortresses are flying at altitudes up to 40,000 feet at the test field. It took a long time to get them up that high. But the new ships are doing it. They have been streamlined, blisters cut from their sides and replaced by slide panels, nose turrets eliminated and smoothed down so there is no projection. To really get proper testing the bombers carry full loads. Real machine guns with real bullets. Pilot, copilot, radio operator, mechanic or crew chief, two, three and four gunners, and bombardiers. Weight equivalent to a bomb load is carried.

Endurance testing is the hard routine. The big bombers take off with full fuel load and stay in the air, flying over a triangle course that takes them from Dayton to El Paso to Indianapolis to Dayton, a total of 3,200 miles. The entire flight is made at altitudes above 15,000 feet. Pilots wear oxygen masks. They can eat only certain foods because their digestive organs don't function the same at the higher altitudes. They smoke cigarettes, but the smoke tastes bad. Sleeping is uncomfortable. Talking is hard on lips, already parched from sucking on wooden oxygen stems. But most of all, just sitting, hour after hour—and they will tell you the time drags—is the hard part about it. But pilots, like the airplanes they fly, must be able to take it.

How about armor and armament? The planes that are being flown and tested at Patterson Field are the very latest, with six machine guns on the pursuits, as many as eight on some of the bombers, and revolving turrets, bulletproof tanks—all the devices that have been the outgrowth of the war abroad. Take the P-39. It packs more fire power and more armor plating than any ship in the skies, according to the test pilots who fly it. A 37-mm. cannon fires through the propeller hub, and surrounding the cannon, all in the nose of the ship, are four heavy-caliber guns.

(Turn to page 33)

Our fastest production job, the Lockheed P-38, powered with liquid-cooled Allison engines has machine guns and cannon in center nose. Speed is over 400 m. p. h.

SEEN AT WRIGHT FIELD

Some of our newest ships being tested at Wright Field as seen by our photographer during a recent visit.

Army goes air-cooled. First 2,000 h. p. single-engined fighter is the XP-47B by Republic. Heavily armed and armored, it is said to have service ceiling of 8 miles.

Indian fighter up-to-date. The North American XP-51 "Apache" being tested by the army is also Allison-powered and will be heavily armed. Note belly radiator.

Twin-engined medium bomber by Douglas. B-23 with tail turret is an improved version of the Douglas B-18A.

Twin-engined fighter. Douglas A-20A has speed of 325 m. p. h. Nose guns fire forward from streamlined coverings.

The Boeing B-17C heavy bomber, equipped with leak-proof tanks and armor, has new flat blisters on sides.

New basic trainer. Fleetwings XBT-12 has top speed of 195 m. p. h. Spot-welded steel fuselage gives strength.

Twin-engined bomber. The North American B-25 has a speed of well over 300 m. p. h. Note the tail turret gun.

Army gets B-24s. Under the name Liberator, England has received many Consolidateds. Has tail turret.

For officers' use. This Beechcraft AT-7 will be used for light transport work and training of aerial navigation.

Tough trainer is the Fairchild XPT-23. This primary trainer also bears the materiel division insignia, MD, on tail.

Still used here and abroad. This P-36A by Curtiss has speed of 323 m. p. h. and 1,000 mile cruising range.

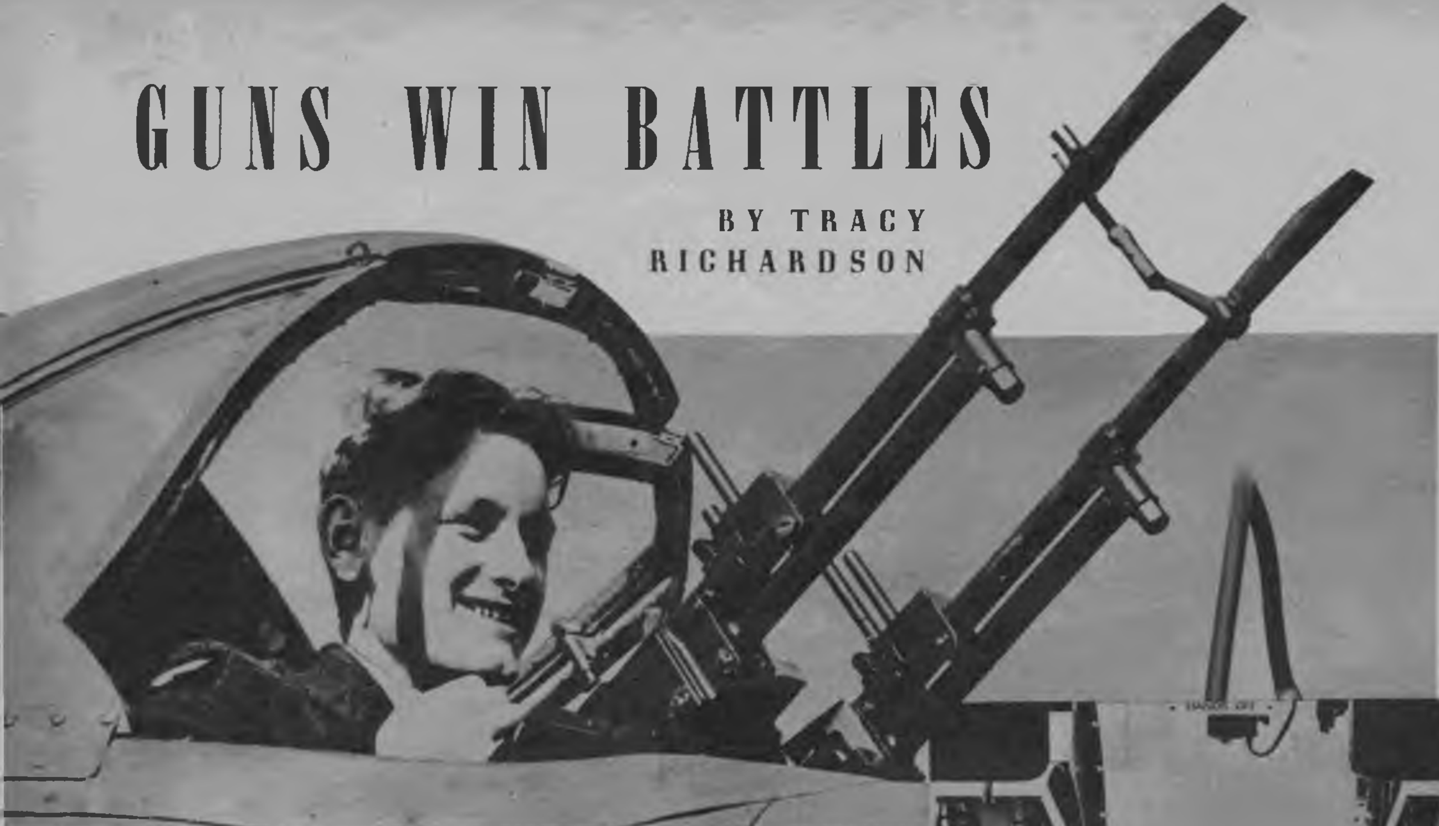
Giant killer. The Bell P-39 with Allison in rear of pilot has a shell gun in nose, as well as many machine guns.

Flying sunroom. This Vultee BT-13 trainer has fully inclosed cockpits. Full radio equipment is used in training cadets.

Designed for observing. The famous North American O-47A is kept up-to-date. Speed is 243 m. p. h.

GUNS WIN BATTLES

BY TRACY RICHARDSON



To the gunner protecting the tail goes the responsibility of coping with surprise attacks.

Behind the tail guns. Inside the four-gun turret in the tail of a Whitley bomber. Two guns on either side. Ammunition and triggers in center. Below—Side view of same turret showing the four guns. Sides of turret are of plexiglass for better gunnery visibility.

First of all the air marksman must know his equipment. A veteran instructor introduces you.

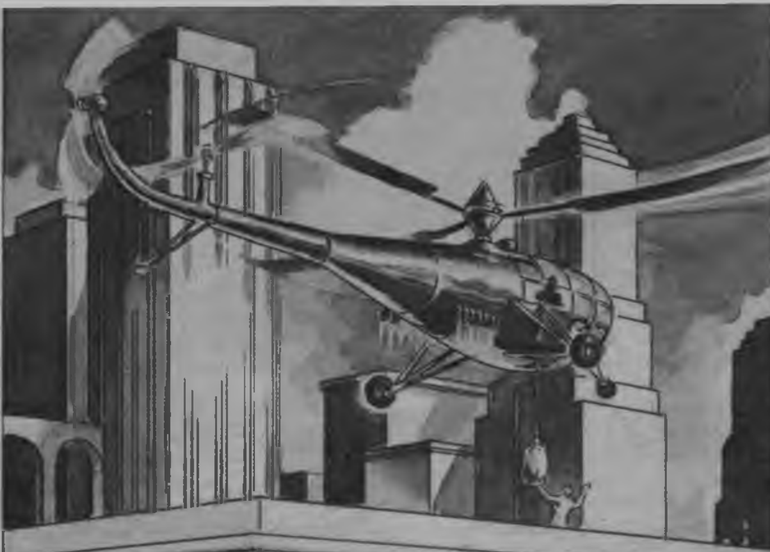
A RIFLE is only as deadly as the marksmanship of its user. A modern combat plane without a marksman pilot is but an expertly flown target for its adversary.

In the aërial combats of World War I when guns mounted upon fighting planes were effective mainly at close range, and numbered not more than several to a plane, the outcome of each contact with the enemy depended largely upon piloting skill. Guns jammed easily, were poorly mounted and often inadequately equipped with sights. As a result, piloting and surprise attack made up for poor marksmanship.

It is true that the better-known aces were all good marksmen, and spent many hours at the butts to perfect their skill, but you will also note that they were tops in flying skill. Many a good marksman never lived to prove it for lack of the piloting skill possessed by an equally good shot in his adversary's cockpit. On the other hand, many a poor marksman overcame this handicap by using his flying skill to bring him into a position where even his mediocre shooting ability did the trick.

It's different today. The speeds of modern combat planes, the decreased "on-target" time and armorplating make the real aërial marksman top man in air warfare. Flying skill is still imperative, but the ability to call shots without fail and put them *(Turn to page 30)*

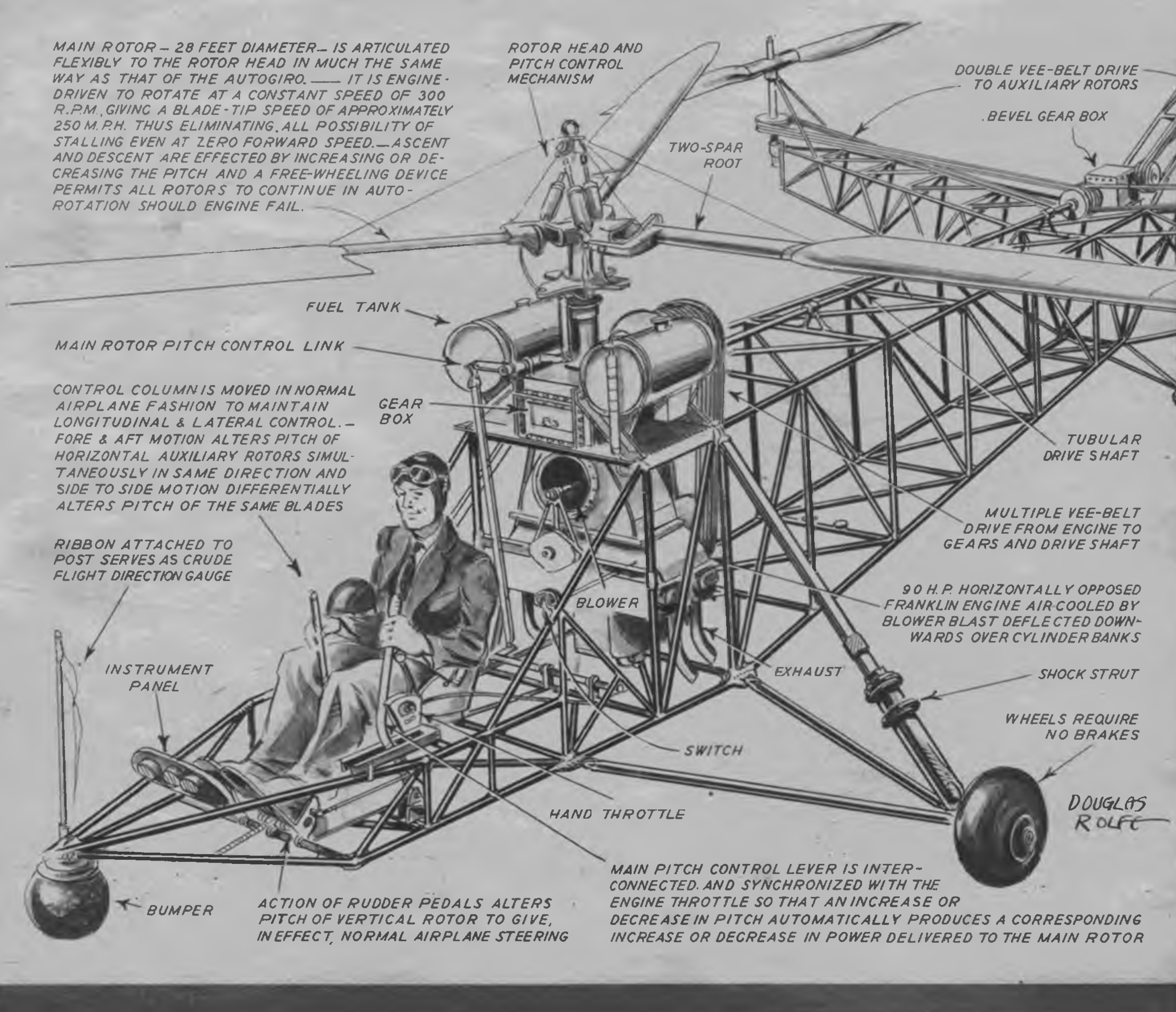
Bad news night or day. The four-gun turret of the Boulton Paul Defiant fighter.

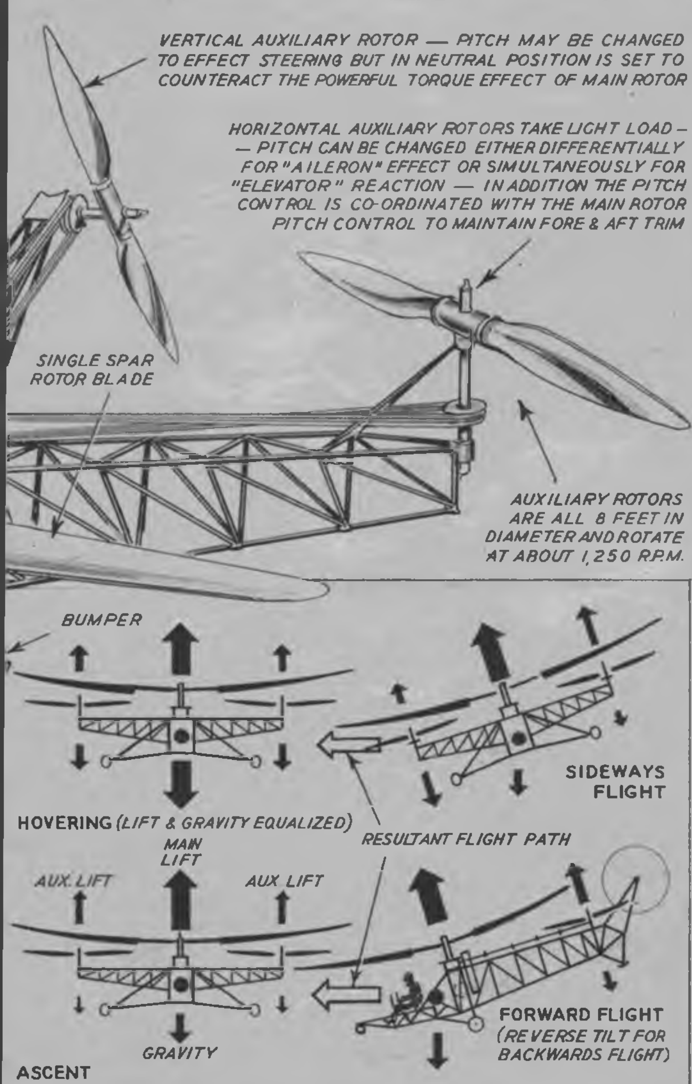


COMMERCIAL *AIRPORT SHUTTLE FOR PASSENGERS AND MAIL*

PUBLIC *POPULAR FLYING AND TAXI SERVICE. CAN GET IN AND OUT OF ANY PLACE LARGE ENOUGH FOR ROTORS TO SWING*

VERTICAL FLIGHT HAS A FUTURE!





THIS IS HOW SIKORSKY'S HELICOPTER FLIES

ESSENTIAL FEATURES AND CONTROLS OF THE SIKORSKY-VS-300 HELICOPTER ARE EXPLAINED IN THE DRAWING AT LEFT. THE VS-300 RECENTLY BROKE ALL EXISTING HELICOPTER ENDURANCE RECORDS AND WILL BE DEVELOPED FUTURE DESIGNS WILL BE SIMPLIFIED, CLEANER LOOKING AND HIGHER POWERED BUT PROBABLY WILL REMAIN COMPARATIVELY SLOW. DESPITE THIS, HELICOPTERS HAVE A DEFINITE PLACE IN AVIATION AS SUGGESTED IN SKETCHES

Eventually full-size ships are tested in this giant N. A. C. A. tunnel. But models do pioneering.

Power to blow away. This is stationary part of the 40,000 h.p. fan motor to drive the propellers at Wright Field tunnel.

STRAWS IN THE

Big warplanes from little models grow. Uncle Sam learns a lot of flying characteristics from those miniature test ships flown in wind tunnels.

BY DOUGLAS J. INGELLS

Now try this one. Various wing shapes are tried out on some fuselage model to determine efficiency of different wing designs. Tiny yarn tufts give data on air flow.

Sitting in a draft. The model with wing attached is suspended in tunnel ready for test. This particular model has scale flaps built in to test their effectiveness.

BOMBERS, pursuits and fighters that you or I won't see in the air for at least three years are flying today. They are unusual planes, incorporating radical shapes and designs, but some of them are destined to be the great ships of tomorrow. Right now they are small models suspended in wind-tunnels "getting the works" under the scrutinizing eyes of the army's crack designers and aeronautical engineers.

You may not know it, but no small portion of that money the American taxpayer puts out each year for national defense is spent for model planes. Uncle Sam spends hundreds of thousands of dollars annually to pay skilled craftsmen who fashion from woods and metals precision-built models of new warplanes, and the whole process in the long run saves millions.

Let's start at the beginning.

Say General Blank of the army air corps receives a confidential report stating that a foreign country has developed a new high-speed bomber that will do 400 miles per hour and cruise for 3,000 miles without refueling. (He'd be mighty surprised if he learned of such a plane.) However, here is the birth of the idea. After reading that report he decides that the United States should have a plane that will do 450 miles per hour and cruise for 4,000 miles. That may be stretching a point, but Uncle Sam's designers are continuously trying to keep "at least three years ahead of the parade." And they are doing it.

But back to our story. Conferences with fellow officers and engineers produce specifications which are turned over to aircraft manufacturers who have government contracts and to Wright Field engineers for them to design this new superplane. Plans are drawn by designers in the experimental engineering section at the materiel division—Wright Field—in Dayton, Ohio,

WIND

and estimates are made on the new plane's performance. All of this, of course, is done "on paper." But from these rough sketches the best designs are selected and models of them are made.

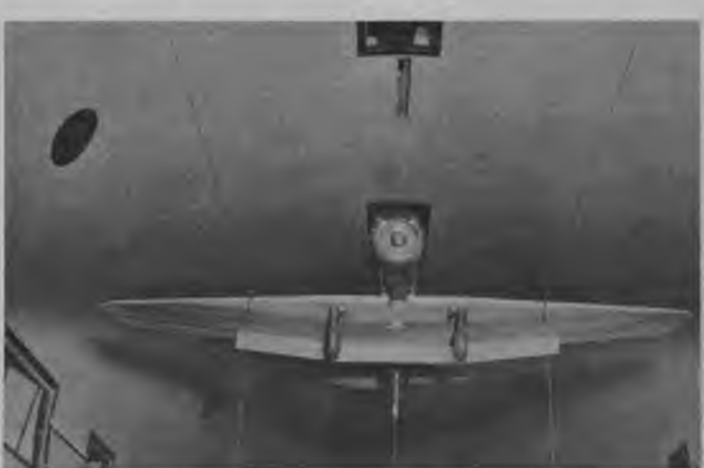
These models vary in size and cost. Some are small with only three or four-foot wing span; others are built as large as twenty feet or more. Some cost only $200, and seldom less, while others run as high as $2,000, depending upon the amount of work hours required in their construction. "The purpose of building these models," an army officer in charge of the section explains, "is to give the engineer and manufacturer an idea of an airplane's flying characteristics before going into the cost of building a full-size ship." Full-size experimental airplanes, by the way, cost as much as $1,500,000.

