AIR TRAILS Pictorial

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THE CARRIER QUESTION

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41 are in Commercial Air Transport—14 with Transcontinental and Western Air, 1 with Eastern Air Lines, 16 with American Export Airlines, 1 with Pan American Airways, 8 with Northwest Airlines, and 1 with the Air Service Command.

17 are in U. S. Army Air Forces training activity in the five Parks Air College organizations.

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AIR TRAILS *Pictorial*

MAY, 1943 — VOLUME XX NO. 2

CONTENTS

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W. F. TYLER . . . . . ASSOCIATE EDITOR
ETHEL KERESZTES . . . ASSOCIATE EDITOR
ALEX D. SNIFFEN . . . . . . ART EDITOR
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CAVU
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GOING INTO ITS FOURTH YEAR, the war in the air is producing some startling developments as it snowballs along. For example—as this is being written, the British have announced that Germany has built a six-engined troop glider capable of carrying 130 persons. The 600-700-horsepower engines get the machine up to operational height, after which a long, gliding descent is made into enemy territory. Ten tractor-type wheels facilitate landing on bad terrain. This latest and most weird of German gliders is a Messerschmitt Me-323, it is said, a fact which has its interesting angle, for Willy Messerschmitt's early history is one of gliding.

NO AIR FORCE IS PERFECT. If it were, the nation possessing it would probably win the war. In the Battle of Britain, the Nazis swallowed a bitter pill and probably lost the war then and there when their underarmed bombers and somewhat inferior fighters melted under the fire of eight-gun fighters like butter under a hot knife. The point is that every nation guessed wrong in one way or another. Our ships lacked armor and firepower; the British lacked day bombers, dive bombers, or attack bombers like the Havoc. Under duress, makeshift arrangements sometimes have saved the day. The Kittybomber instanced this in the African fighting against Rommel's tanks and supply lines. Clearly indicated is the need for a dive bomber with fighter characteristics. But, of course, there is the Russian Stormovik—the first true fighter-dive bomber. Again, when the German warships escaped up the Channel from Brest, the British failed to stymie the move because of weather and strong air protection. Every one of a group of slow Swordfish torpedo planes went down, with the result that the fast British Beaufighter is now also being manufactured as a torpedo plane which may be the Barracuda. The Russian U-2 ambulance biplane which literally crawls through the air is another example. Used at Stalingrad, these archaic biplanes pestered the Germans no end. Russian pilots pelted small bombs out of the cockpit by hand and, when the Messerschmitts tried to intervene, the U-2s turned sharply. The Nazi pilots then either whisked by or fell into fatal spins if they slowed down for a pot shot at the flying "Cossacks."

NEW PLANES include a Heinkel He-274, the transport version of the famed He-177. However, it is reported to have four 2,000-horsepower engines (B. M. W. radials) in four separate nacelles instead of the two nacelles with paired engines of the 177. Other French jobs: VG-50 twin-engined fighter with tandem engines and contra-rotating props *à la* the Fiat racer; the Bloch 157 single-seater—it looks somewhat like the 190—with a 1,500 h. p. Gnome-Rhone and a reported top of 420 m. p. h.; another Breguet helicopter, this time with a 600-h. p. Gnome-Rhone (the most powerful helicopter built to date); the Centre substratosphere job with two side-by-side engines in the nose and contra-rotating props (crew of five and 49,000-foot ceiling). The Breguet helicopter bears watching, since it is one of a direct line of developments. It weighs 7715 pounds, has a tricycle landing gear and carries four people!

ACCORDING TO Lord Beaverbrook, the finest production job he has seen is in the production of the Merlin—at Detroit. The bang-up job that Packard has done in converting the Merlin's measurements from the metric system to our system of measurement and producing it in quantity for both the British and our own Warhawk, was beautifully done, so well done, in fact, that the British Ministry of Aircraft Production needs only one representative, and even Rolls-Royce has only four on the spot. Said Beaverbrook: "The Packard Rolls-Royce engine is an example to the whole world. There was a good American airplane, called the Mustang. The engine of the Mustang was giving good service, but some genius had the idea of putting the Rolls-Royce engine into the Mustang and the result is a very good airplane, one of the best of the world—some people will say the very best." Hats off to Packard!