From small models in wind-tunnel tests, engineers can, by mathematical calculation and the appliance of specified and proven formulas and delicate instruments, determine the flying features of a large-scale airplane. Manometers, instruments whose measurements can be translated into pounds of pressure exerted per square foot and other delicate testing devices are connected to the model when it is in the tunnel. Thus, aerodynamic forces can be accurately measured. Engineers can tell how heavy a load the wing will lift, how fast the ship will fly and whether or not design changes will produce a more efficient airplane.

On one particular type of model bomber that was being tested in Wright Field wind tunnels, a small piece of putty that was placed in just the right spot on the wing where it joined the fuselage increased the plane's speed by nearly twenty-five miles per hour.

Take the Airacuda, for instance. This pusher-type fighter of Larry Bell's went through one of the most grueling series of model tests of any plane for the last several *(Turn to page 36)*

Long-range observation. Peering through telescopic instruments, the expert keeps check on the action and attitudes of model in tunnel.



Front view of same model shows fine wires supporting it in the air streams. These wires actuate delicate scales that register drag, lift, stability and other data.

Final check. An engineer goes over a big scale model fuselage before test in the wind tunnel. Many of these models have movable control surfaces.

WHAT'S YOUR QUESTION

QUESTION: *Could you tell my friend and me the difference between interceptor, fighter and a reconnaissance plane? D. C. and R. B., Alhambra, Calif.*

Answer: An interceptor is usually a single-place machine powered by one or two engines. It has an exceedingly fast rate of climb and a high speed, and its object is to intercept bombing planes and bring them down before they can attack their objective. A fighter plane, while it can be an interceptor, is usually a highly maneuverable single-place machine whose object is to engage the attacking airplanes and bring them down. It may not be as fast as the interceptor, but its exceptional maneuverability makes it a very dangerous adversary. A reconnaissance plane is a multiplace airplane whose job is to photograph and gain information as to the movement of the enemy, the location of its airdromes, supply bases, artillery emplacements, communication centers, et cetera, and to relay this information to headquarters so that tactical problems on future action can be figured out.

Question: Could you tell me what a pitot tube is used for? And could a person wearing glasses get into the army air corps? C. M., Milwaukee, Wis.

Answer: A pitot tube is a tube with an open end located usually on the wing of the airplane away from the slipstream of the propeller, and is connected with the air speed indicator located on the dashboard. It either has a coaxial tube surrounding it or a closed tube placed parallel to it. The closed tube has perforations in its side and is subject to static pressure, the open tube measures the impact pressure, and the speed of the air is determined from the difference between the static and impact pressures, this being interpreted in miles per hour on the dial of the air-speed indicator. A person wearing glasses cannot receive flight training in the army air corps.

Question: Could you please tell me the addresses of the following aircraft companies: Douglas Aircraft Corp.; Curtiss-Wright Corp., Airplane Division; Grumman Aircraft Engineering Corp.; Glenn L. Martin Co.; Boeing Aircraft Corp.; Seversky Aircraft Corp. and Consolidated Aircraft Corp. H. B., Bronx, N. Y.

Answer: The Douglas Aircraft Co., Inc., is located at Santa Monica, Calif. Curtiss-Wright Corp., Airplane Division, has two factories, one located at Buffalo, N. Y., and the other at St. Louis, Mo. Grumman Aircraft Engineering Corp. is at Bethpage, L. I., N. Y.; Glenn L. Martin Co., Baltimore, Md.; Boeing Aircraft Corp., Seattle, Wash. Seversky Aircraft Corp. is now the Republic Aviation Corp., Farmingdale, L. I., N. Y. Consolidated Aircraft Corp. is in San Diego, Calif.

Question: In your estimation which is the most formidable and fastest pursuit ship among the Vultee Vanguard, Curtiss P-40, Bell P-39 and Lockheed P-38 and the Republic P-43? Also the most formidable medium bomber among the Lockheed Hudson, North American B-25, Martin B-26 and Douglas B-18?

Answer: Among the pursuits there is a close tie between the Bell P-39 and the Lockheed P-38, although one ship is a single-engine fighter and the other a twin-engined interceptor. Among the bombers the Martin B-26 has an edge on the others you mention.

Question: In the February, 1941, issue of your magazine there was an article called "You and Your Idea." I followed its instructions and took my drawings to my nearest air corps station and gave them to an officer. He said that he could not do anything for me. Could you tell me the next step I should take in order to submit my idea to the U. S. army air corps? L. C., Jersey City, N. J.

Answer: Send your drawings to the U. S. Army Air Corps, Materiel Division, Wright Field, Dayton, O.

Question: Can you tell me where I can get the book "I Wanted Wings," and do you know when the picture is coming out? E. P., Carney, Mich.

Answer: The book "I Wanted Wings" by Beirne Lay is published by Harper & Bros., 49 East 33rd St., New York City. The picture of that name has already been released.

Question: Would you please send me a list of books covering the following subjects: installation and maintenance of radio equipment in aircraft and installation and maintenance of aircraft instruments (Sperry gyroscope, et cetera). Corp. B. McC., Fort McClellan, Ala.

Answer: We suggest the following two books: "Aeronautical Radio" by Myron F. Eddy, published by Ronald Press Co., 15 E. 26th St., New York City, and "Airplane Instruments," by E. Molloy, Chemical Publishing Co., 148 Lafayette St., New York City.

Question: Will you please let me have information on the Stinson 105 and the Stinson SR-7? With what instruments are they equipped? W. J. V. V., Chicago, Ill.

Answer: The latest Stinson 105 has a wing span of 34 feet. The top speed is 115 m. p. h., cruising speed 110 m. p. h., landing speed 47 m. p. h. The service ceiling is 13,000 feet. Ship is powered by a 90 h. p. Franklin engine. Maximum range with 20 gallons of gas is 450 miles. It is equipped with an altimeter, air-speed indicator, oil pressure and oil temperature gauges, tachometer, ammeter, compass and fuel gauge. The SR-7 has a span of 41 feet, 7½ inches. Equipped with a 225-h.p. Lycoming engine, its top speed is 142 m. p. h., crusing speed 136 m. p. h., and landing speed 55 m. p. h. The service ceiling is 13,000 feet and cruising range 400 miles. The standard instrument equipment is similar to that of the 105.

Question: Could you tell me the model and make of the two airplanes shown in the pictures which I sent you? D. C. H., Riverside, Calif.

Answer: The biplane shown in your photo is a Curtiss-Wright Sport powered by a five-cylinder Wright J6 engine of 175 h. p. The open-cockpit monoplane is a Stinson Model O powered by a Lycoming engine developing 215 h. p. Neither of these models is built any longer.

Question: I would like to know what companies sell gliders in kits and how much do they cost? W. J. Henning, Minn.

Answer: The following glider manufacturers sell ships in kit form: Bowlus Sailplanes, Inc., San Fernando, Calif. The kit sells for $425. Briegleb Aircraft Co., Inc., Van Nuys, Calif. Their kits of the BG-6 sell for from $210 to $465. Kits manufactured by both companies can be bought on installments. Another manufacturer making a kit is Midwest Sailplanes, 15100 Woodward Ave., Detroit, Mich., which sells its product for $500. Crating and shipping charges are extra.

Question: I would like to know what subjects should be taken up in high school in preparation for aeronautical engineering and aeronautical drafting. H. C., Ruston, La.

Answer: We suggest that you take up mathematics, physics, chemistry and mechanical drawing.

Question: Could you tell me the physical qualifications and requirements for a private license? R. S. Huntington, Ore.

Answer: For the above information write to the Civil Aeronautics Authority, Washington, D. C., and ask them to send you their Bulletin CAR-20.

Question: Where can I buy models of .30 and .50-caliber machine guns and also a 37-mm. antitank gun? Where can I buy photos of the Bell Airacobra, Airabonita, Lockheed P-38, Bell XFM-1 and Vought Sikorsky SB2U-1? R. P. B., Brooklyn, N. Y.

Answer: We do not know where you can buy models of the above guns. Try contacting Gun Model Co., 2908 N. Nordica Ave., Chicago, Ill. For pictures of the Bell ships write to the Bell Aircraft Co., Buffalo, N. Y. For the Lockheed, Lockheed Aircraft Co., Burbank, Calif. Other photos you may be able to buy from Rudy Arnold, Floyd Bennett Field, Brooklyn, N. Y., at ten cents each.

REVIEWING STAND

Through these current books you readers may extend your knowledge of aviation.

Preliminary Airplane Design. By R. C. Wilson. (Pitman Pub. Corp., $1.) Obviously intended for the serious student of aviation interested in becoming proficient in at least the rudiments of aircraft design, this book appears excellent. It is based upon a successful method developed for the air corps, and although simplified, gives the design student a good and complete basic working knowledge, from the free-hand sketch of projected aircraft to the computation of the characteristics of its component parts. Various charts and tables of weights are included.

Aircraft Propellers, Basic Training Manual. By Carl M. Harlacher. (Aero Publishers, Inc., $2.85.) Written in the popular question and answer formula, this manual prepared by a propeller instructor in the air corps division of the Curtiss-Wright Technical Institute gives the reader a good general knowledge of standard propellers. It covers in an understandable way the construction, maintenance and repair of all common types of air screws. Of particular interest to mechanics and those connected with propeller repair stations.

So You're Going to Fly! By James L. H. Peck. (Dodd, Mead & Co., $2.50.) With all the money being spent at the present time on military aviation, training and production, there is need for a comprehensive book on the aviation set-up and its various activities. "So You're Going to Fly!" will answer many questions regarding air operations and strategy. Much of this material will be familiar to Air Trails readers, for the author has appeared in our pages from time to time. A highly informative book on modern aviation and its activity. Many photos.

The Student Pilot's Training Primer. By Hugh J. Knerr. (D. Van Nostrand Co., $2.) Obviously taking a tip from Assen Jordanoff, Author Knerr has chosen to illustrate his book with many semihumorous diagrams and illustrations to clarify flight problems and points of aërodynamics. While this book might be considered elementary, it is excellent for those at whom it is aimed.

Elementary Aerodynamics. By D. C. M. Hume. (Pitman Pub. Corp., $1.50.) This author, a group captain, Royal Canadian Air Force, has chosen a subject that is usually difficult to make lucid to the average layman, but he has succeeded in doing this, provided the layman has a working knowledge of rather advanced mathematics. A unique treatment of this subject is advanced by an author's digest of each chapter at its conclusion, enabling the reader to review at a glance the purpose of the material contained in each chapter. A series of test questions for personal check by the reader conclude the book.

Famous American Flyers. By Chelsea Fraser. (Thomas Y. Crowell Co., $2.50.) This collection of biographies suffers for lack of illustrations of the many famous names that fill the nearly 350 pages of text. Although this lack of illustration (seven photographs and several small maps) might prevent the popular appeal that it might otherwise have, this excellent handling of an always popular subject should make it an invaluable addition to every aviation library. Much of the material was gathered from relatives and intimate friends and gives unexpected and highly entertaining insight into the characters of the men and women biographed. To the serious student or casual follower of prominent figures in aviation this book will bring much that is inspirational as well as amusing.

Horizons Unlimited. By S. Paul Johnson. (Duell, Sloan & Pearce, Inc., $3.75.) Friend Johnson, formerly editor of *Aviation*, and now co-ordinator of research for the N. A. C. A., must have had a lot of fun as well as headaches in digging up the material for this "graphic history of aviation"—to judge by some of the illustrations. This highly entertaining and enlightening story of man's conquest of the air consists of over 350 pages of text and illustrations gathered from all over. It recounts the progress of aviation from the first feeble attempts by man's imagination to visualize "flying machines" up to the stratoliners of today. A book recommended for aviation followers of all ages. *(Turn to page 32)*

FLYING BOX CARS

Will national defense needs hasten big-scale air freight haulage in this country?

OUT of New York for Chicago every day wing seventy-six regularly scheduled transport planes. Seventy-five of them are laden to the de-icers with passengers, mail and express. The seventy-sixth, a sort of aerial ugly duckling, carries no passengers at all—but it totes plenty of express, and bigger packages than the other planes. It is the nation's only all-cargo craft, a DC-3 United Air Lines Mainliner which gets away from LaGuardia Field nightly at eleven p. m. for its 740-mile nonstop hop. It is always stuffed from nose to tail with a 5,000-pound load, ranging from pins to pianos.

Operating since January, this unique flying box car is quietly blazing the trail of what many far-seeing aviation and shipping men think will be a vast national network of heavy-duty freight planes after World War II ends. They remember well what the auto truck did to freightage after World War I, and are laying plans accordingly to cash in on this expected new phase of air transportation. There are some among them who are clamoring for the establishment of this system now as a national defense measure, and it would not be surprising, therefore, if steps in this direction were taken in the coming months, at least preliminary ones.

The fact is, air cargo carrying has been one of the most backward phases in the development of American aviation. In 1939, for example, the nation's air lines did $28,000,000 in passenger business and only $1,500,000 in express, whereas eighty percent of the railroads' revenues came from freight cartage. United's all-cargo ship consequently is unique not as a milestone of progress, but rather as some ghostly, belated flight from a 1930 schedule. The rest of the world carries much more air cargo than the United States, has had all-freight ships for years. In the year before the present war started, Canada lugged 12,500 tons; Russia, 10,000 tons; Air France, 1,368 tons; the Dutch K. L. M., 2,371 tons, and TACA, in Central America, 7,500 tons. In 1940 the total U. S. air tonnage was only 3,850.

Lumber and coal are hauled by air in Alaska, livestock and heavy machinery weighing several tons in Guatemala, household goods and wheat in Canada, autos in New Guinea. From London, a British freight plane used to fly nightly to the continent with 3,000 pounds of mail. K. L. M. even boasted a "sky-tramp" service.

It isn't that America didn't start early enough. Indeed, the first shipment by air express in this country—and probably the first anywhere—took place thirty years ago. The shipment was

The Curtiss-Wright cargo airliner in flight above has special baggage door in the belly for easy loading.

This 750-pound crankshaft is being loaded in Chicago for a 6,825-mile flight to Wake Island in the Pacific.

Pump to Chile. Emergency met by flying boiler pump to South America in time to save long plant shutdown in Santiago. More and more heavy stuff goes by air.

BY ALLAN FINN

five bolts of silk worth $1,000 flown to Columbus, Ohio, from nearby Dayton, whence it had been dispatched by rail from New York. In 1915 a load of hams was carted by air from St. Petersburg to Tampa, Florida. And in 1919 Railway Express began experimenting with planes as carriers, sending out from Mitchel Field a heavily laden Handley Page which, unfortunately, was forced down at Mount Jewett, Pennsylvania. U. S. commercial air transportation did not come into being, however, until 1925, with the award of the first air-mail contracts. Regular express service opened with inauguration of regular air-line flights in September, 1927. Slow to get started, air express took in a mere $200,000 in 1929, year of the crash.

After a period of irregular operations, American air express reached its present stage in 1935 after the mail cancellations and passage of the Black-McKellar bill prohibiting air lines from engaging in any other business except transportation on their own systems. Hard up at the time, the lines found it necessary to sign up with their greatest competitor, REA. Owned by seventy railroads, REA today has contracts with seventeen lines, gets for its work thirty-two percent of air-express revenues.

Reason for tie-up: REA effects an air-rail co-ordination pick-up and delivery system covering 44,399 miles of airways and 230,000 miles of railways, manned by 59,000 employees in 23,000 offices and on 12,500 vehicles. REA services 250 planes daily in 269 airport cities.

The notion that air express is necessarily limited to light shipments is one of the illusions of aviation, one of the stumbling blocks to the public's acceptance of real freight transportation via the clouds. The average person conceives of air express as de luxe delivery of baby chicks, perishable table delicacies and millionaires' playthings. Of course, the bulk of even today's haulage consists of light goods, such as radio transcriptions, printed matter, newsreels, wearing apparel, medical supplies, jewelry, et cetera. But America's big transports are daily engaged in heavy traffic operations, too. Not long ago when a huge motor generator broke down in a factory in Emeryville, California, armature windings weighing 2,657 pounds were rushed west by air from Pittsburgh, saving *(Turn to page 38)*

Lockheed aluminum also flies. Special aluminum bars and strips travel by air across the country to meet shortage in bomber plant in California.

Boeing box car. The Stratoliner interior will hold 33 passengers and has cargo room below. Future freight planes would use entire space for cargo.

Double-decker. This gives excellent view of passenger and cargo holds of the Curtiss-Wright CW-20. Passengers number 40, cargo over three tons.

Gliders Fill A Need

(Continued from page 21)

suggest teaching gliding to youngsters between the ages of fourteen and eighteen, especially model builders, who usually have the all-consuming urge to fly, and thus create a pool of future pilots from which all the inept have been eliminated and only good pilot material remains. Germany, Russia and Poland used both of these methods with a great deal of success. In Germany commercial and military pilots are required to take a refresher course in soaring once a year. All their air-line pilots prior to the war had to have a "C" license in order to get a job.

Practical knowledge of meteorology and air currents enables the pilot to avoid situations which otherwise might lead to disaster. A number of fatal accidents in private, commercial and military flying can be traced directly to the pilot's lack of understanding of meteorological conditions. On the other hand, men with soaring experience have taken advantage of such conditions to pull themselves out of a tight spot. Not so long ago we were witness to an occurrence where glider training came in handy. A young pilot with certain amount of glider time was told by his employer to fly a Cub from a small airport to another one situated three miles away for a check-up of the engine, which was not functioning right. Soon after take-off the motor of the Cub revved down quite a bit and the pilot was about to land back on the field when he hit a strong thermal. Immediately he circled in the lift, rose to 5,000 feet, and glided into the bigger airport, where the engine was repaired. His knowledge of soaring saved his boss the expense and delay of having the Cub's motor taken out and trucked to the repair station for overhaul.

The pilot who flew us to Elmira to see the triple-tow demonstration was Emil Lehecka, one of the ablest soaring men in the country. During the trip the air was rough and the sky dotted with cumulus clouds. We noticed that just before we hit exceptionally strong bumps he would throttle down, slowing the ship. We were flying in a fast Beechcraft and all ships possessing high speeds must be flown slower in rough air or great strains are imposed on their structure. Emil, because of his vast soaring experience, knew when these strong bumps would occur by watching the clouds and was able to take precautionary measures before we hit them. We could quote a number of similar examples, but they would all lead to the same thing: A powerplane pilot who has a knowledge of soaring will make a better and safer flier.

NEWS AND EVENTS

Twenty-six sailplanes and thirty-one soaring pilots gathered at the Kern Mesa gliderport at Arvin, Calif., for the Fourth Annual Western Soaring Championship held from April 12th to the 27th. New records and notable performances included an out and return flight by Allan Essery with passenger in his two-place Baby Bomber sailplane, from Arvin to Maricopa. This flight established a new goal and return distance record, as well as a new American record for two-place ships in this event. Dick Johnson, seventeen-year-old soaring pilot, became the first one to ever cross the Ridge Route, soaring over the 8,000 to 10,000-feet-high Tehachapi Mountains which separate central and southern California. He landed at Saugus, having flown a distance of 55 miles. The present altitude record was considerably topped by Henry Stiglmeier in his Bowlus Baby Albatross when he rode a thunderhead to an altitude of more than 20,000 feet. Unfortunately his barograph needle had been set too high and ran off the paper just 200 feet short of 17,000 feet, so this flight cannot be credited as an official record.

Best duration during the meet was made by Dick Johnson, when he remained aloft for $5\frac{1}{2}$ hours. A new sailplane made its first appearance during the meet, a two-place ship built by Volmer Jensen. It finished high in the point totals, although it did not participate in the contest for the full time. Several ships were equipped with thermal locators and a motion-picture camera was installed on Frank Wolcott's craft from which some sensational aerobatic shots were taken, later to appear in the newsreels. The Stiglmeier brothers, Herman and Henry, had their sailplanes equipped with two-way radio sets and talked with each other and their ground crews as well as the assembled crowd while in flight. A total of 2,574 miles of cross-country distance which took 246 hours and 51 minutes of flying time were flown in these two weeks. First prize and the title of Western Soaring Champion went to Allan R. Essery. Second place was taken by Howard Morrison and third by Harold Huber.

The Tennessee Bureau of Aeronautics inaugurated recently the first State-sponsored glider school in the country. A two-place Schweizer sailplane has been ordered and Hawley Bowlus will supervise the program. State-supported schools will be established in Tennessee for boys between the age of fifteen and eighteen.

Lewin Barringer, Golden "C" pilot and ace record breaker, has accepted a position as head of public relations and manager of mechanics school with the South-West Airways at Phoenix, Ariz. This school trains pilots for the army air corps. Barringer has also been made director of the Briegleb Aircraft Co., Van Nuys, Calif.

Guns Win Battles

(Continued from page 20)

in the black in the granted fraction of a second is what keeps the medal-makers busy. Whether the man behind the trigger peers through a reflector sight and pours his spearhead of lead from fixed guns or spins his power turret to defend his bomber's blind spot, the mastery of aerial marksmanship is paramount.

When I first entered aviation in 1916 I'd been using machine guns since 1909, when I mixed up with a revolution in Nicaragua. Afterward through Honduras, Guatemala, Venezuela, Brazil and Mexico I had perfected myself in the art of machine gunning and I finished off with a post-graduate course with the Princess Pats of the Canadian Expeditionary forces in Europe. Wounded and invalided out of the infantry, I joined the British Royal Naval Air Service and learned to fly. My groundwork with machine guns was as near perfect as experience could make it, but I had to learn the science of aerial sights and it was a tough job. Later, after my transfer to American aviation, I was in charge of aerial gunnery schools.

The first and greatest trouble I ever encountered was to convince a gunner of the importance of the sights. The most important adjunct to this was the development of the aerial camera gun which photographed the target against a background of sights and gave proof to the student of his inaccurate holding.

The common aerial gun sight and the type in universal use is known as the ring sight. This is a ring, varying in diameter according to the distance between the front and rear sights. Usually the ring sight consists of three concentric circles. The inner ring and the smallest is the peep sight for dead-on shooting. The other two are designed to give the gunner an automatic and instantaneous gauge, or lead, on another plane, taking into consideration its speed and direction of flight in relation to the attacking plane.

One of the most important elements in the training of an aerial gunner is to teach him to know every plane with which he may come in contact, and their speeds while flying at any angle, from climbing to diving. A plane in a dive must necessarily be given a greater lead than one flying level or climbing. Likewise allowances must be made for a a ship flying at right angles or quartering.

The most common front sight is a straight steel peg topped with a round ball, sometimes red but often of a luminous material for better visibility in darkness or dull weather. Some front sights—especially those on movable gun mounts—are fitted with a double vane sight that at first glance resembles a miniature airplane. This movable gun sight is supposed automatically to take care of the windage and drift of the plane. With the average gunner it causes more misses than hits. Likewise tracer bullets can cause poor marksmanship.

Tracer bullets are bullets filled with magnesium instead of the regular lead core. The magnesium is ignited by the flash of the gun and as it travels through the air toward the target it leaves a trail of smoke behind. In theory this is supposed to give the gunner a line on where his bullets are going. Actually the bullet becomes lighter as the powder burns out and it is subject to the vagaries of the wind, and at a distance of two hundred yards may be as much as a hundred feet off the course taken by the regulation bullets. The latest tracers are being made with an explosive content in their point. This tends to keep the bullet on its course with greater accuracy and it is so constructed as to explode at a given range, usually one hundred yards. This not only gives the gunner a better gauge on his sighting but the explosion helps him check his distance. All in all, with the present great speed of combat airplanes, tracer bullets are not much additional aid, for the speed is too great to allow for corrections.

The interrupter gear and the aerial sights as developed during World War I have not been changed in principle. They have been smoothed down and made more mechanically accurate. Today if a gunner knows his sights and his reactions are swift enough, he may be sure of a percentage of hits on the enemy target, but no single branch of the service requires more study or quicker reactions.

In 1919 a good pilot could hold his ship in a firing position long enough to get in a hundred or more shots as most fighting planes had a top speed of a hundred miles per hour. Today with speeds of three hundred or more miles per hour the firing time is cut to split seconds, and to get in a volume of fire larger numbers of guns are needed.

At the end of the World War I the best machine guns were rated around four hundred shots per minute. Let me explain one thing, probably the most misunderstood thing about machine guns. They speak of a machine gun as firing a thousand rounds per minute, or fifteen hundred. The correct statement should be "firing at the rate of one thousand rounds per minute." Few guns could stand up to throwing a thousand bullets a minute. Barrels would overheat, springs would give way and feed belts would whip through the gun at such speed they'd jerk themselves to pieces. In actual combat a machine gun—both on the

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Guns Win Battles

(Continued from page 30)

ground and in the air—is fired in short bursts, very short, almost as quickly as the button can be depressed and released. So it is that eight machine guns firing forward from an airplane would deliver, during the second the pilot was actually on the target, somewhere around a thousand bullets, depending on the caliber of his guns. The larger the caliber the slower the rate of fire. Machine guns of .30 have been stepped up to the point where they can fire *at the rate* of fifteen hundred rounds per minute. The 20-mm. guns—just short of three quarters of an inch—fire at the rate of one hundred and twenty rounds per minute. Some of the 37-mm. guns are stepped that high for antiaircraft fire, but not for firing from planes. These larger guns have the decided advantage in that one of their explosive shells will do more damage than a hundred of the smaller machine-gun bullets.

Undoubtedly the most valuable adjunct to practicing aërial gunnery is the camera gun. This, too, was developed during the last World War, but has since been perfected to the point where it is almost as good, if properly used, as the real machine gun. The latest type camera guns are movie cameras mounted exactly as a machine gun. The regular sights are used and the same firing mechanism. The pilot aims his ship as though in combat, fires his burst and the target is photographed on the film over an imposed image of the sights. In some cameras a clock is inserted in the camera and the exact time of firing is also recorded on the film.

Several pilots go up for combat practice and when they return to the ground the films from the camera guns are developed and the results analyzed. They show first the exact time the shots were fired, thus establishing which of two planes might have got in the first fatal burst. They show the target ship, its exact position in relation to the firing plane when the picture was made. By this simple process of photographing the target against the ring sights and knowing the exact speed, the percentage of hits and misses can be figured and corrections made. There was never a better lie detector than the aërial camera gun; it furnishes proof in black and white. The British have realized this to the extent that many of their fighting planes are equipped with camera guns in addition to their regular quota of machine guns and cannon. Every time the fighter pilot fires a burst at an enemy plane the camera operates and the pilot comes back with an indisputable record of his accomplishments. If he comes back with his ammunition expended and no enemy plane recorded on his film he is packed off to an aërial gunnery school for more practice.

There *is* one element of aërial gunnery that has not changed since its inception, and that is the necessity for study and much practice. The principle is simple, but it takes a lot of experience to make a first-rate aërial gunner.

Reviewing Stand

(Continued from page 27)

Book of Modern Airplanes. By Harold H. Booth. (Garden City Publishing Co.) The author-illustrator presents in this aviation "picture book" twenty-three excellent pencil drawings in color of various foreign and American planes of well-known types. The end pages contain fourteen silhouette drawings showing various types of wing placement and type details. While in no sense a technical work, much information is contained in these drawings and the younger aviation fan will enjoy the various types presented. A foreword by Colonel Roscoe Turner gets it off to a good start.

A. B. C. of Aviation. By Victor W. Pagé. (Norman W. Henley Pub. Co., $2.50.) This work, an old stand-by for many years, has been revised and enlarged with many added pages and chapters. Its hundreds of photos and diagrams, some of which will be familiar to readers of Air Trails, make this work interesting reading. The statement that this is an "elementary introduction to the study of aviation for students, mechanics and nontechnical people wishing a groundwork in basic aviation fundamentals" seems well backed up by the contents.

Aircraft Electricity. By Norman J. Clark and Howard E. Corbitt. (The Ronald Press, $2.50.) Good reference books, while never "best sellers," should find a ready market in the trade if they give real information in well-arranged form. Such a trade book is "Aircraft Electricity." The coauthors of this book have aimed its contents at electricians and designers of modern aircraft. The many charts, tables, scales and photos of wiring diagrams should be of great practical value to this book's many potential buyers.

Navigation of Aircraft with **Air Pilots' Dead Reckoning Tables.** By Logan C. Ramsey. (The Ronald Press Co., $4.50.) These two books are to be used together for the study of air navigation by the serious student, advanced pilot, or air navigator. Commander Ramsey has certainly covered the subject completely and, through his vast knowledge of the subject, in a comprehensive way. The first of the two books covers all phases of navigation and the instruments used in this exacting science, while the second volume consists of the important data and tables necessary for the practical use of navigation knowledge and instruments. While not for the novice, these volumes should be invaluable to the men making a serious study of aërial navigation.

Service Test—*Rush!*

(Continued from page 17)

Around the cockpit and the motor, which rests underneath the pilot in the center of the plane's fuselage, is three-quarter-inch armor plating. In Europe the armor used is never more than one-half inch.

The light caliber .30-caliber guns used in the foreign turrets are not capable of penetrating the three-quarter-inch armor on the Airacobra, which could safely approach very near to any of the European bombers and blast it from the skies with its heavy fire power without endangering its own pilot.

Tests run with the new guns at Patterson Field on the ground show that at 200 yards the .30-caliber bullets are stopped cold when they meet with one-third-inch armor plating. The .50-caliber bullet "cuts through it like butter," at the same range. American planes are all being equipped with .50-caliber guns and 37-mm. cannon. In one test, an attempt to prove the fire power of .50-caliber guns, the bullet pierced the outer skin of an airplane, tore through three bulkheads, a one-third-inch plate of armor and smashed through the other side of the ship's skin after the bullet had flattened itself out. This is fire power unexcelled.

Our planes are also being equipped with the electrically controlled revolving gun turrets that you've heard so much about. There are three companies in America today producing the turrets for our bombers as fast as they can be turned out. One of the newest planes under test is equipped with three of these gun turrets, one in its tail, another on top of its fuselage and still a third beneath. The plane has no blind spot.

New methods of testing have been developed that help to speed up the program. When pilots take a pursuit plane up to "give it the works," usually a magic camera goes along as a third pilot. Mounted in the airplane so that its wide-angle lens films a set of instruments that tell speed, altitude, oil pressures, gas consumption, r. p. m.'s, et cetera, the camera takes pictures that record the plane's actual performance by recording the readings on its instruments. The film is studied closely on the ground by engineers and experts.

On the big bombers, crew members stationed at the different posts have small movie cameras that they use to film instruments at the various test boards inside the ship. Sometimes a camera is mounted on engine nacelles to record bullets as they pass through the whirling propeller blades, color cameras film exhaust stacks to show how the metal is holding up. And oftentimes the camera eye reveals deficiencies that the human eye cannot see.

Landings and take-offs are also filmed on motion-picture film. A course is marked off and from the sidelines movie camera crews follow the airplane from a fifty-foot altitude down to earth until it rolls to a complete stop. In this way the engineers and test experts learn how long runways must be for their big ships. Pilots are told what size fields to pick for operations. The same procedure is applied to the take-offs.

The spin test is one that is required of every airplane, especially the pursuits and fighters. Special safety devices have been developed to eliminate the hazards for pilot and machine. A small parachute is attached to the rudder of the airplane and when the plane is in a spin the pilot releases the 'chute which snaps the rudder into a normal position and straightens the ship out into a dive. A dive is a simple maneuver for any pilot to pull out of, but spins are dangerous. Thus, when ships are proving too difficult to bring out of tailspins the spin 'chute is used and it has saved many lives.

The story could go on forever—the story of wings under test. Planes in the sky, dipping, soaring, night and day. It is an impressive picture. One that leaves you with a feeling of security—that Uncle Sam's wings are being made safer than any in the skies.

Supercharged Pilots

(Continued from page 15)

loses consciousness so quickly and so easily that there isn't time to realize it. Nor is there time to take steps to prevent it. In such high altitudes and low pressures, the amount of oxygen in the lungs (the alveolar oxygen) is very small. This means that it is impossible to hold one's breath for a minute, as one might while diving. In fact, ten seconds will mean that a pilot may pass completely out. And also, the carbon dioxide in the lungs is very small, which means that one may forget to breathe! Moreover, removing the pipe from the mouth and then replacing it does not signify that recovery is possible, because oxygen itself is not a respiratory stimulant —oxygen alone will not start a pilot breathing.

What is the lesson from this near-accident? Simply that our pilots are now learning that they must be "supercharged" before quick ascents to the substratosphere. By going into a chamber containing pure oxygen and no nitrogen (our air at sea level contains one-fifth oxygen, four-fifths nitrogen) and breathing this oxygen, say for half an hour, a large part of the nitrogen in the blood is eliminated. By exercising mildly during this period, nearly all of it is expelled.

That's the first step.

After the supercharging or pre-decompression period is over, the pilot takes his oxygen mask with him, leaves the chamber, and steps into his interceptor fighter. *Without*

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MEET THE B-24

Named "Liberator" by English, the B-24 has a crew of 9, many guns, 4 tons of bombs; weighs 40,000 pounds. Four 1,200-h.p. engines give it speed of over 300 m.p.h.

Supercharged Pilots

(Continued from page 33)

breathing natural air he switches to the plane's oxygen and takes off.

Instead of using a pipe, which has been found to be dangerous, inefficient and wasteful, he uses a specially devised mask. This allows complete absorption of the oxygen and permits no chance dropping of a pipe. There is a device in the mask by which the pilot can speak into his microphone, thereby allowing him to speak without removing his mask.

The ascent to 30,000 feet is thus made with comparative lack of discomfort. No nitrogen bubbles form and there is ample oxygen for attack at high levels. How important oxygen is and how dangerous the lack of it may be, cannot be stressed too highly. The length of time that an aviator can stand such work varies with the individual.

This in turn can be aided by proper diet and living habits. It has been recommended that persons flying above 10,000 be furnished with chocolate bars, because a diet high in carbohydrates increases an aviator's ceiling from 1,000 to 2,000 feet. The reason for this is that more oxygen is needed to oxidize a fat than a carbohydrate because the fat must have extra oxygen to unite not only with the carbon to form carbon dioxide, but also with the hydrogen to form water. Of course, the actual eating of candy must be done prior to the ascent if a face mask is used!

Diets must consist of nongas-forming foods. The expansion of gas in the intestines at 30,000 feet will be four times what it was at sea level. This expansion will not only cause interference with breathing but will cause distress. Animal charcoal is recommended for the absorption of gas.

Clean living, abstinence from excesses of any sort, and excellent physical condition must be the lot of any pilot who flies or fights at 30,000 feet. Even supercharging pilots before flight cannot remedy the effects of a sleepless night or a hangover.

Finally, what altitude should be considered as the limit to which one may fly? Flight surgeons agree that pilots must not ascend higher than 15,000 feet without oxygen, and better yet, 10,000 feet, if the flight is for some duration. For one thing, anoxia (lack of oxygen) may cause an injury to the brain that is permanent, and as has been pointed out, the effects of anoxia are so unapparent and so insidious that the results are present before they can be counteracted.

It is claimed that 40,000 feet is as high as our pilots can fly even with pure oxygen, adequate training and modern equipment. After that, stratosphere chambers, in which the pressure is maintained at a given figure, must be used. This does not seem to be a good idea, at present, because a single bullet piercing the chamber would cause the pressure to fall, terminating the engagement briefly and painlessly!

Straws in the Wind

(Continued from page 25)

years. Why? Because it was a radically new design. An unusually large replica of the ship having a wing span of thirty-five feet was constructed and tunnel tested. Small items, but important ones from the standpoint of the aerodynamicist, such as the location of the two superchargers and Prestone radiator ducts were fully explored and investigated. Many times the shape, size and location of these "necessities" were changed. Nothing was left to guesswork. Consequently when you see a particularly complex installation on one of our new planes, remember that there is plenty of reason for its location and shape based on actual facts and research. At one time it might even have been a small piece of molded putty placed "just right" on a tiny wing of a model.

Another one of Lawrence Bell's ships, the Airacobra, prize package of all pursuit planes and virtually a "flying cannon," went through practically the same long, drawn-out research. Unique in that its motor was mounted behind the pilot with a drive shaft whirling its air screw, the Airacobra presented a new problem to designers and engineers alike because there was little or no data on such a type airplane motor mounting. Two versions of the ship were tested in wind tunnels at the University of Michigan engineering laboratories. One model had the engine placed conventionally forward of the pilot and the other had the power plant located in its aft position as called for in the plans. The results of the tests proved conclusively that the "idea" was one that had merit. After similar exhaustive tests by Wright Field engineers at the Dayton, Ohio, laboratory, the army fell in agreement with the new radical design and construction work on the new deadly "flying gun platform" was given the go-ahead signal by the the air corps. The results have been encouraging, for the Bell P-39 is regarded here and in Britain as a truly great airplane. It might never have been possible without that small model that proved its merit.

It is necessary to build several types of models of each airplane of new design, thus enabling engineers to study air flow, weight, lifting capacity, pressure distribution and other aeronautical features that affect flying qualities.

The army, at Wright Field, has two wind tunnels used for testing models which are built in the model workshops at the materiel division. One of the wind tunnels is five feet in diameter and the other is fourteen inches in diameter. The larger one is used for testing portions of full-size airplanes and wings, while the smaller wind tunnel is used for testing propeller airfoils.

(Right now, nearing completion at this great aviation research center is the largest wind tunnel in the world. A forty-foot-diameter tunnel that will send air through its funnel at better than 400 miles an hour. It will lead to larger models and in some cases full-size airplanes to be tested here. The "big wind" was built at a cost of more than $2,500,000.)

Skilled workers are hired by Uncle Sam to build the small models that are to be tested in these tunnels. Special templates are made so that the woodworkers can make the models to exact scale. Here is where the cost mounts up. Many hours are spent in cutting the wood to the desired shapes. Extreme accuracy is required, for discrepancies would make the wind-tunnel experiments of doubtful value. These models have to be correct to "hair-line" accuracy.

Lathes for turning out small round fuselage parts and other special equipment have been especially designed for the Wright Field woodworking shops, so that the wood craftsmen have everything at their fingertips to produce the experimental warplane model.

There are generally six types of models: the *performance and stability* model; *pressure distribution* model; *drag* model; *spinning* model; *flutter* model; and the *free-flight* model. Each of these models has its own particular function in producing results for a specified test.

The performance model is complete in every detail and is used to determine the general flying characteristics of an airplane. The pressure distribution model is only part of a model depending upon which portion of the airplane is under consideration, and it is used to learn the amount of pressure that is applied to that particular part of the plane when it is in flight. The drag model is used to find out the amount of resistance offered by the various parts of the model when subjected to the windstream. The spinning model is one tested to make certain that the airplane will recover from a tail spin. The flutter model is used to test the flutter characteristics of any part of the plane. (Flutter can be compared to shimmy in the wheels of your automobile.) The free flight model is used to determine the controllability and stability of the airplane in free flight. These models in themselves and in name represent the types of tests that are run with each in trying to determine generally the all-around performance of an airplane before it is built.

Perhaps the most interesting of the wind-tunnel tests is one that is not carried out at Wright Field. It is known as the spin test utilizing the spinning model. The test is carried out at Langley Field, the N. A. C. A. laboratories, and a vertical tunnel is being contemplated for Wright Field under the rapidly expanding air corps program.

The spin test is conducted in a vertical wind tunnel. The model is dropped into the tunnel in which there is air blowing upward to support its surface. The model is equipped with a delicate and intricate clock-timing mechanism which moves its small control surfaces so as to cause the model to stop spinning. If the model straightens out into a dive, engineers know that the plane is safe for spinning. The model is caught in a net at the bottom of the tunnel.

There are two methods of supporting the performance models in the wind tunnels. One is the National Physical Laboratory's balance scale system, and the other consists of wire attachments. The latter is used at Wright Field, but the new wind tunnel will incorporate the first process.

When the model is suspended in the wind tunnel by wires, the lift and wind resistance can be recorded on balances and scales outside the tunnel. Wires are attached to the wing of the model and as the wind is drawn through the tunnel the model is blown back—depending upon its own resistance—and as it pulls the wires back it indicates on the balance scales outside the tunnel the amount of its resistance. Other wires attached to undersides of the wings indicate its lifting capacity by the same method.

Ordinarily tests in the tunnels are made at an air speed of 100 miles per hour. Using this figure as the basis for their calculations, engineers can learn approximately the speed and performance of any type airplane in existence today.

Flying Box Cars

(Continued from page 29)

$1,000 a day in insurance payments for the idle machine. From New York to Honolulu went new dies and fifty connectors from the Anaconda Wire & Cable Co., for a big construction job held up by a breakdown. To Portland, Oregon, from San Francisco a gear was sped by plane to a cannery, saving 5,000 tons of fresh fish. Several packages containing a plane shaft and weighing 1,000 pounds were flown from Wisconsin to Chile. Detroit shipped vitally needed auto parts weighing 2,000 pounds to Los Angeles. A 1,205-pound shipment of aluminum was planed from Pittsburgh to the Burbank, California, plant of Lockheed. Last January, a 750-pound Diesel crankshaft needed in a navy defense project at Wake Island was rushed by United and Pan American to the Pacific outpost.

All of which makes it as plain as a pikestaff that American aviation is capable, if given an opportunity, of heavy freight operations. With much of the world's air transportation commandeered by the military authorities and stepped up to blitz speed, indicating possibly the commercial pace to come after the war, the time to begin heavy sky trucking is, therefore, *now*, according to some experts. They point out that such operations not only would speed up defense, but would blaze the trails for post-war services which are certain to come. A vast cargo fleet, operated by the U. S. government or privately, is pictured by these men as shuttling back and forth between far-flung industrial points, where vital defense parts are manufactured, and assembling centers, saving days and weeks in the production of finished machines and weapons. And come war time, with its threat of air attack, these ships could operate with considerably more safety than surface carriers.

The possession of such a fleet in time of hostilities, it is further stated, would be invaluable. As Grover Loening, noted aëronautical designer, pointed out to the National Aviation Forum in Washington last year: "We have but to look at the photographs of the most recent German air invasions to see our old friend the trimotor Ju.52—one of the most familiar airliners in the world—doing yeoman service by carrying troops, parachute troops, demountable guns, ammunition and all manner of supplies just like nothing more than a flying freight car."

True, in time of war, the army would promptly take over about 400 of the big airliners now in operation, but expert observers insist at least 10,000 to 15,000 would be necessary in blitz tactics. For example, our defense outposts are yearly stretching farther from home frontiers, which means that to stave off lightning surprise attacks great masses of shock troops would have to be rushed from garrisons and cantonments in hours, not days, to be really effective. Some time ago the U. S. army dispatched several regiments from New York to Alaska, the trip taking thirty or more days, whereas forty to fifty commandeered airliners could have done the job in less than twenty-four hours. In time of war the need of such speed is obviously imperative. With 1,000 planes like the new B-19 the army, for instance, could put down ten divisions in Brazil, 3,000 miles from the U. S. border, in fifteen hours. And no wonder—this great plane has a maximum weight when loaded of eighty-four tons and can carry forty tons of cargo, more than a railroad box car.

But we don't have to look entirely to B-19s; with minor alterations in design, the big combat fleets of Boeings, Martins, Douglases and Lockheeds coming off the assembly lines today could easily be transformed into all-cargo carriers. Moreover, with a standardized blueprint, automobile and aircraft factories all over the land could turn out freighters like doughnuts in a doughnut factory.

As for the United States, the ratio of cargo carriers to combat ships is about one percent, but even as small as it is, the army has long operated one of the world's best air-freight services. "There is an air-freight operation right here in the U. S. and a very successful and efficient one," Mr. Loening also pointed out. "It is run by the U. S. army. Perhaps again, as it did with the original air mail, in 1919, the army will show the way. With no less than seven squadrons of specially equipped load-carrying aircraft some sixty in number, the army moved over 2,000,000 ton miles of freight in the last year, carrying all manner of supplies between the depots at Dayton, Ohio; Middletown, Pennsylvania; San Antonio, Texas; et cetera, to air fields and factories, loads including entire loads of engines, propellers, parts, munitions and even lead pencils. And, of course, all these craft are also fixed for conversion to troop carriers at short notice."

For a number of years, in fact, the army air corps has employed the "DSC," a typical Douglas liner resembling the DC-2, for cargo haulage. A low-wing monoplane, its cabin is thirty-three feet long, its loading door at the after end (some have sliding tops). A DC-5, three-ton carrier, also is in service. But soon to be delivered to the army for troop transport is the brand-new Curtiss-20C, largest twin-engined aircraft ever built in the U. S. Dwarfing in size all transports now operated by the domestic air lines, this ship has a wing span of 108 feet, is seventy-six feet long, is powered with two 1,700-horsepower Wright Cyclone engines (they are more powerful than any commercial transport engines and have electric propellers with three blades), and weighs 40,000 pounds.

Originally designed for substratosphere commercial use as the CW-20, this ship was to accommodate thirty-six passengers as against twenty-one in the current DC-3s, and about 6,000 pounds of cargo. The craft is all metal and designed with two concentric circles intersecting so that the floor joins their points of intersection, thus affording spacious passenger accommodations above and cargo space below. The fuselage is "pressurized" (or supercharged) to enable the plane to cruise at 20,000 feet with equivalent "cabin altitude" of 6,000 feet. Maximum speed is 243 miles per hour. Introduction of cargo is done from a trapdoor at the bottom side. Ready to come off the assembly line of the Curtiss-Wright plant in St. Louis are 200 of these behemoths, all for the army.

It is doubtful, however, that were they being turned over to the air lines, as planned, they would satisfy needs for heavy cargo business. These needs call for a single-purpose, economical all-cargo ship—main bar to full freight operations. This craft must possess adequate hatchways, among other requirements; its floors must be well reinforced.

But in May, 1939, Benny Howard, racer-designer-engineer, announced that he was mapping a flying box car; it was to be a high-wing monoplane, twenty-two feet long, seven feet high and seven feet wide, with a wing span of eighty feet. Tail was to swing out on hinges to permit loading of an 8,000-pound cargo from the rear. Cost of operations was figured at the time at twenty-six dollars per one hundred flight miles. Charles H. Babb, international airplane broker who converts and sells old passenger craft for use as freighters abroad, has designed an even bigger high-wing monoplane for all-cargo purpose; it is one hundred feet long, carries a payload of 11,500 pounds, and unhinges its nose for loading.

Air experts believe that one of the chief drawbacks to past realization of full freight operations has been the failure of shippers and carriers to differentiate between a strictly luxury passenger-express service and straight cargo operations. They contend that such haulage must be based on slower and therefore low-cost traffic. The emphasis, in their opinion, should be on the plane's lift rather than its speed. Indeed, today much of the big airliners is wasted in helping the take-off for long runs. Shorter runs consequently should be the rule, thus providing more payloads. Furthermore, in keeping with the lower standards of these operations, the latest, high-speed craft would not be needed, nor would the numerous and skilled personnel be required, since there would be fewer safety rules to fulfill.

These experts like to conceive an ideal future cargo carrier which might be called a streamlined tin goose, for the way these old trimotors pick up bulky cargoes in their slow-poke fashion is the marvel of air traffic men. Extending the concept further, the future air freighter might well, in their mental blueprints, be a behemoth like the B-19, geared for a comfortable 125-150 miles an hour, a great, huge-winged ship built to carry a whole lot mighty cheaply. It could, too, pull a string of trailers. There seems to be no question in the minds of traffic visionaries that these trailers will play an important part in coming air freight. It has been pointed out, for example, that a Douglas DC-3, slowed to about 100-125 miles an hour, might conceivably pull eight fully loaded "box cars" designed on the same type of plane.

Tentative routes for these projected freight lines already have been worked out in some blueprints. One of the first to be suggested is, of course, that between New York and San Francisco, with vast feeder services tapping adjacent farming and industrial sectors along the way. The American Air Freight Corp., for example, has a pretty good idea of where it wants to operate. Some of the projected runs: Los Angeles to Boston, via Southern points, passing through New York from Washington; Los Angeles to Boston via mid-continental points, also up past New York; San Francisco to Boston via Chicago, Great Lakes points and New York; and Laredo, Texas, to Minneapolis via Kansas City and Chicago. As a matter of fact, the company was the first to file such planned routes with the CAB.

In fact, more than a year ago it was announced that the big air lines were angling to set up the framework for heavy freight operations. Some of the lines, like United, hired management engineers to make surveys. Chester M. Mayer, president of Air Express International Agency, Inc., which promotes air express abroad, is credited with starting the ball rolling, charging that Rail Express Agency (REA), which controls the ground pick-up and delivery service throughout the nation, did little to solicit air business.

At that time the General American Transportation Corp. warned the railroads that if they didn't wake up and combine with the air lines and REA to control the air cargo business, truckers might line up with the air carriers. This was realistically emphasized when the U. S. Freight Co., an important carload forwarder and motor truck operator, named an air freight consultant and mapped the nucleus for a ground system. Some of the railroads also got busy. The Kansas City Southern and the Seaboard Airline applied to the CAB for certificates to operate air freight services. Apprehensive, REA launched a gigantic survey among 100,000 shippers to ascertain future needs of the field.

Last January, an application of informal nature to operate transcontinental air lines strictly for carrying freight was filed with the CAB by the American Air Freight Corp., a newly formed California company. Before asking for a formal request for a certificate of necessity and convenience as air carrier under the "grandfather clause" of the Civil Aeronautics Act, founders planned to devote two years to surveying routes, evolving a ground pick-up and delivery service and developing suitable aircraft. Then in March, Colonel Edgar S. Gorrel of the Air Transport Association announced the formation of Air Cargo, Inc., which will engage in sky carrying of freight and express. The corporation is owned by American Airlines, Eastern Air Lines, Transcontinental & Western, and United Air Lines, which handle about ninety percent of today's air express.

Next after the need for ships of this type to expedite the dawn of widespread all-freight operations, are lower rates. Air lines and shippers together have clamored for a reduction in current high tariffs. Loening and others believe that cheaper charges will be obtained only when the REA monopoly is broken. In July, 1939, Loening demanded a slash in tariffs when, joined by air-line executives, he protested a REA request to the CAB for a certificate to act as a carrier, a request (later denied) which was allegedly made to formalize the agency's grip on air express. Loening at the same time urged formation of a new ground handling corporation to build fifty ships of eight tons immediately.

There are any number of opinions on desirable air freight rates. General agreement appears to be on one point: the larger the payload the lower the ton operating cost. The cost, it is declared by some, diminishes only slightly between nine and one-half and thirteen tons, and in this bracket hovers around five cents per ton mile. Oft-mentioned ideal rate for air cargo is ten cents a mile. REA shippers today pay eighty-six cents per ton mile compared to twelve to eighteen cents by rail. Curtiss-Wright figures cited a flying cost of 6.14 cents per ton mile for flight legs of 200 miles or 5.29 cents for 800 miles. According to these figures, based on operations of the CW-20, with all additional costs, including pick-up and delivery, a ship could operate competitively with railway express. As a matter of fact, stripped down to haul cargo from the River Rouge plant to assembly lines, old Ford geese got the rate down to ten to fifteen cents.

Much talk on a better rate structure has centered on the contention of some experts that a delayed or "deferred" service would solve the problem. Opponents of this view, and foremost among them are REA executives, reply that while American shippers want lower rates, they do not want deferred deliveries.

There is much to be said on both sides, as can be seen, but it's likely that the present national defense emergency will have more to do with settling the question than anything said on what now might be called the side lines. Right now some of the heaviest air freight traffic has to do with shipments to far-flung military, naval and defense projects—machinery, vital parts, bundles of blueprints, supplies, et cetera.

And if war comes, scores of big commercial airliners will promptly have their innards yanked out to make room for troops or munitions. And, any way you look at it—whether we get in or not—cargo ships are bound to take up the slack of military production when the conflict is over. Hundreds of bright, new bombers on the assembly lines will be converted to peaceful purposes. Big business will not overlook its opportunities. Glenn L. Martin has pointed up the whole question with his boast: "Give me enough money to build a ship big enough, and I will build a plane able to carry wheat to Europe cheaper than ocean-going ships!"

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A-20

Fun for young and old. The Potter family of Alexandria, Va.—all three generations of them—at Berlin, N. J., meet. Potters are contest goers.

H. S. Dion, Glendale, Calif., thinks his ship unusual enough to publish. We agree. Don't you? Inspired by P-38, has pusher and tractor propellers.

Model matters

Gordon Light's Dope Can. Moon's On The Field.

THE DOPE CAN. (By Gordon Light.) Recently newspapers carried an interesting shot of forty four-engined Douglas transports lined up outside the American Airlines hangar at LaGuardia Airport. Complete with the airline's insignia and license numbers it looked like a genuine collection of the company's rolling stock. But both caption and close inspection revealed that the airplanes were models lined up for a trick photo. Very clever!

Roy Marquardt has finished his graduate study at Cal Tech and is working in the aerodynamic department of Douglas. We hope he has time to keep up his low-speed wind tunnel experiments so nobly begun a few years ago.

The motto of the South Jersey Gas Model Airplane Association is "Clean Altitude Above All"—which is a good thought for anyone interested in getting more than a few prizes out of the hobby.

The monthly newspaper of the Fresno Gas Model Association is designed to circulate news and ideas among the clubs on the West coast. R. O. Spacy (editor) and E. Weymouth (assistant) put out the first issue last April. F. G. M. A. has a membership of nearly seventy-five with a goal of one hundred by the end of the year. In November, 1940, the club was formed by five builders who thought a club offered the maximum in model fun. John Drobshoff is one of the most successful FGMA members in contest circles. He was the West coast champion in 1940 and won the Air Trails Trophy at the Chicago Nationals.

The hobby lost one of its stalwarts in Robert A. Romeiser. He died last May in Indianapolis after a four-weeks' meningitis infection. *(Turn to page 59)*

Robert Johnson, Bloomingdale, Ill., supplies this action shot of his Comet Sailplane in a glide. Note single wheel.

Elmer Powell and his Brown-powered Scientific Flagship. The smaller ship, his own design, is powered by a Bantam.

MORE ABOUT THE BUZZARD BOMBSHELL.

In June Air Trails the featured gas model kit survey "Your Choice of Kits," mentioned Aircraft's Buzzard Bombshell as a "boxlike contraption." Although these words of an experienced builder who himself regards the Bombshell highly enough to fly one in contests are modeler's lingo, we fear some readers will give them a derogatory meaning.

We want to go on record as saying the Bombshell is one of the best-looking and possibly the finest performer published in Air Trails this past year. Anyone who recalls the Bombshell plans in the October 1940 issue knows what a swell job it is. We said then, "Our nomination for all-American gas job is this Nationals Class C, Open, record smasher."

Photographer says, "This model astonished the experts. Almost flew out of sight on 20-sec. motor run." F. Horch.

MODEL TINTYPES

Ideas both good and "screwy" abound in this latest dream ship collection.

This tricky number features detachable outer wing panels, pusher engine, twin booms, kitchen sink—

Art Gray and prize "finish" model at Berlin, N. J. Has three-bladed prop, Super Cyclone.

How Gray's propeller works. Each blade is hinged near prop hub and folds back in glide, thus reducing air drag.

Centrifugal force holds folding propeller blades in position when the motor is running. Hinges must be strong for safety.

Jack Powell and Bantam-powered gas model won Flight Command best finish contest.

We like this one for its design. Crutch construction, sheet-balsa fuselage, "U" stabilizer, no rudder. Cliff Travis.

This Class A pusher is Robert Harrison's dream ship. Powered with a Megow 199, it flies well. One wheel and fin skids.

John Ullman's Class A, Elf Twin-powered job looks something like a light plane with that nose cowl he's worked out. Nice model, we would say.

Leon Shulman's Super Zombie has inclosed engine, retractable monowheel. Skin friction is reduced by lack of fuselage area. Note folding prop.

Sal Taibi just got a job with the N. A. C. A., but had to take off twenty pounds to do it, hence the sweatshirt. Oh yes, that's a gas model, too.

This Russian what-is-it could be an autogyro, or anything else. Apparently, it's a tail-first, pusher seaplane. Think you'll make one?

George Reynolds, Jacksonville, evidently likes parasols, and the higher the better. Maybe it's because of that hot Florida sun. Ohlsson 60.

It's a stick-up. Charles Richburg, Tampa, uses a four-foot stick and a single-strut wing mount on his job. It's a neat trick—if you can do it.

Frank Hernandez made this snappy racer-type model. Has cockpit with pilot, shielded wing lights, spats. Flies nicely.

Geodetic wings distinguish Elmer Wassman's gas job. Spars are eliminated. On the whole, it looks a whole lot easier.

One way to launch a gas buggy. Mac Jurist just grabs his Atom job by boom and let's go.

NOMAD

Pod-and-boom aerodynamic efficiency make this realistic Class C gas model a top-notch performer.

BY CHARLES HOLLINGER

The Nomad is based on experience gained from two earlier pod-boom jobs.

Long-tail moment arm enables Nomad to handle Ohlsson 60s, Super Cyclones.

And here is the intrepid pilot himself, goggles, helmet to boot. Balsa block.

THE Nomad marks the third endeavor of the designer to create a top-notch flier using the pod-and-boom arrangement as a basis. Wind-tunnel tests show that it has the least drag of any fuselage design and there is practically no fuselage interference where the tail surfaces are concerned, regardless at what angle it may be flying. Why isn't it used more? The answer is that most modelers don't like the type of construction that is required, namely, planking and the bending of sheet for the boom. This slight extra work is well repaid by the performance that is gained.

In the month of May, 1939, the first of this series made its appearance. The model was designed with efficiency (high lift and low drag) as its keynote. An 8-foot wing span, 4-foot stabilizer, double rudders and short moment arm (to keep cross section to a minimum) resulted in a remarkable gliding angle of 12:1. I know that when this is called remarkable there will be some who will say, "Shucks, that's nothing, my rubber model has nearly a 20:1 glide." Wind-tunnel tests have proven this to be absolutely untrue. We of the Tacoma Gas Wings Club have found through tests and observations at contests that the best rubber-powered models have a glide ratio of about 6:1 and the best gas models of approximately 9:1.

Well, we had better get back to the model. True, it had a fine glide coupled with a slow sinking speed, but there was one bug and that was stability. Under low power it left nothing to be desired, but when the Brown D was opened wide it couldn't be counted on. This was due to the short moment arm, small rudders and lack of sufficient dihedral.

In the second design some efficiency was sacrificed to attain proper flight characteristics. Features of this model were an inverted M&M motor of .23-cubic-inch displacement, stabilizer on top of the rudder and a fifty-percent moment arm. This little 42-inch job proved to be a fine flier, at least good enough to win two first places, one in a thirty-mile wind with a time of 3 minutes, 54 seconds. Susceptibility to right spirals was its undoing later.

With the experience from these two as a guide, the Nomad was formulated in March, 1940. At that time a retractable gear had been planned for it, but this was passed over for the sake of simplicity. A single rudder was used because *(Turn to page 56)*

SPECIFICATIONS

WING SPAN	78"
WING AREA	SQ FT.=6½
WING LOADING	8 OZ
LENGTH	60"
POWER USED	OHLSSON "60"
PROPELLER	14-15"

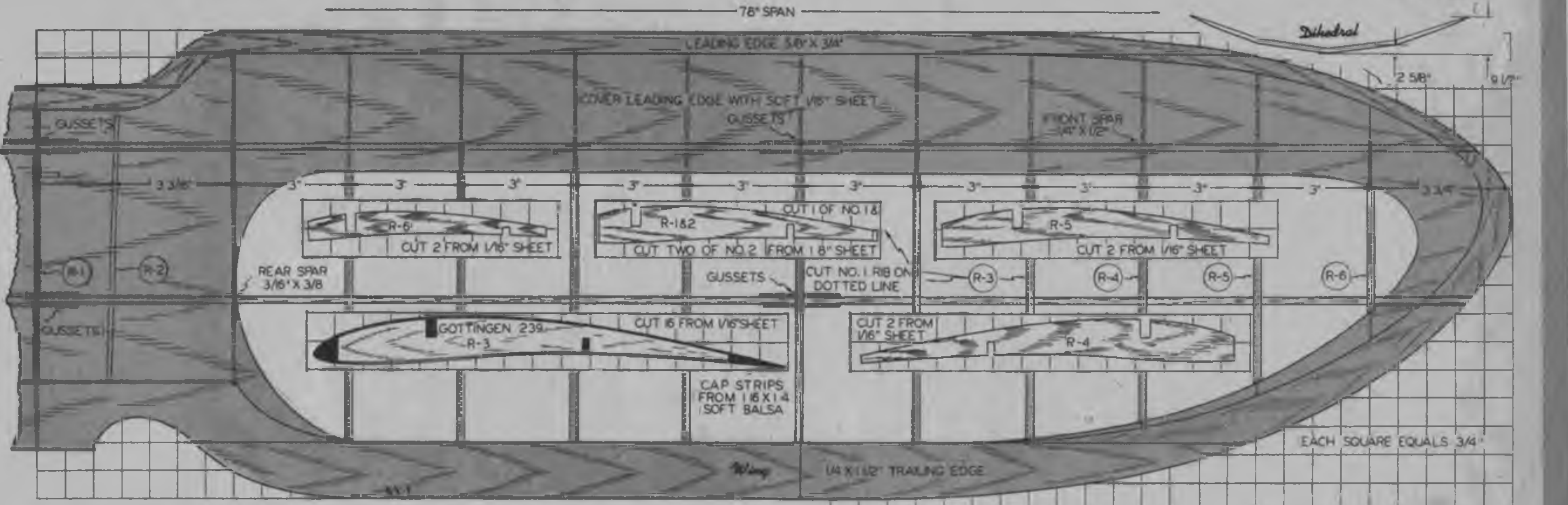
WEIGHTS

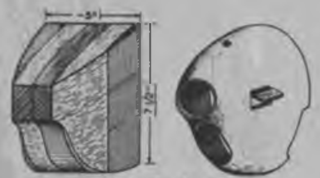
WING	12 OZ.
FUSELAGE	38 OZ.
TAIL SURFACES	3 OZ.
TOTAL	3 LBS. 4 OZ

ANGULAR SETTINGS
(TAKEN FROM CENTER LINE OF FUSELAGE)

WING	2° POS.
STABILIZER	0°
MOTOR	2° NEG.

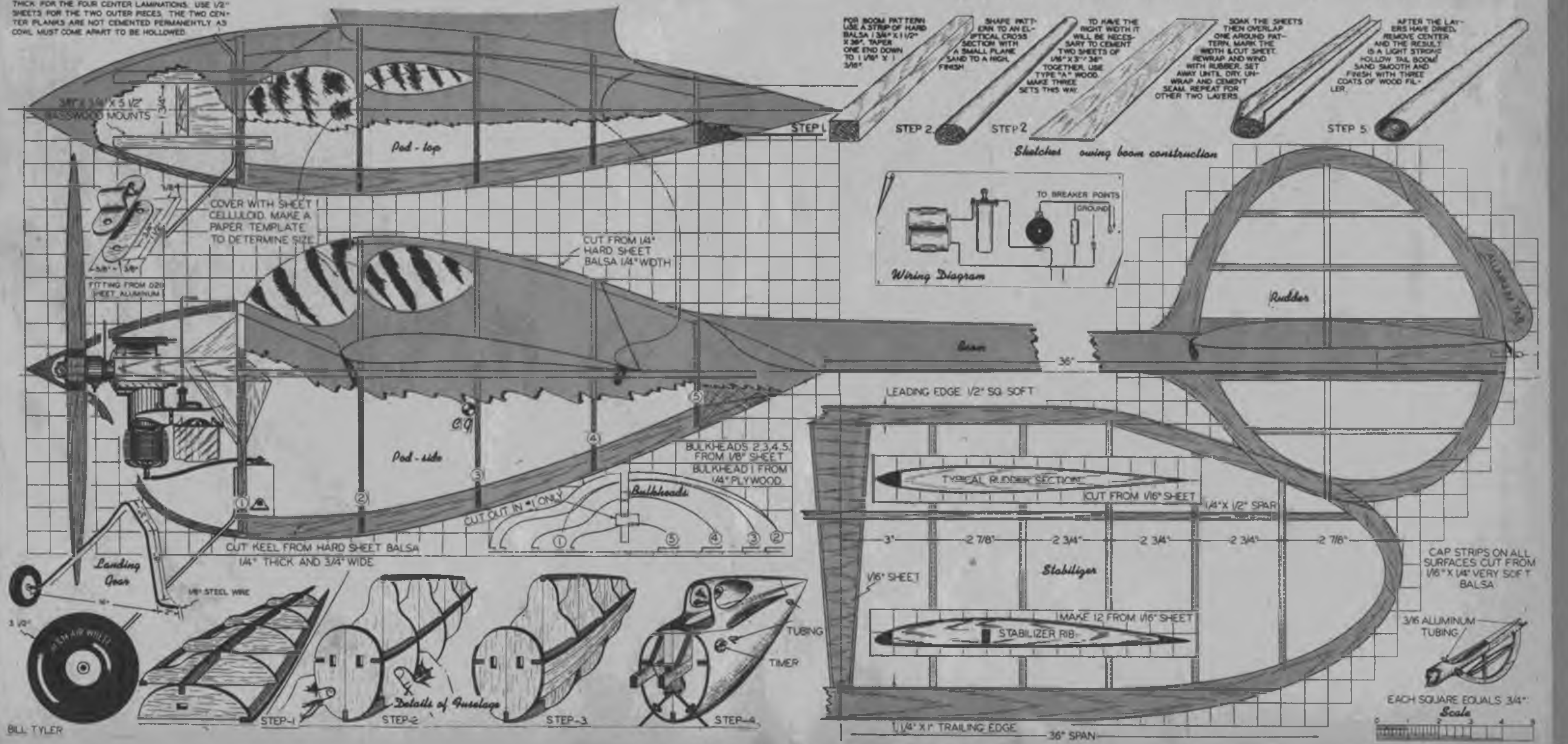
3° LEFT THRUST





Motor Cowling

BUILD UP COWLING FROM SOFT PLANKS OF BALSA 1" THICK FOR THE FOUR CENTER LAMINATIONS. USE 1/2" SHEETS FOR THE TWO OUTER PIECES. THE TWO CENTER PLANKS ARE NOT CEMENTED PERMANENTLY AS COWL MUST COME APART TO BE HOLLOWED.



Putting finishing touches on batch of Grumman midwings, part of an order of 1,500. Note DC-4.

Pouring molten white metal into small prop mold held in vise.

MODEL CAREER MEN

Joe Battaglia makes a scale hobby into a career.

JOE BATTAGLIA has been building models for twenty-two years. Says Joe, "It started with one of Mom's best table knives and a crude attempt at carving a weather-vane propeller. That was before balsa wood. But we had gas models, believe it or not."

Even Joe himself has no idea of how many models he's built. Certainly it runs into the thousands. He recently turned out 1,500 metal Grumman midwings in three months. His largest job, a six-foot Pan American Clipper, required six months. Somehow, he found time enough to have a fling at making boats, trains, liquid-powered rockets, toys and what-have-you. But Joe's outstanding success has been his precision custom-made model airplanes.

How he makes metal models is shown on these two pages.

Sawing wood wing blanks for Stinson. After assembly carved blanks become pattern for plaster casts from which bronze molds are made.

This Pan American Clipper was a six months' job. The plane itself is wood carved, but the pedestal is cast. Some Battaglia models are on display in museums.

Plaster is poured around model to make casts. Casts are then duplicated in bronze for molds. White metal is cast in the bronze molds.

Recent Battaglia models. British Grumman is cast, others built from wood on special order for airline official. Ford, right, has covering corrugations. Fairchild 71, front right.

Joe holds wooden pattern of DC-4. Left and right plaster cabin core molds against wall. Sand packed between them and baked to form core for making of the final bronze mold.

Paint trimming is done with an airbrush. The unpainted sections are protected by metal mask. These models are seen on display all over the country in air transportation offices.

Finished transport models sell for about $35. The molds cost as much as $900 apiece. Thus an order for 1,500 Grummans worked out for $5 apiece.

SLIDE, RULE, SLIDE!

BY GEORGE HUGGINS

THE beginner who is now building, or who has just completed his first gas model, is considerably handicapped by his lack of some of the finer technical aspects of this interesting sport. The following formulas will enable the veriest tyro to compete with builders of greater experience.

MOTOR SPEED

When discussing your pet motor, you must always assume a motor speed of 10,000 r. p. m. When discussing relative merits of other motors, you are to assume speeds of not over 4,000-5,000 r. p. m. However, when relating some particularly sensational flight of your own, you must never concede that your motor has developed high speed, but it must invariably be described as having run at "part throttle," "four-cycling," or "just barely turning over."

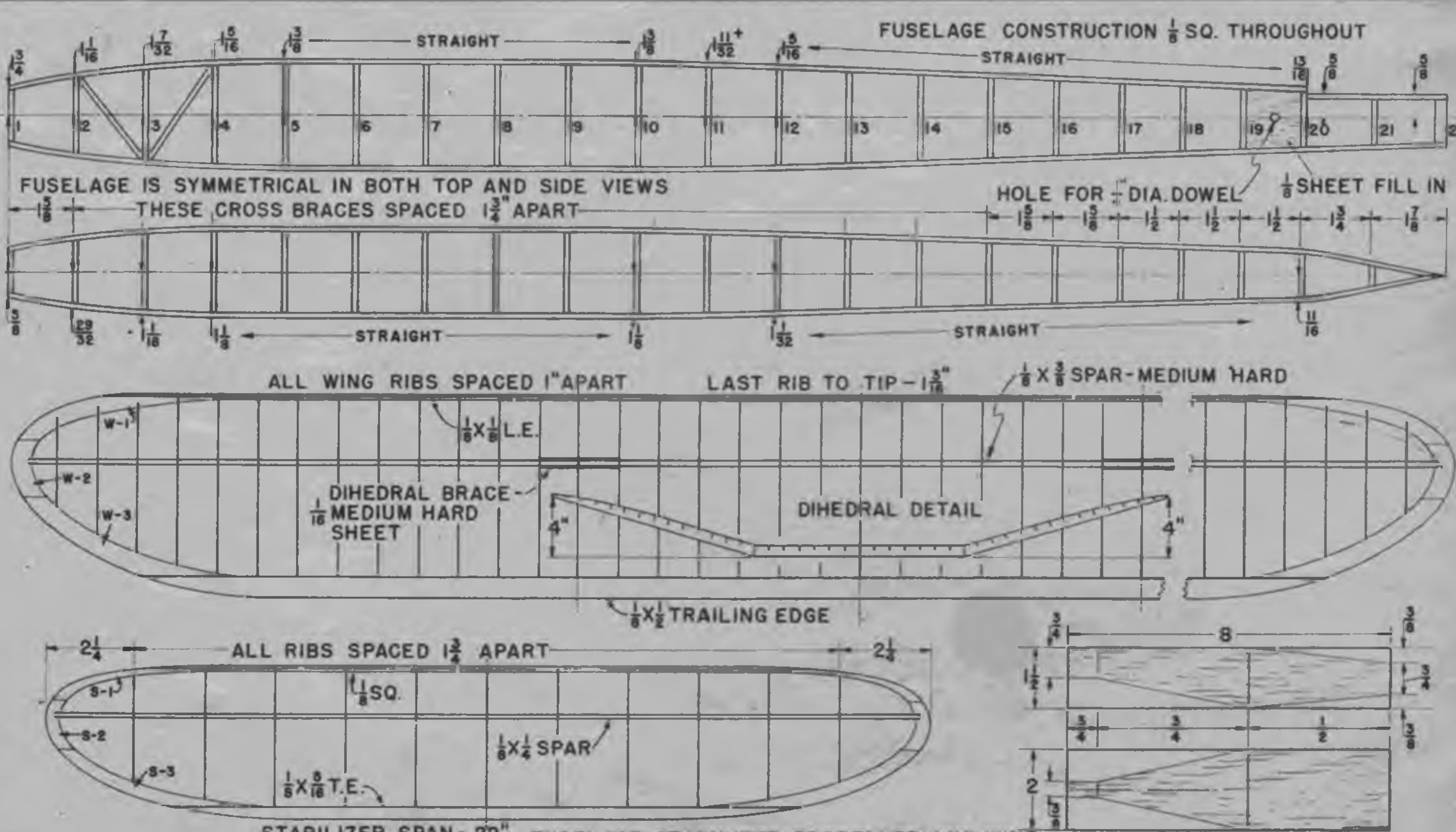
RATE OF CLIMB

All gas models previously climbed at the rate of 1,000 feet per minute. This got rather monotonous, so it must be assumed now that all gas models climb at the rate of 2,000 f. p. m. When your motor cuts off, your altitude can be ascertained readily. If you are still able to read the manufacturer's trademark on your airwheels, your ship is 500 feet high. If estimating the height of a friend's or competitor's ship, similar altitudes can be taken as fifty feet or "barely off the ground."

GLIDING RATIO

A ratio of 10:1 is very favorable indeed, but due to the fact that you have "modified" the airfoil section, you should easily be able to claim a glide ratio between 18:1 and 22:1. Fo *(Turn to page 57)*

MULVIHILL TROPHY WINNER



FUSELAGE, STABILIZER, PROPELLER AND WING ARE GIVEN ONE-QUARTER ACTUAL SIZE.

MULVIHILL TROPHY WINNER BY HOMER HELLER

THIS model was completed the week before the Nationals and was first test-flown in Chicago. During the tests I was able to average between 3½ to 4 minutes quite consistently. On its first official flight on the day of the contest it flew out of sight after almost twelve minutes (11:54:7) and another ship was used to complete the day's flying.

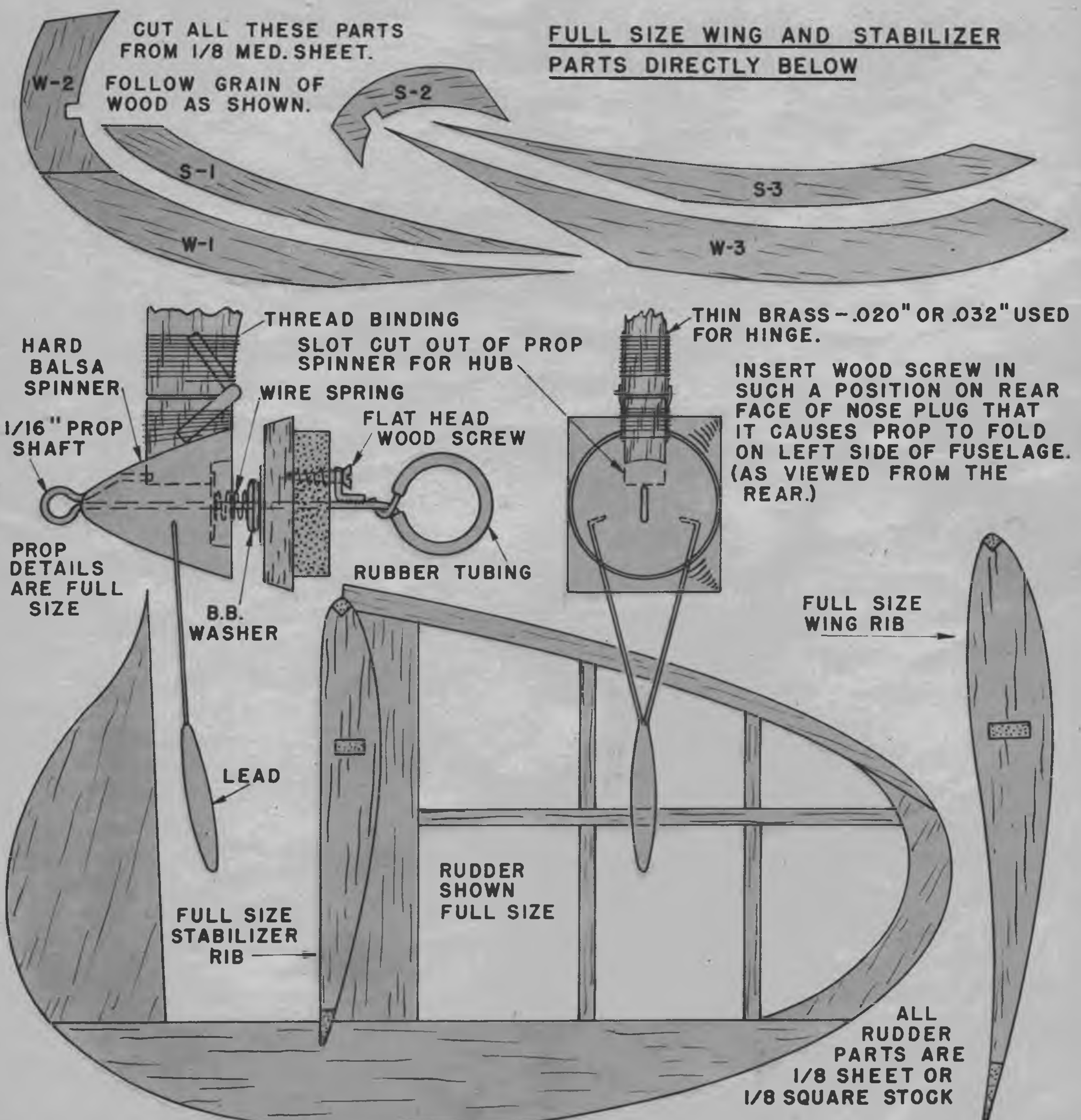
CONSTRUCTION

The fuselage is built in the conventional manner, by first making two identical sides, one above the other to insure similarity of shape. The longerons should be ⅛" square hard balsa and the cross braces ⅛" square medium soft balsa. The two halves are then joined by cementing the cross braces in place, starting at the widest portion and working toward each end, and thereby forming a rectangular fuselage. The front and rear ends are both filled in with ⅛" hard sheet balsa as indicated on the plans.

The wing is built in three 14" panels, which are joined after all are complete. The dihedral breaks are reinforced with 1/16" hard balsa. The ribs are made from 1/16" sheet (soft) balsa. See plans for further details.

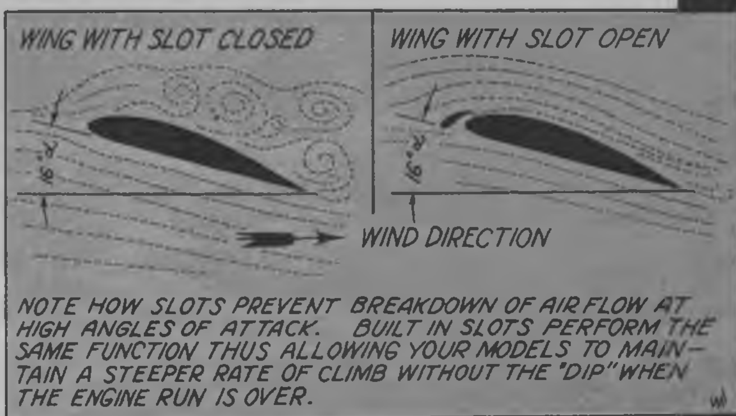
The stabilizer is built in much the same manner as the wing, using wood sizes and grades as specified in the plans. The rudder has a flat cross section of ⅛".

The propeller is carved in the usual manner from a medium block of balsa, measuring 8 x 1½ x 2". Cut the blade to about a ⅛" cup at the halfway point, diminishing to a *(Turn to page 65)*



WHY SLOTS?

Massachusetts Institute of Technology tests prove value of "letter-box" wing tip slots.



Bill Tyler, left, shows Doug Corrigan details of the Jordan-Marsh slow-speed model wind tunnel in Boston. Model aerodynamics are a specialized problem.

BY JACQUES SHAW and BILL TYLER

THE use of slots in aircraft wings, in recent years, has become increasingly popular. To determine whether the benefits derived from slots by full-scale aircraft are applicable to model aircraft, a series of tests were run off in the four-foot wind tunnel at the Massachusetts Institute of Technology.

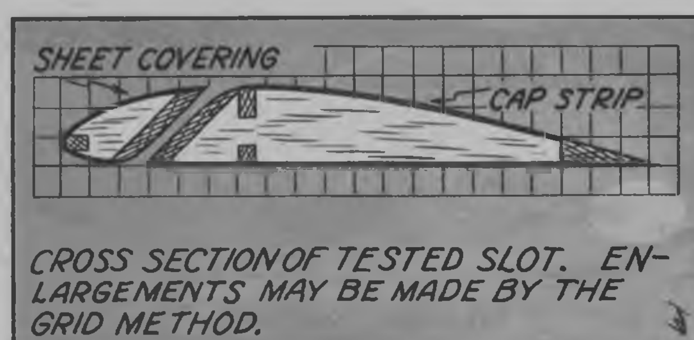
The basic qualitative theory of the slotted wing is relatively simple. We may consider the portion of the wing ahead of the slot as a wing itself. This "wing" acts on the air passing over it just as any wing will, and there is a resultant downwash off the trailing edge. This effect, combined with the speeding up of the air stream in the slot itself because of its venturi tubelike construction, allows the stagnation point of the boundary layer to occur much closer to the trailing edge. The location of the stagnation point determines where the streamline flow is going to break away from the wing, or where "burble" will start, for this burble point creeps up toward the leading edge, determining how completely the wing is stalled.

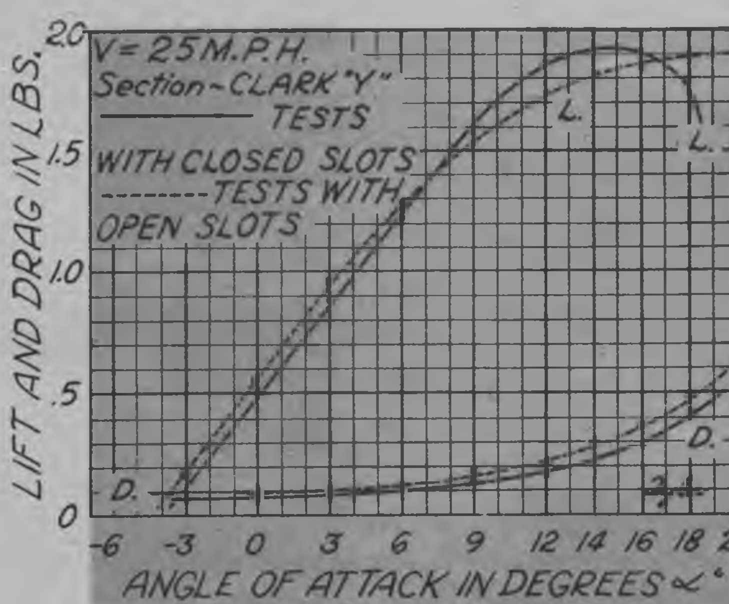
To insure uniformity, the same test section for both the slot and nonslot observations was used, this being made possible by the simple expedient of doping a small piece of tissue over the slot openings.

The test section itself was of standard proportions for the particular tunnel used. It had a 30-inch span, aspect ratio of 6—1, constant chord, Clark Y airfoil, and square tips. With the exception of square tips, the section is typical of many wings in use, and it was learned that the tip shape had negligible effect on our results in this case.

The structure and finish of the section were made to conform as closely as possible to an average gas-model wing. Specifically, the ribs were spaced 2 inches apart and capped, and the leading edge was sheeted. The slots were 9 inches long, and placed on the tips.

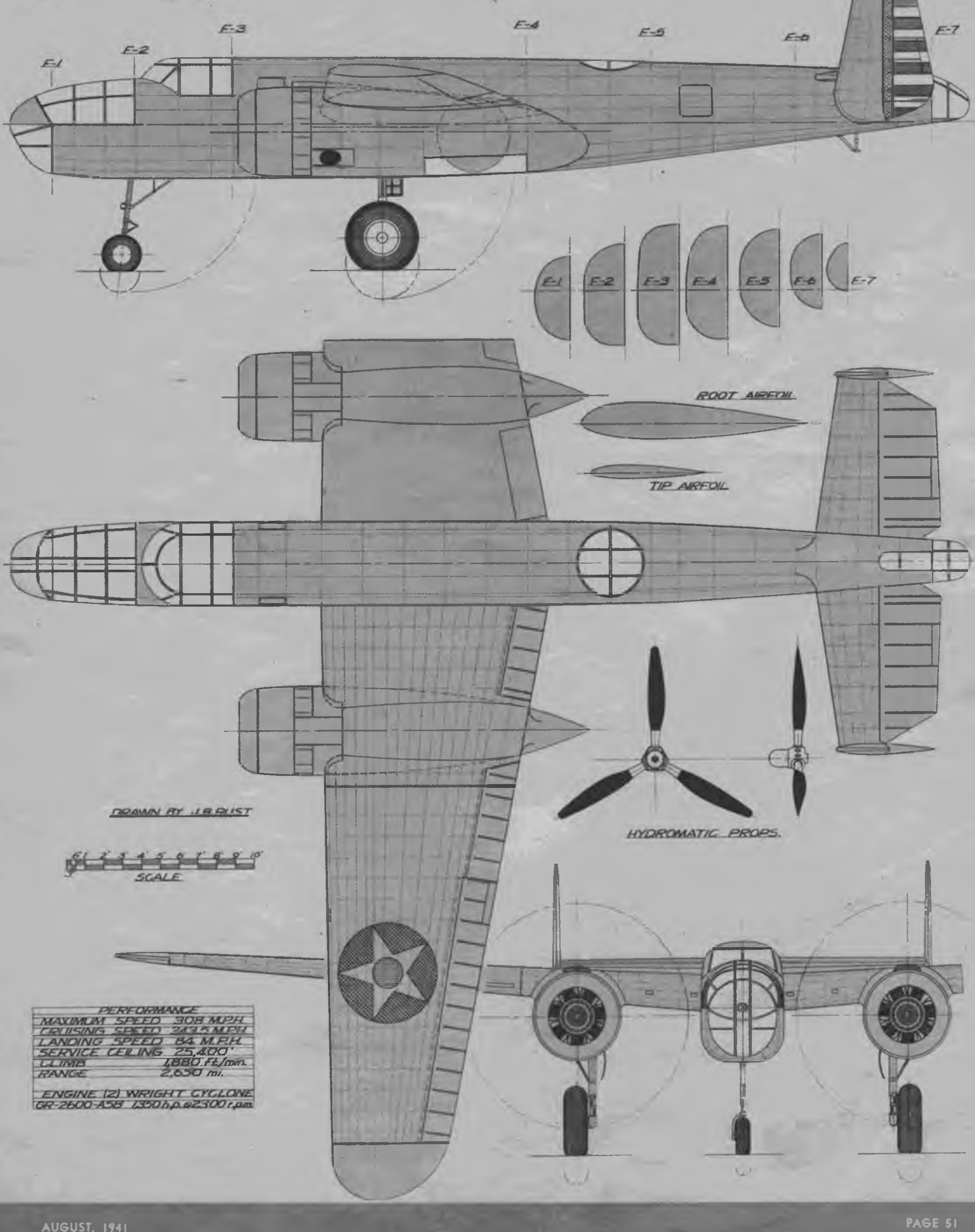
It can be seen from the plots of lift and drag that substantial advantages may be obtained by the use of slots, accompanied by some slight disadvantages. Note the lift curve of the nonslot wing. It rises in conventional manner along a virtually straight line and then rounds off rather *(Turn to page 65)*





NORTH AMERICAN B-25 Army Medium Bomber

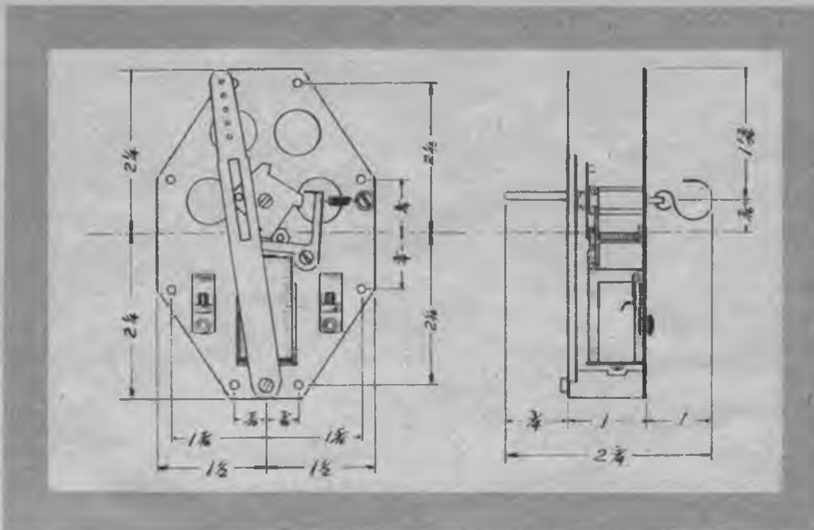
SPECIFICATIONS:	
SPAN	67' 6"
LENGTH	51' 5"
HEIGHT	14' 10.5"
WING AREA	610.1 Ft²
WING LOADING	39.33 lbs./Ft²
POWER LOADING	7.5 lbs./h.p.
EMPTY WEIGHT	16,000 lbs.
GROSS WEIGHT	24,000 lbs.
FUEL	916 GALS.



PERFORMANCE	
MAXIMUM SPEED	308 M.P.H.
CRUISING SPEED	243.5 M.P.H.
LANDING SPEED	84 M.P.H.
SERVICE CEILING	25,400'
CLIMB	1,880 Ft./min.
RANGE	2,650 mi.
ENGINE (2) WRIGHT CYCLONE	
GR-2600-A5B 1,350 h.p. @ 2300 r.p.m.	

NEW RADIO CONTROL ESCAPEMENT

Left or right rudder does not depend on proper series of pulses; automatical return to neutral.



RECENT trends in the radio-control field have been toward standardization of two basic control systems. One employs the rubber-powered escapement mechanism originally introduced by Ross A. Hull and the other utilizes the reversible miniature electric-motor drive with limiting switches first described by Clinton B. DeSoto. The advantage of the escapement system include lightness, simplicity and economy, while the motor drive excels in reliability as well as offering a variable degree of control.

One reason why the motor drive is more reliable than the rubber-powered escapement is that it can be fitted with a centralizing switch. As used in the RCH (Radio Control Headquarters) No. 1345 control-drive assembly, this switch always returns the control to dead center, either at the option of the operator or automatically when the control is released. Furthermore, the determination of right or left rudder is a positive operation and does not depend on the proper series of pulses, as is the case with the escapement.

"Why isn't it possible to endow the escapement mechanism with these same qualities?" we asked ourselves. There followed long sessions over the drafting board, a succession of experimental models—and finally the idea came along that turned the trick, an idea so simple that we wonder now why we didn't think of it in the very beginning (as is usually the case with ideas of that sort). All it takes is a few changes in the escapement disk of a standard RCH No. 121 escapement—and presto! we have a device that gives us right rudder when we push the button once and left rudder when we push it twice. What about neutral? Why, neutral is restored the moment we lift our finger from the button. When the signal is turned off the escapement goes back to neutral.

We best can describe the new escapement by first giving the principles of the standard RCH No. 121 escapement *(Turn to page 58)*

★ ★

DOUBLE-DECKER

BY AUSTIN RINALDI

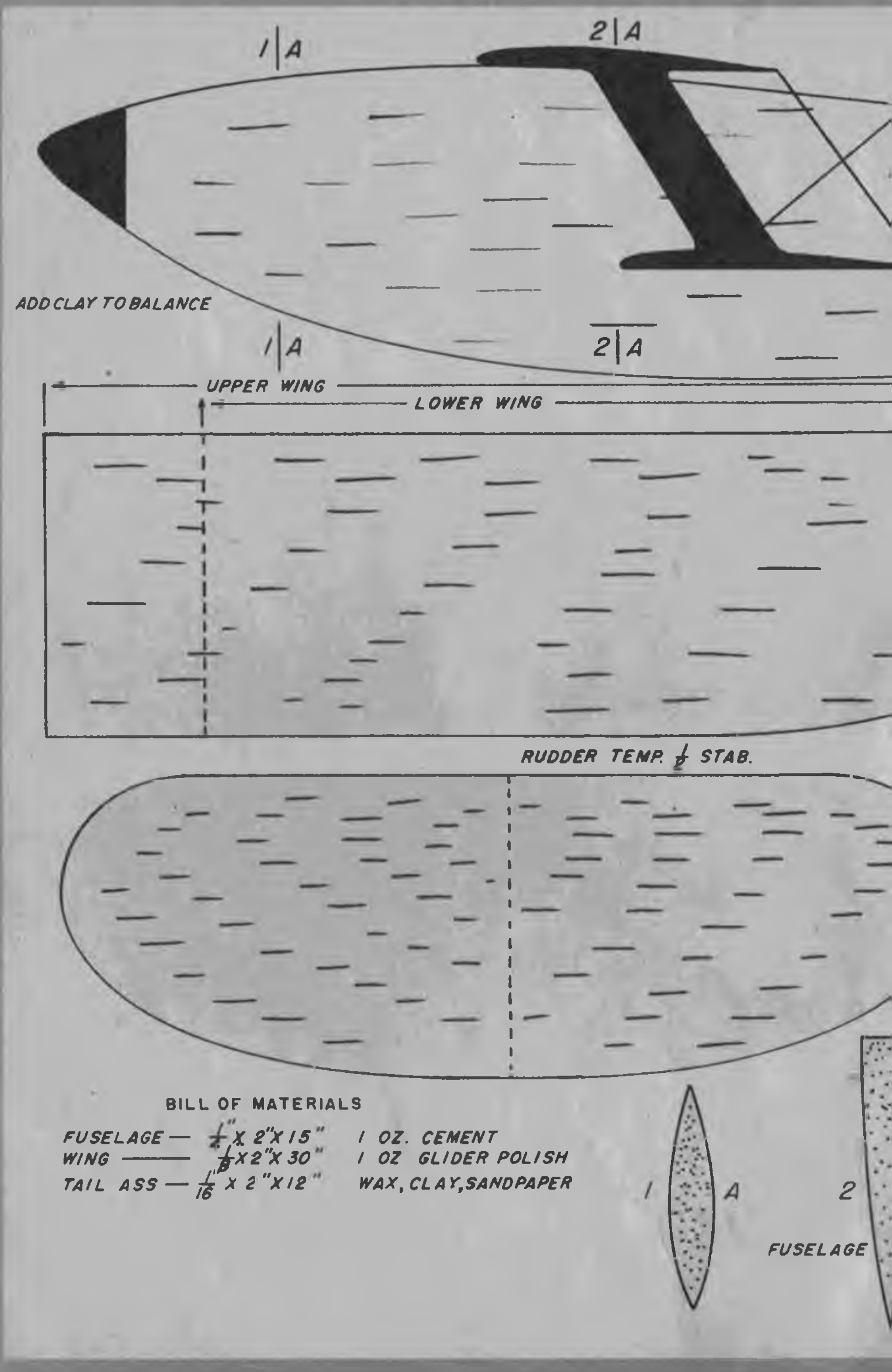
This nifty all-balsa biplane glider has plenty on the ball. Wait until you see it fly.

HERE it is, something different—a Class B hand-launch biplane glider that's a peach in looks and in flight. Despite the theory that monoplane gliders are superior, this ship was designed, and after some changes here and there, has proven itself in many contests a match for the ordinary monoplane glider. It is of simple construction and can be easily built by anyone who has made other gliders. It is just the job for you model builders who are getting tired of that same glider everyone brings to the contests. This ship can also be used as a catapult glider by cutting a catapult groove in the lower section of the body. Not once while being catapulted has it looped, but climbs until the power is exhausted and soars around, turning in good flights.

But without going any further, the picture and plan impress you enough. Check the bill of materials printed on the plan and see how little it will cost to build this biplane glider.

CONSTRUCTION

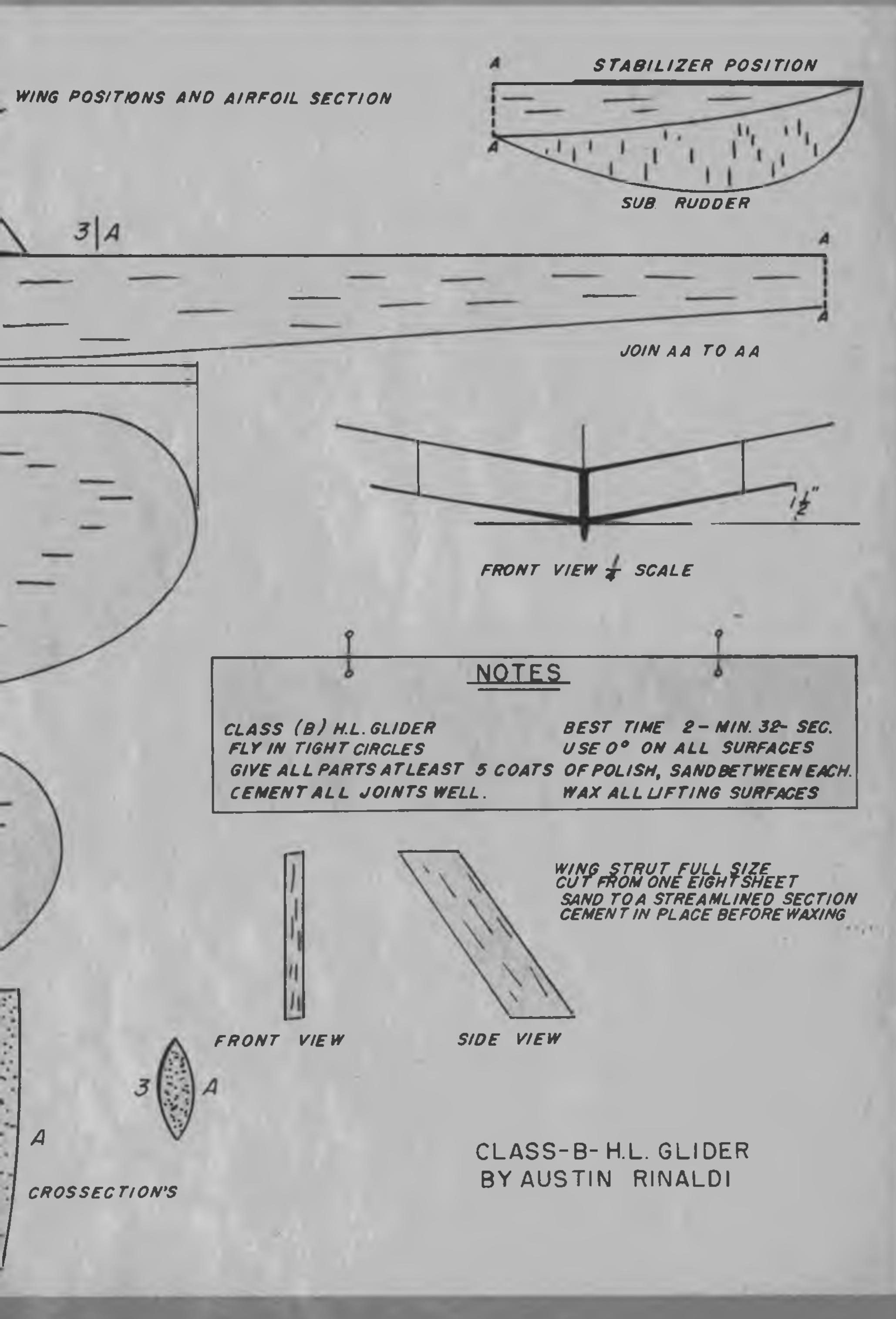
The first job in construction is the wings. The plans are full size, so all you have to do is trace the wing pattern on a sheet of ⅛ x 2" medium-size balsa and cut to shape the four half wings. Sand these to the airfoil given on the plan. When this is done glue in dihedral of both wings (making sure that both wings have the same amount of dihedral) and then set aside to dry. When dihedral is completely dried, polish wings with either clear or colored dope, whichever you prefer. The next thing is to cut out body from ¼ x 2" sheet of medium-hard balsa, sand to cross section as given on plan, and rub a coat or two of glue into body to strengthen it before polishing. In cutting out slot for lower wing be sure that it is set at 0° incidence (this is very important) and cut groove for upper wing which must also be set at 0° incidence. Then glue lower wing in place. When it dries, glue on upper wing, and while that's drying, cut out stabilizer and rudder from $^1/_{32}$" sheet balsa. Sand these to streamline airfoil, polish. Glue stabilizer to body, setting it at 0° incidence. Then glue on rudder, and cut wing struts from ⅛" sheet balsa, sand to streamline and glue to position as indicated on plan. *(Turn to page 58)*



BILL OF MATERIALS

FUSELAGE — 1/2" X 2" X 15"
WING — 1/8" X 2" X 30"
TAIL ASS — 1/16" X 2" X 12"

1 OZ. CEMENT
1 OZ GLIDER POLISH
WAX, CLAY, SANDPAPER


WING POSITIONS AND AIRFOIL SECTION
A
STABILIZER POSITION
A
A
SUB RUDDER
3|A
A
A
JOIN AA TO AA
1½"
FRONT VIEW ¼ SCALE
NOTES
CLASS (B) H.L. GLIDER
FLY IN TIGHT CIRCLES
GIVE ALL PARTS AT LEAST 5 COATS OF POLISH, SAND BETWEEN EACH.
CEMENT ALL JOINTS WELL.
BEST TIME 2 - MIN. 32- SEC.
USE 0° ON ALL SURFACES
WAX ALL LIFTING SURFACES
WING STRUT FULL SIZE
CUT FROM ONE EIGHT SHEET
SAND TO A STREAMLINED SECTION
CEMENT IN PLACE BEFORE WAXING
FRONT VIEW
SIDE VIEW
3
A
A
CROSSECTION'S
CLASS-B- H.L. GLIDER
BY AUSTIN RINALDI

DOWN THE RUNWAY

Official aeromodeling news compiled by the Academy of Model Aeronautics, governing body of model aviation in America.

CONDUCTED BY AL LEWIS, EXECUTIVE DIRECTOR

Lucky 711? One thing about the Academy of Model Aëronautics that makes it different from most organizations is that there are no free memberships or gas model licenses issued. In other words, any youngster can pay fifty cents or one dollar for a license with the knowledge that even the oldest enthusiast or important leaders in the model industry must also pay a similar sum if they desire to enter formal competitions.

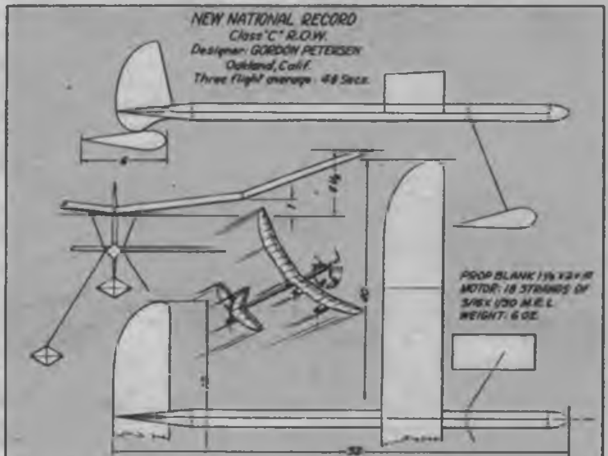
Because of this it will be of interest to know that one of the newest licensees of the Academy of Model Aëronautics is that well-known problem child, Mr. Charlie McCarthy, whose protégé, a young chap named Edgar Bergen, is a well-known private flier and amateur ventriloquist.

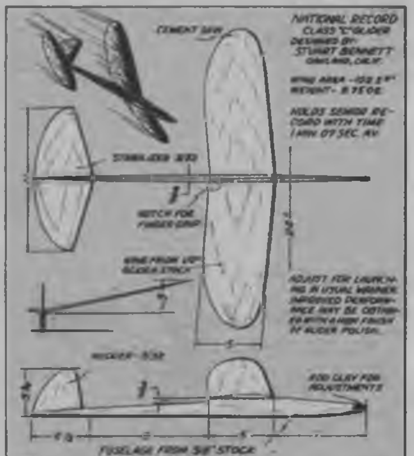
Modelers may recall young McCarthy's exploits with model airplanes which consisted mainly in scaring the daylights out of contest officials. It seems in one of the meets in which Charlie entered, according to subsequent revelations aired over a national network, that he took delight in mowing down the contest directors and it was only their agility and experience that saved them from being demolished by Charlie's craft. In forwarding McCarthy's application for gas-model license, this other chap, Bergen, said that Charlie has changed his way of living and in signing the gas-model pledge has agreed to live up to the safety-first principles established by the Academy of Model Aëronautics. In recognition of this complete change of character, the A. M. A. officials awarded No. 711 to C. McCarthy, and at last reports he had received his credentials and was more than pleased with materials issued by Academy headquarters in Washington.

★ ★ ★

A Few Plain Words. In these times of national defense and increased aviation activity, model builders throughout the country, and especially leaders of the activity, must realize that they have a responsibility when it comes to flying model aircraft. Models must not be flown in congested areas near cities, near large highways, on or near established air ways, or on or near an airport without the full approval of the airport director. These are not just commonsense regulations set by the Academy, they are Federal rules and ones that cannot be violated under any circumstances.

A certain amount of laxity has crept into the model program with the introduction of thousands of new model fliers during the past year or so. That we must become more careful and considerate is evidenced through the following letter *(Turn to page 58)*





"DON'T QUOTE ME!"

Talk of the trade as overheard in factory, field, store.

Harry McCall and Cleveland Shop.

MACO MAKES GRADE

LIKE many another model airplane firm, the West Side Model Distributors of Cleveland, Ohio, started in life as a distinctly different enterprise. Back in 1933 H. D. McCall, president of the concern, launched a secondhand magazine firm in a corner of a plumbing shop in Cleveland. Maco—as his friends know him—was assisted by his wife, and the little firm added a few model kits and supplies as a side line shortly after the business opened.

The first shop was by no means pretentious. Library tables served as counters, but business was so good that within a month larger quarters were sought. The firm remained in the new location for two years, when it was moved to its present location at 9609 Lorain Avenue. By that time Maco really began to build up his model business, and after a visit to Chicago and the *(Turn to page 66)*

Harry runs American Airlines Club.

QUERY: Is there any truth in the rumor that Jack Keener, Madewell Motors, Oakland, California, is contemplating the production of a Class B engine to sell for $12.50?

We hear that Ohlsson & Rice Manufacturing Co. is thinking about capturing the medium-priced Class C engine market with a low-cost "60."

At this writing there is still no word from the Model Industry Association as to what success their committee has had with the O. P. M. Looks bad!

The distributors of the Xacto line (high-grade hobby knives with surgical blades) will soon introduce one or two low-priced numbers selling for 15 and 20 cents.

High cost of paper board reflected in the price of boxes has affected tremendously the manufacturers of model kits, particularly the low-priced ones. Fred Megow urges some action by large users to prevent unjustified skyrocketing of box prices.

Ben Shereshaw, president of Miniature Motors, Nutley, New Jersey, manufacturers of the Bantam, is teaching drafting in a Newark defense school. If you cannot get any materials, might as well do something useful elsewhere!

American Junior Aircraft Co. is discontinuing its warehousing facilities in Bush Terminal, Brooklyn, due, no doubt, to the fact that every boat shipment east of this ever-increasingly popular line is sold before the boat arrives in New York. Shortage of material and steel have caused the discontinuance temporarily of the 10-cent Coast Guard models. Perhaps future versions will have plastic engines and nacelles!

The Comet 35, which has been going to town, is undergoing a few minor improvements in the arrangements of the extended needle valve. Bill Bibichkow of Comet Model Airplane Co. was in the East recently and visited the Academy's headquarters in Washington. He has been the "spark plug" of the Model Industry Association's Show Committee.

Berkeley is working on three Apache kits, based on the Air Trails design by Henry Struck. Plastic construction will be used extensively, eliminating need of shaping nose blocks, et cetera. Berkeley recommends their Brigadier for beginners. Ready in August, it will be a new streamlined.

Burd Model Airplane Co. has appointed D. D. Boselly, 5053 Range View Avenue, Los Angeles, California, their Pacific coast representative who will warehouse Burd's complete line of popular-price model airplane construction kits at 4207 N. Produce Plaza, Los Angeles.

This set-up enables Pacific coast dealers and jobbers to obtain Burd models without having to wait for the merchandise to be shipped from Baltimore.

Don't quote me, but it is being rumored that the largest stock of Strombecker airplanes, guns, boats, trains, Bill Dings and tanks in the State of Pennsylvania is now in a warehouse in Philadelphia. It might be wise for the Pennsylvania dealers who have experienced difficulty in getting their Strombecker orders filled to write to M. B. Spotts, wholesale model distributors, 3141 N. Broad Street, Philadelphia, who has *only key* to that warehouse.

Bill Effinger, Jr., of Berkeley Models in Brooklyn, honeymooned in Bermuda. We wonder if his Clipper flight will influence new design trends by Berkeley.

BY THE TRAVELING SALESMAN

Nomad

(Continued from page 44)

they have proven less sensitive than the double type. Most persons remark about the long moment arm employed. This is to handle the "hot" motor at full power. The midwing was chosen for a speedy, unhesitating climb, and because a cabin could be placed over the wing blending with the design nicely. For more realism a dummy pilot was carved which added a great deal to the appearance. Why not try him in one of your future ships?

CONSTRUCTION

We'll start with the pod first by laying out the center line, marking intervals of three-quarters of an inch and then connecting, which will form the graph. If you don't care to use this method, use a pair of dividers and enlarge six times. Mark out the location of the bulkheads accurately by using the dimensions from the top view. Be sure to use hardwood for the four keels. Follow the steps shown for the construction of the pod fuselage. In planking use soft sheets of 1/8 x 2 x 18" that are cut to a width which can be worked easily, about two inches wide on the shallow curves of sides and about one-half inch wide on the sharp curves of the top and bottom. Taper the tail ends down, of course, and wet the outside of the pieces before gluing in place. This simplifies the job a great deal. After planking is completed and roughly sanded, cut out the tail block from a piece of soft wood 2 1/4 x 3 5/8 x 4 1/8". Apply a coat of cement to rear bulkhead and tail block. Let them dry and apply the second coat on both, then put together. This must be cemented well because the tail boom is attached to it.

The plans show clearly the various steps in the construction of the tail boom. Just remember to put a strip of wax paper under the seam before you glue the first layer. Also keep the core free at all times by moving it out slightly, as each layer is cemented. If this isn't done the drying cement, which contracts when drying, will make a very tight fit and make it necessary to cut and recement. You don't have to soak both sides of the sheets; just the outside of the bend will do the trick. Each layer is to be formed and dried before gluing.

After the boom is finished it is ready to be attached to the pod. Set the pod on a level keel first, holding in place with blocks of wood, books, et cetera. Cut the large end of the boom to fit pod, using the plans as a guide. When fitted correctly, coat both with a generous amount of cement and put in place. Check with a level to see that it is right. After setting for at least eight hours, mix some balsa dust with glue to the consistency of a paste and apply at joint, making a generous fillet. Let dry twenty-four hours and sand to a smooth surface. This is the whole strength of the connection, so do it well. It's surprising how strong this mixture is when properly worked.

Finish the pod and boom down with coarse to fine sandpaper. Apply three coats of wood filler and one coat of clear dope, sanding carefully between each coat.

Form the landing gear from 1/8" spring steel wire and attach with aluminum fittings as illustrated. The wheels can be made from two layers of 1/2" sheet balsa 3 3/4" diameter, or regular 3 1/2" air wheels may be used.

Construction of the wing is conventional. Enlarge the plan six times with a pair of dividers or ruler as you did for the pod. The airfoil section is the Goettingen 239. This was selected from a series of airfoils tested at twenty-nine feet per second (twenty miles per hour). Full data and ordinates along with many other sections are given in the N. A. C. A. Report No. 124. The airfoil was thinned slightly, sacrificing a slower sinking speed for a higher rate of climb.

The ribs are cut from 1/16" sheet, except the three center ones which are 1/8" sheet. Cement ribs to top spar. Attach trailing edge, being sure front edge is raised to match the undercamber. The leading edge is glued in place next. Slide rear spar in place, gluing each rib securely to

Bomber formation seen from belly turret of B-18A.

it. At this stage put in the required dihedral by butting the leading and trailing edges. Raise each tip 4" above your working surface. As soon as the breaks are glued and thoroughly dry, cut at center section and raise each tip to 9½" and cement carefully.

The leading edge is covered with 1/16 x 3" soft sheet to form a good entry and to gain extra strength. Center section is covered on top and bottom with some thickness. The underside of the leading edge is not covered with sheet as above, but is capstripped for the full chord. The wing capstrips are 1/16 x 3/8" and are of very soft wood. Shape leading edge and tips with a knife or a small hand plane, finishing with sandpaper to provide a smooth covering.

The original model was covered with silk and this is recommended. Paper can be substituted, however. Use clear dope for applying the silk and a mixture of half dope and half glue for covering with bamboo paper. Spray covered wing with water. Let it dry. Follow with one coat of clear dope.

Construction of the rudder and stabilizer will be the next step. Enlarge the plan first. Taper stabilizer spar from ¼ x ½" to ¼" square at the tips. Ribs are made from 1/16" sheet and will be glued in place on the spar. Shape the trailing edge before cementing to the ribs. The leading edge is made in two pieces and the tips are cut from ¼" soft sheet. Shape the four tip ribs, then cap with 1/16 x ¼" strips on top and bottom. The rudder is made in the same way, using ¼" sheet as the outline. Be sure to raise ⅛" above surface to make the section symmetrical. When covering and doping be careful of any warping tendency.

Since the pod was made in one piece, it will be necessary to cut the cabin part loose. First mark with pencil the exact part that is to be cut loose. With a sharp blade cut through the planking and top of the firewall as shown. Then cut through Bulkhead No. 2. This bulkhead may be trimmed to within a quarter-inch all around the cabin part or it all may be removed. Remember that is for the cabin only and not the lower part. With No. 2 removed proceed with No. 3. It isn't necessary to trim No. 4, just cut it straight across so the cabin may be lifted off. Cement the windows and the windshield in now. Be sure to use a piece of paper for a pattern, employing the cut-and-try method in order to get the exact shape. Trace on the celluloid, cut out and cement the two halves in place.

When installing the wiring follow the diagram as shown in the drawings, being sure to make your wiring neat by soldering all connections where needed.

The original model was colored red. About thirty percent orange dope was added to achieve a red-orange color. Three coats were used on wing and tail, with four coats on pod and boom. Sand lightly between each coat with 400A wet or dry carborundum paper. Water is used with it to cut faster and more evenly for a smooth finish.

FLYING INSTRUCTIONS

Move the batteries until center of gravity is in correct place as shown on the plan. When this is done attach the cabin, using several strips of transparent cellulose tape to do the job. Test-glide the model until you become thoroughly familiar with it. Increase the incidence in the stabilizer if it shows the least tendency to stall and use negative incidence if there are any diving tendencies. Start motor, run at half throttle and launch just as if you were going to glide it. The timer should be set for about ten seconds. The Nomad should circle to the left under power and to the right in the glide. When adjusted properly and with an opened motor you can count on 2½ minutes every flight.

Until we meet again—many happy landings!

Slide, Rule, Slide!

(Continued from page 48)

uninformed persons, this can be described as "flat as a pancake" or even "as level as a billiard table" if your friends are all pool sharks.

DURATION

All degrees of optimism are embraced in the following formula for calculating your duration on test hops:

$D = TE^2$ (D being your claimed duration, T the actual flight time, E the exaggeration.)

This formula accommodates both the big fibber and the medium fibber. For example, for the medium fibber:

T (actual flight time) is 1 minute. E is found by your estimate of motor run. If it actually runs 30 seconds, and you say it has run 15 seconds, your E factor is 2. Therefore D (your claimed duration) is TE^2 or 1 minute x 2^2 or 4 minutes.

For the big fibber:

T (actual flight time) is 1 minute. Your motor runs 30 seconds and you say it runs 10 seconds, so your E factor is 3. Therefore D equals TE^2 or 1 minute x 3^2 or 9 minutes, your claim for this flight.

GASOLINE CONSUMPTION

Your motor will run for at least 2 minutes on 1 eyedropper of gas. Even if it takes two or three tankfuls to get it started, you must still insist that your motor is quite frugal. If you must refill your tank after every 10-second flight, this can be explained by saying that your ship tipped up and the gas ran out, the gasket leaks, the tank leaks, et cetera, et cetera.

RECORD FLIGHTS

If you will make a practice of closing your eyes tightly for about five or ten seconds during the glide, a very fine total of "out-of-sight" flights may be claimed.

New Radio Control Escapement

(Continued from page 52)

The rubber-band motor is hooked to an escapement disk with four tabs bent up at 90°, which engage an escapement arm. Part of this escapement arm is also the armature of a small electromagnet, which is operated by the receiver relay. When the electromagnet receives a pulse from the receiver, the armature depresses, releasing the escapement disk one quadrant. As the escapement disk rotates, a projecting pin slides in a slot in the rudder bar, moving the bar to its next position. Beginning at neutral, the first pulse will move the bar to "left rudder," the second back to center, the third to "right rudder," the next back to center, and so on. It is therefore often necessary to go through one entire cycle to get to the desired rudder position, because the escapement rotates in only one direction.

Now instead of having four tabs on the escapement disk we only have two. These are situated opposite each other. One of these tabs, which we will call A, is made slightly longer than the other. The escapement arm it will be noticed has two stops, one at the end of the horizontal part of the arm, and one at the end of the vertical part. We will call the stop at the end of the horizontal arm X, and the other Y. The shorter tab on the disk we will call B. The escapement is now adjusted so that when the arm is off the magnet, that is when there is no signal from the transmitter, X will stop A but will not stop B. In this position, of course, Y can stop neither A nor B. In other words, when the signal is off the disk will always rotate until A is stopped by X. This is the neutral position of the rudder or elevator. From this neutral position one signal will draw the arm down on the magnet and Y will stop A. This will be either right or left depending on the hook-up. We will say it is right. One more signal, or two signals from the neutral position, will allow the disk to rotate until Y stops B. This will be left. As long as the signal is held, the rudder will stay in its right or left position. As soon as the signal is turned off, the rudder will come back to neutral. In other words, we have an escapement that keeps in step all by itself!

We have installed this escapement in the ten-foot pusher RC-1, and have had very satisfactory results.

Down The Runway

(Continued from page 54)

received at Academy headquarters recently.

"As you know, I hold a private pilot's license, and am now grinding away for my commercial with instructor's rating. Flying as much as I do around the thickly populated skyways of Long Island, I know the grave danger of gas-powered model aircraft on the loose.

"Matter of fact, I had always treated the problem of uncontrolled model aircraft pretty lightly as any sort of real menace to pilots—but one day, as I came in for a landing in a little field not far from Roosevelt Field, one of these gas-powered jobs whizzed out of the tall grass straight at my ship. Believe me, it was some moment! The model plane missed my ship's prop by a fraction—and I proceeded to neatly mess up my landing and leap four or five times across the small field like an enraged bullfrog. Of course I was mad—and scared to death!

"Today especially the act of flying model aircraft near the scene of any airport or auxiliary field is really criminal. Student pilots need every ounce of concentration they possess to land or take their ships off the ground, and there is really no excuse for carelessness on the part of gas model owners who fly their powered jobs near the scene of such activities."

The author of this message is not an aviator with no understanding of the model builder and his work. The writer is Miss Jeannett Eastman of New Rochelle, New York, a licensed pilot and member of the 99s, international organization of women pilots. Miss Eastman has been building model airplanes for the past few years and holds A. M. A. gas-model license No. 3642. Miss Eastman, who is one of the best-looking feminine model builders you could ever hope to meet, is a skilled craftsman and has achieved a considerable reputation in the built-up replica scale model competition field. She placed first and second in two of the largest scale-model competitions ever held and her metal-covered Gulfhawk is the result of months of careful work.

★ ★ ★

Be Safe—Fly Safely. The editors of Air Trails join with the Academy of Model Aeronautics in urging that all model airplane builders exercise extreme care in flying their craft.

This hobby-sport is too fine a one to restrict through carelessness on the part of a small number of model fliers.

Be Safe—Fly Safely, away from crowds or other air activity.

Double Decker

(Continued from page 52)

FLYING AND ADJUSTING

Take the ship to your favorite flying spot and test-glide, adding clay to the nose to balance it and warping rudder for turn. When a long flat glide is obtained throw model into the air. For best launching hold one finger behind wing, giving ship a little bank, and toss it straight out. When model is adjusted a higher altitude may be obtained by adding positive to stabilizer and taking a little clay off nose. From here on it is all yours, and lots of luck in flying.

Model Matters

(Continued from page 41)

Bob was seventeen years old, had attended several nationals where we got to know him. He won high-school varsity letters in track, was an expert tennis player, and a championship model builder. Last October Air Trails published plans for his Crusader, a contest-winning rubber-powered fuselage. The Stofers—Harold and Thelma—of Indianapolis, knew Bob very well and had taken him along to the contests. What they miss most of all is the pleasant and contagious smile he always wore, reflecting a happy outlook on life.

"If you can't beat 'em, join 'em," or something like that, should have been followed by a Philadelphia woman. Her husband was a model builder and she was recently divorced from him on the grounds that he spent so much time building models he neglected her and their child. Instead of this drastic action she should have bought herself some supplies and joined the model ranks. Many a wife has found she couldn't compete with the model hobby (which by the way is much more deadly than golf, stamp collecting, et cetera) so they, too, built and flew models—taking care never to get too good and embarrass their husband which would probably drive him to divorce!

Aëro speed merchants will have a chance to get it out of their systems at the Florida State Meet. A speed event for gas models tethered with a seventy-five-foot rope is included in the events. Speed events have always attracted builders despite the short course necessary and the difficulties in timing accurately a few seconds of flight. Pylon flying with gas models eliminates this trouble. A few rules can be formulated and a national record set up for planes of this category. After all, this type of speed event is all that model race-car fans have to look forward to in life. Looks as though it has possibilities for aëro-modelers. We hope William Thomas, Florida State AMA director, will tell us how this event worked out.

Anne doesn't live in Astoria any more. Unless, of course, Lars Johansson was lucky enough to find his 48" Bowlus-type glider which soared out of sight last April. He towlined it from Astoria, Long Island, and watched it climb steadily in sweeping circles, drifting out of sight on a southwest wind. It was built from a Cleveland kit. Color was red with black trim. The name Anne was painted on the pod-fuselage.

With defense claiming raw material and production facilities, the model industry may be forced to curtail production of motors and reduce the consumption of balsa wood and other special items. The Academy of Model Aëronautics was enough concerned to confer with the Office of Production Management regarding priorities in aluminum alloys and bronze, also rubber motor and balsa wood. AMA officials pointed out that model building forms a sound basic training for the aircraft workers and pilots who are so necessary.

Model building has been an important phase of Germany's air-training program. Yet gas motors for model work are scarce. Few individuals own them because they're too expensive. Some of the larger clubs own one or two. Winners of rubber contests are allowed to use them for limited lengths of time. The Quaker City *News Flash* estimates that in Philadelphia there are more than 500 boys with at least one motor and many of them have two or three. Our gas activities are far and away ahead of any other country and our model effort should be given its share of material to keep the industries and the activity humming.

Of course, if the bottle necks get real tight, we can always use hardwood and specialize in gliders. For many years German competition has been limited to models built exclusively from material available inside Germany. Synthetic rubber motors were inferior, but otherwise the hardwood models stacked up favorably alongside balsa. So it looks as though true model love will find a way, regardless of what materials are available.

The Witch City Gas Model Club of Salem, Mass., has had a rough time with their contest weather. Mrs. Marjorie Day says they are not a bunch of sissy fair-weather fliers, but after all there is a limit. Sunday is model-flying day for the Salem crowd and invariably it was windy following six days of tantalizingly calm week days. WCGMC meetings have been featuring news-letters from other clubs which are read, discussed and digested by the club members. It's a good idea. We know our individual club is the best, but it wouldn't hurt us to review the doings of the little club in Frog Hollow. They might have hit upon something that missed us. WCGMC insignia is a witch riding a gas model. In case you don't quite get the idea, you better review Salem's part in early American history.

Organized model building in Jacksonville, Fla., is coming back strong. Model Aëro Club is the name of the new club. Last August the old club went under for the third time. Until recently the boys had been free-wheeling without any organization. Old-timers and newcomers have formed MAC and the heat is on. Acting Chairman Al Anderson is dishing out enthusiasm and information about MAC. You can write him at 416 West Eighteenth Street, Jacksonville.

Winter has come to Bungo-Bungo. As Cousin Hugo puts it—"It may be 92 in Jersey City, but it's winter down here." He explained that their seasons are always a half year ahead of ours. He hated to miss our national meet. For the last year he had planned the trip. It would have been nice to go north for the winter. But at the last minute he talked it over with the warden and the guards and they recommended he finish his course at reform school before leaving the country. He threatened to visit us for the 1942 contests. Meanwhile, he'll keep us posted on the breath-taking and thrilling-model news as it unfolds in B-B.

A letter to the editor of *Aero Modeller* (English) published in the February, 1941, issue gave American modeling a pat on the back. Hugh C. Furneaux was the writer. He liked the sensational progress made over here in gas design and in radio control. Praised the Academy of Model Aëronautics organization and policy and said they were more effective than the corresponding English organization, Society of Model Aëro Engineers, which he accused of having a somewhat stuffy and reactionary policy. He liked the plans for championship models and articles by experts presented in our model literature.

Following publication of this letter, the English boys jumped on Mr. Furneaux and began to take our model set-up apart. Comments were that American modeling was confined to producing kits and engines to suit the pockets of all from twelve years old upward and selling them to thousands of people who probably don't know the first thing about power modeling. The SMAE was defended in glowing terms along with unfavorable criticism of our AMA.

Mr. Furneaux's letter was refreshing. Too often criticism from England left the impression that they thought American models were hodgepodge collections of sticks that always caught lucky thermals. Commenting editorially, the *Aëro Modeller* sensibly analyzed the argument: ". . . It is all a question of outlook. So many people in an argument of this sort overlook the fact that models are built and designed to meet very different conditions. It is not possible to compare fairly a typical American with a typical British plane, as, of course, they are designed to meet two entirely different sets of conditions."

ON THE FIELD. (By Carroll Moon.) The season of contests is with us. Once more we feel the urge to attend the almost weekly meets, to hear the roar of "hot" motors, and to loose our ship on the runway in the hope that it will "catch one" and "stay up."

As this is written we have before us a score of contest announcements. By the time these words have reached the printed page most of the contests will be history. The Eastern States (June 7th at Hadley Field, N. J.) is the biggest thing on the contest horizon. Right now in our basement shop a wing is being built for that great day. If you insist, it's a Buzzard wing, although only 90% the size of the original—the better to accommodate an OK 49.

Yes, the contest season is with us. We'll have reams of material in the coming months about great performances and we earnestly request all publicity chairmen to get the results to us as soon as possible after the last prize has been awarded.

San Francisco modelers report, by means of a news page in the San Francisco *News*, the results of weekly contests. The publication, a Scripps-Howard unit, is actively behind model flying and the publicity does modeling a great deal of good in that area.

"Listen, Mabel, as I was saying—hello, hello—Operator! Operator!"

The California Championship meet, held May 3rd and 4th, was divided into two classes. The rubber-powered division was held May 3rd and results indicated that the weather was not too helpful in making good flights. Jim Morris won first in the senior outdoor fuselage ROG class with 2:28; second was Don Laustem with 1:57; while Perry Broz was third with 1:24. The open class was won by Bob Amos with 1:39; Gene Larson with 1:08 was second, and Charles Werle was third with :51. Junior class was won by Robert Ozowa with 1:14; second was Curt Holzhauser with 1:06, and Norman Busse was third with :48. The outdoor stick event, junior class, was won by Charles Dosset with 3:05. Senior stick was taken by Jim Katayma with 2:27; Robert Irwin was second with 2:04, and Stan Burns third with 1:39. The open stick event was won by Bob Amos with 2:01; Charles Werle was second with 1:02, and Dick Schumacker third with :47.

Bob Blau won the speed event, with Lester Elmore second and Bob Mueser third. Jim Morris won the flying scale event; M. Andrade was second, and Bob Mueser third.

The gas division of the championship meet was held on Sunday, May 3rd, despite a high wind which cut the times to a great extent. Clyde Holloway took the senior event, with Richard Chamberlain second and Frank Niblet third. Vernon Oldershaw won the open event, with Harry Waltz second and Donald Foote third.

The meet was sponsored by the San Francisco *News* and the San Francisco Exchange Club. Dr. Irving A. Dundas was meet chairman; Negley Monett was in charge of publicity, and Wesley Wooten handled arrangements.

At last we have at hand a report of a contest which admits that "thermals abounded," and by looking at the times turned in at the second annual Superior California Gas Model Contest, held April 27th, we can vouch for the fact that the models did exceptionally well. Before the day ended four national records had been beaten. They were Class C, junior senior and open, and Class B open.

Donald K. Foote, of Oakland, flying a Class C ship, took first in the meet with the sensational time of 24:37. Carl Guidici was second with 14:40, also flying a Class C job. Don Lampson, of Lakeport, Cal., flying a Class B ship, took third with 14:14, and another entry of Don Foote's was fourth with 14:06. Jack Cudd was fifth. Other winners were W. H. Pittenger, Ralph Igler, Dick Pittenger, Gorden Peterson and Rob McCord. Gene Larson took Class A honors with 6:11.4. Ted Ravellette, AMA State director, directed the meet.

The sixth annual Southwestern Championship Gas Model Airplane Meet, sponsored by the Exchange Clubs of San Diego (Cal.) County, was held April 27th at Aeroneers' Field. The meet, one of the largest on the coast so far this year, attracted 366 entrants and more than 5,000 spectators.

Walter (Ross) Houck, of Ocean Beach, took first place with a time of 22:07 for two flights, the last being out of sight. He received $50 cash, the Consolidated Aircraft Trophy, the Southeastern Exchange Club AMA Trophy, the National City Exchange Club Class C Trophy and a Blue Ribbon.

Ray Acord, of Hollywood, was second with a time of 21:22, while Charles Koby of Van Nys, last year's winner, took third, doing 20:49. Bob White was fourth, Ray Budwig fifth. Ray, incidentally, took the Class B Trophy in the bargain, his time being 15:47. Bruce Main won the award for the best-looking ship and Miss Eva Wells won the award for the women's event. Holly Watrus won the Fireball event for the most spectacular performance.

Harold Strawn was contest manager and Rupert Ranger was contest director.

The San Diego Aëroneers, who were cosponsors of the event, presented an excellent meet and are to be congratulated on their fine handling of the affair. Charles Underhill is president of the Aëroneers. Bill Sweet is vice president and Mrs. Rae Davis is secretary. Treasurer is E. J. Brown; Franz Secrest, corresponding secretary; Harold Glines, recorder.

An interesting item in the contest was the very comprehensive program which gave a list of entrants, the motors used, and ships. According to this list, almost every type of motor made was sported by contestants. Super Cyclones, Ohlssons and Bunch motors predominated, but others used included Hurleman, Brown, Torpedo, Dennymite, Atom, Forster, Madewell, Elf Twin, Brownie, the Willard, Bantam, Perky, Comet 35, Baby Cyclone, Sky Chief, Little Dynamite, O. K. and a Clark Special. 360 entries were listed.

Gotham Gas Gossip—The well-known Creedmore Flying Field is almost a thing of the past. A large hospital has been erected on the old field and power lines now intersect it. The new field is so near the houses that residents have called police to keep modelers from flying in that area. Instead, all flying (or most of it) has been transferred to Hicksville, L. I., a bit farther away, but a much better location. The site is just west of the famed Aviation Country Club, and the flat terrain enables modelers to retrieve ships quite easily. Only one fault—the thermals are terrific. For example, one recent Sunday, Sal Taibi lost a Tiger-powered Pacer with a 7:55 flight. Jerry Stoloff lost a Bantam-powered ship (called the Swami) after six minutes, and during the same day a Scientific Mercury with a Dennymite did almost ten minutes before disappearing.

Incidentally, the Sky-Scrapers Fall Contest (sponsored by AMA) will probably be held at Hicksville. The date has been set as August 31st.

New Yorkers bemoaning the lack of a flying field should drop a line to Arthur Hasselbach, care of Jackson's Model & Supplies, 3079 Third Avenue, Bronx, N. Y. There's a gas-model contest open to residents of Greater New York and New Jersey to be held opposite the Bronx-Whitestone Bridge, on July 20th.

LET'S BE SCIENTIFIC. (By James R. Custin.) During the past few years we have witnessed the growth of the bigger and better type of model airplane contest, with a list of prizes that makes "bank night" look like a piker's affair. Sponsors are thrown for a loss with every meet, and modelers lap up the cream with little thought to what they are giving in return.

Four or five days before a meet, the contestant rushes to the nearest hobby shop and buys the latest and most popular gas model kit. Then begins the twenty-four-hour-a-day grind of turning out the model in time for the contest. The house is upset, the family kept awake, electric bills go sky high, meals are late because the kitchen table is covered with balsa wood and cement, and everyone has a beautiful grouch. (How do you suppose I know all this?)

At last, on the morning of the meet, the modeler emerges with his creation—to give it its test flights. If he has done a sloppy job, he excuses this on the ground that it will stay up just as long as anybody else's —in a thermal. If he has turned out a very neat job he will probably regret the extra time spent when some crate that looks like a wreck hooks a riser and smashes all the records.

The average contest has degenerated to the level of a glorified bingo game. Most of the models are kit jobs, figured out by some genius who makes a profession of model airplane designs. It is no longer necessary to know even the most basic elements of aërodynamics in order to build a prize-winning contest model. The whole thing boils down to a question of who can adjust his model best and then hook the strongest riser with it.

Yet sponsors are inveigled into putting up cash for this sort of thing on the grounds that it stimulates a wider knowledge of the principles of aeronautics among youth, encourages the development of a scientific attitude, et cetera, et cetera. So does Chinese checkers.

It has always seemed to me that a contest ought to be a real test of aëronautical knowledge and skill. It ought to provide modelers with a chance to try, under actual competitive conditions, the ideas and theories which they have worked out in their models.

As one means of encouraging such a scientific attitude, I feel that an original design competition ought to be made a part of every major contest. The judging of such an event does present some difficulties, but these are not so great as to rule it out completely. Some sort of a scale can be evolved, with a little thought, which would make such judging less arbitrary than would seem necessary at first glance. I believe that the idea is worth considerable study.

More stringent loading and motor run rules, during the past few years, have tended somewhat to cut down the luck element in contests, but they have not eliminated the thermal current. Since it is almost impossible to select only cloudy days for model airplane meets, I suggest the night contest as a possible solution to the problem.

A row of automobile headlights and a spotlight provide illumination for starting motors and making adjustments. Flying lights on the model make it easy to time and find. Both the model and motor must be carefully adjusted before the meet, since it's pretty hard to fumble with close adjustments in the dark.

While a night contest cannot so easily be made into an elaborate affair, with a couple of hundred contestants, thousands of spectators, and an impressive list of prizes, this is not entirely an evil. The contest is a model airplane meet, rather than a ballyhooed show, and contestants are forced to concentrate on the performance of their ships. Furthermore, night contests are real fun, as anyone who has ever attended one will testify.

But the burden of cleansing model aviation of the toy airplane attitude is not entirely on the sponsors and directors of contests. The aëromodeler himself must adopt a scientific point of view with respect to his hobby if it is to be more than just a passing fad. He must realize that the model airplane is really a powerful means of aërodynamic research, and he must do something about it.

"How am I going to do it?" you ask.

Well, it is obviously impossible for anyone to try to do experimental or research work on anything so complex as the model airplane considered as a whole. It is necessary, therefore, to select some particular problem or phase of model aërodynamics and concentrate on it. The model airplane is certainly not too small for specialization.

Following are some suggestions for research projects which can be carried out by any ambitious modeler. Model airplane clubs looking for some activity to fill the nonflying months would do well to select one of these problems for group study. The idea is to choose one problem and stick to it until everything has been learned that there is to know about it.

Stability. In spite of the reams of paper that have been filled with discussions of spiral stability, no one really seems to know much about the subject. I can cite at least three theories purporting to explain the mechanism of the spiral dive, each of them very plausible, and each contradicting the others. And I have seen models built in strict accordance with each of these theories smash themselves to bits in vicious spiral dives.

The study of spiral stability is not a simple one, but the fellow who can come up with the right answer will really have accomplished something worth while. One method of attacking the problem might be the use of a pendulum attached to a movable rudder tab.

Even such a comparatively simple matter as longitudinal stability presents many problems for the model builder. We know, for example, that, other things being equal, a longer tail moment arm generally makes for more stability. But just what are the limits of this effect? Suppose we used a seventy-percent tail moment arm? Or one hundred percent? The answer won't come by thinking about it. Someone has to try it. How about you?

And what about downthrust? Why does one model fly perfectly well without it and the other require a great deal in order to keep it from looping? Your guess is as good as mine, but we can't find the answer by guessing. It will take some honest experimental work to find out.

Control. Closely allied to the problem of stability is that of radio and remote control. Radio control presents an interesting and challenging problem to those who have the necessary knowledge and ability. The perfect radio control has not yet been invented. Even the army uses a telephone dial system which is far from the ideal cockpit-type control of which R. C. enthusiasts dream.

But even the simplest radio-control system can be of inestimable value in a study of stability problems. Nor is it necessary to use a radio signal for remote-control operation. A movable control surface can be actuated by the timer arm at a predetermined moment, or combinations of timers and controls can be used. The value of such apparatus in the study of stability is obvious.

Airfoils. The largest part of the performance of a model is determined by the wing planform and airfoil section used, yet modelers are notoriously careless about airfoils.

Too many model builders simply chop out a rib that looks like an airfoil, and then hope for the best. When asked what airfoil section they are using, they beam and brightly say that it is an "original design." Then if the ship works well, they praise the airfoil; if it works poorly, they don't know what's wrong.

The only way to determine the efficiency of an airfoil is to compare it directly with another. This means the construction of several wings for each ship, identical in all respects except airfoil. If the modeler thinks he has something unusual in the way of an original section, he can test it by direct comparison with other foils of known characteristics.

It is in this matter of airfoils that the kit model has an excellent place. A model built from a kit is usually dependable from the standpoint of stability and general performance, so that when different airfoils are tried on it the number of variables involved is reduced to the minimum.

Motors. The big problem here, of course, is how to get more power out of the present corn popper. And maybe some day some research genius will figure out why it always starts perfectly on the bench, but always balks just before an official flight.

But the field of motor research is not limited to the gasoline engine. Successful steam engines have already been built for models, and it is possible that with research and development they can become serious rivals of the gasoline motor. Diesel, compressed-air and rocket motors also present interesting fields for thought and experiment.

And the rubber motor is not to be neglected. Running torque and horsepower curves on rubber motors of various sizes and kinds is an excellent and very useful exercise in applied physics. If you're interested in chemistry, you might figure out the perfect rubber lubricant. The possibilities in the field of rubber motors are virtually inexhaustible.

Right here, by the way, is a good place to say a few kind words in behalf of the rubber-powered model. There are now only a very few hardy souls who still fly rubber-powered ships year after year, just for the fun of it. Yet the rubber model is far superior to the gas-powered ship for experimental purposes, since it can be built much more quickly and cheaply.

The rubber model, moreover, presents a real challenge in the matter of design and adjustment, because its power run varies over such a wide and continuously changing range. All too many young modelers are starting out by building gas models, often with disastrous results. More experienced fliers should point out to them the importance of starting with rubber-powered craft.

Propellers. Mere mention of the name should suggest a host of problems. One suggestion for particular study might be this: Does the propeller which delivers the greatest amount of static thrust necessarily deliver the greatest amount of power in actual flight?

Structure. Structural design is still a wide-open field. Geodetic and monocoque construction present possibilities for experiment, as do papier-mâché and various other plastics. Light weight, strength and simplicity of construction are the goals to aim for.

Unorthodox Types of Aircraft. Recently there has been considerable interest in model helicopters, and several successful and promising designs have already been evolved. The small number of modelers working with helicopters makes this an excellent field for further work by the fellow who likes to lead the way.

Very few model autogiros have been made to work successfully, yet the model autogiro may possess some advantages over the fixed-wing airplane. The same is true of ornithopters.

Canards, seaplanes and amphibians present other possibilities for experiment for the fellow who has a spare gas motor and a little ingenuity.

Gadgets. There are still a host of gadgets which must be perfected. How about a really effective two-wheeled retractable landing gear? Or a good folding or freewheeling prop for gas models? Or a gadget to drive coaxial gas props in opposite directions, thereby eliminating torque problems? Or automatic wing flaps? Or slots? Or—shades of Buck Rogers—retractable wings that permit skyrocket climb and unfold to produce that floating glide?

Measuring Devices. The essence of science is measurement. Yet, after the construction stage, the only measurement that takes place on the average model is timing the motor run and flight.

No one has yet invented an altimeter suitable for models, yet think of the advantages of such an instrument. And how about a practical airspeed indicator that will make a continuous record of airspeed at each stage of flight?

Some amateur psychologist might make a study of human errors in the timing of motor runs, and devise a means of remedying them. We know that one timer will clock a motor run at nineteen seconds while another may call it twenty-one. What's the answer?

No matter which of these problems you decide to work on, certain precautions must be observed.

A scientific approach demands careful planning and building. It requires constant checking and measurement. One successful flight proves nothing. Six successful flights prove very little. Fifty consecutive successful flights prove the point convincingly.

The scientist starts with a problem, and possibly with a tentative solution. Then he devises a means of attack—the experiments which he will perform. He sets up his apparatus carefully, checks every step to see that no disturbing factors enter the picture, and works patiently. If there is a possibility of error, he repeats the experiment, taking averages if necessary.

When he has finished, he may find that his tentative solution or "hypothesis" was correct. Or he may find that it was all wrong, and then he has to start out on some other track. But he never quits until he gets the right answer.

That ought to be the spirit in which the aeromodeler works. That is, in fact, the way the successful modelers work—the ones who win contests consistently, risers or no risers.

So—let's be scientific.

Mulvihill Trophy Winner

(Continued from page 49)

symmetrical cross section tip. Then shape the blade, sanding it well, following with four coats of clear dope, sanding lightly between each coat and finally rubbing it well with rubbing compound so as to obtain a smooth, glossy finish. Care should be taken to obtain a perfectly balanced prop so as to obtain good flights consistently. Refer to plans for prop assembly and tensioner.

The model is covered with regular Jap tissue. Use dope to apply paper and always run the grain of the paper the long way in order to eliminate excessive sagging. Cover the total under surface of the wing first, sticking the paper directly to the underside of each rib in order to obtain the best airfoil, then cover the top of the wing. Spray the entire model with water, and paint the wing and tail assembly with one coat of clear dope and the fuselage itself with two coats.

The tail assembly is then cemented directly to the tail boom; the rudder's trailing edge being offset approximately $^{1}/_{16}''$ to give a right circle.

A motor consisting of 18 strands of $^{3}/_{16}''$ flat rubber with about six inches of slack is used, and is held in place in the rear by $^{1}/_{4}''$ hardwood dowel rod.

FLYING

The model should be tested in the evening when there is very little wind. A $^{1}/_{8}''$ incidence block should be slid under the leading edge of the wing and can always be changed if necessary. Make several test glides. If the model stalls during these glides, move the wing back a bit; if it dives, move the wing forward. The angle of incidence can always be changed by slipping different-size pieces of balsa under the trailing or leading edges as the case may be. After a flat glide is obtained, wind the motor about 150 turns and launch into the wind. It should turn to the right and spiral upward. Adjust for turn by giving it more or less right thrust. Correct stall with downthrust. Adjust carefully each time the number of turns is increased. The model flies opposite torque, both under power and in the glide.

"Why Slots?"

(Continued from page 50)

sharply at the stall point—about 15 degrees.

The slotted wing lift curve does not rise as swiftly, or with a linear variation, but at an angle of attack of 20 degrees the lift is still increasing. This means that there is much less tendency for the model to reach a critical stall point, where it will violently "whip out," with subsequent loss of valuable altitude.

As the stall is approached, the lift decreases gradually and the model "mushes" slowly out of the near-stall. Obviously the adjustment of such a model would be greatly simplified, as the model will fly within a greater range of actual surface settings without disastrous results. Even after the initial adjustment period certain variations in standard conditions could be detected and corrected before any serious damage occurred.

But for this extra dependability we must pay a price—namely, increased drag. The increased drag is very slight at low angles of attack, but rises somewhat as the angle of attack increases. This increased drag, combined with the somewhat flatter lift curve, gives a lower maximum value of L/D for the wing, to which the glide is more or less directly related. (Fuselage, strut and tail drag also affect total drag.) In other words, a perfectly adjusted model which never gets into trouble is better off without slots, but models in general being what they are, any such device which so increases the dependability of the model is highly desirable. How many times have we seen ships turn in one super flight to, shall we say, three or four poor ones—with no apparent change in adjustment?

The usual location of the slot is just at the rear of the leading edge. The section tested was of this type.

This arrangement gives the maximum increase of lift at high angles. The increase of maximum lift diminishes as the slot moves toward the trailing edge, but there is also a decrease in the extra drag caused by the slot. All in all, however, the speed of model aircraft is low enough so that the lift considerations outweigh those of drag, and the slot should be placed near the leading edge. It should be tapered from bottom to top, and all the corners well rounded to minimize drag. The walls of the slot should form a mean angle of about 45 degrees to the chord line.

The single slot in the leading edge is by no means the only means for accomplishing what has just been set forth. Slots which are carried forward and above the wing proper, multislotted wings, all do the same thing. It was thought, however, that the structural fragility of these systems would render them too impractical for small aircraft usage.

So, you fellows with an experimental bend, let's try something different. Put some slots in your wings, and check your performance both with and without slots. If you run into difficulties drop us a line, and we will try to answer your questions.

In the next issue—a new stick model by

DICK KORDA

Maco Makes Grade

(Continued from page 55)

Comet factory, a much larger supply of kits and parts was incorporated into the new outlay of stock. Since that time the firm has added to the lines carried until it now carries a representative stock of all the better-known model manufacturers.

In 1938 Mr. McCall not only became active as a businessman in modelcraft, but took to the flying end of the game. He organized the Propeller Gas Model Club, the name later being changed to the American Airlines Gas Model Club. Today this group has forty-five very active members, including the "boss" himself, who is quite a competent craftsman.

In 1939 the club took in the Nationals at Detroit, and in 1940 the Nationals at Chicago. Of course, Maco went along to supervise flying on both occasions, and his fatherly, or professional, touch produced excellent results. At Detroit, Robert Bessee won the Class B open event and at Chicago, Bill Schwab scored high in all three gas events. Bessee's picture, by the way, graces the cover of the Champion Spark Plug advertising folder.

The "boss" himself gets as big a kick out of flying as other members of the club, and last year won the open gas event at the Erie, Pennsylvania, meet. He has also placed in several meets, including a second in a Pittsburgh, Pennsylvania, contest. Officers of the club are Ralph Mitchell, president; William Barries, vice president; Eldred Hoopengarner, secretary, and H. D. McCall, treasurer. Air Trails readers who visit Cleveland this year for the Scripps-Howard air meet are cordially invited to stop in and visit with Mr. and Mrs. McCall and, of course, the members of the club.

The American Airlines Gas Model Club has sponsored an annual gas-model contest each year for the past two years. This year the meet will be held on August 10th.

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