IF YOU HAVE CHILLS after reading "The Montrose Ghost," on page 24, lend a quivering ear to the story of the haunted Whitley. Outbound over the North Sea, the big ship mysteriously flew hundreds of miles off course; then, stranger still, ran out of gas after only two hours of flying. Just as they reached the coast, the crew had to bail out. As he left, the pilot saw, or thought he saw, a mysterious figure on the catwalk. The Whitley was reported still flying around hours later! A fighter pilot is supposed to have been dispatched to shoot down the wandering bomber. Imagine his bewilderment when the tail guns fired on him! Maybe it sounds screwy to you—and to us—but that's the way it read in the newspapers. Boo!

for KEY MEN in the WAR EFFORT

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C26—Unshielded

USE CHAMPIONS AND FLY WITH CONFIDENCE

PASSING IN REVIEW

Jordanoff's Illustrated Aviation Dictionary

By Assen Jordanoff. (Harper & Bros., New York. $3.50.) At last an authentic aviation dictionary for the layman, student and aircraft worker that removes the mystery from aviation's technical terminology. First, every definition is given in simple language, then each term is illustrated in remarkably clear drawings, a method which Jordanoff has successfully featured for many years in his previous aeronautical books and which has made him outstanding as a writer on aviation subjects.

Over 2,000 terms have been treated in this illuminating style. The 415-page volume concludes with a glossary of aviation "slanguage"—everything from "Ace" to "You've had it," and including those mythical little elves known to airmen as "Gremlins," about which the general public is just learning. Although we can't agree that a good landing is "any landing you can walk away from," as defined in this section, we heartily recommend this latest Jordanoff work as an essential reference book for all aviation followers and for the public which is becoming air-minded.

The Air Offensive Against Germany

By Allan A. Michie. (Henry Holt & Co., New York. $2.00.) Unlike the "armchair theorists" who propound strategies based on "what we could do *if* we had thus and so," Mr. Michie gives us the heartening information that we can strike decisive blows for victory with the planes and equipment we already have. The author bases his analysis of the Allies' air policy on his "on-the-scene" experiences, which include being "on the wrong end of some 600 air raids."

His knowledge of the many difficulties and obstacles that beset the Allies stems from his years at the war fronts and he does not hesitate to speak out against what he considers mistakes in our air policy and that of the British. His most striking claim is that with the softening up which the RAF has already given the Third Reich, it is possible in 1943, using current planes and equipment, to bomb Germany to the point where the Continent can be victoriously invaded.

The book contains quite a comprehensive study of the Luftwaffe: its organization, strength, commanders.

From Bird Cage To Battle Plane

By Ralph Michaelis. (Thomas Y. Crowell Co., New York. $2.75.) The narrator of this history of the RAF is one who by dint of his experience with the British flying forces in both World Wars is especially qualified to depict its growth. The book starts with a brief résumé of the inception of flying in Britain; gives a stirring account of the Battles of France and Britain; and describes the formation of and work done by the other flying units, such as the Coastal Command, the pilots fighting in the Middle East, and the famous Eagle Squadrons.

The story of the epic struggle of the two dozen boys who composed the RAF fighter squadron to hold the whole of the Luftwaffe at bay for eight months is a tribute to the indomitable spirit of the British, who somehow, according to the author, seem always to be up against almost hopeless odds due to their invariably being caught unprepared for war. Mr. Michaelis garnered his material during a long career in aviation; he was a fighter pilot in World War I in the RFC and an air correspondent in France in 1939.

Air Navigation For Beginners

By Scott G. Lamb. (Norman W. Henley Publishing Co., New York. $1.50.) With the present accent on aviation in most of our secondary schools, through the efforts of the Victory Corps, and with such subjects as air navigation coming into the curriculum for the first time, it is most interesting to find a truly elementary book on the subject. Its subtitle, "A Ground School Primer For The Aerial Navigator," is quite appropriate, and although many of the diagrams seem complicated (due to the nature of the subject) the language and step-by-step procedure clearly defines each problem for the reader.

The author, a retired instructor in navigation, Air-Mar Navigation Schools, Franklin Institute, Philadelphia, assumes that the reader knows nothing whatsoever about the subject, and leads him by easy stages through the subjects of instruments, maps, charts, radio beams and dead reckoning to aerial astronomy. At the end of each chapter is included a list of questions and answers so that the reader can check his progress.

THE CARRIER QUESTION

IN scarcely more than a year, the aircraft carrier has established itself almost beyond question as the most destructive naval weapon in history. Yet because of its vulnerability and the comparatively quiet role it has played during the last few months, many are arguing that it is already obsolete. "Isn't it," they ask, "a flash in the pan?" And—"Shouldn't it be replaced by the long-range land-based bomber?" The answer is a resounding "*No!*"

As events will show, the "flat top" has an enduring function in war. It is undergoing extensive changes in design and in strategical use, but it is by no means being eliminated. Since 1939, fourteen or fifteen carriers have been lost in action, as compared to ten or twelve capital ships, although the battleships of belligerent navies outnumber the aircraft carriers nearly two to one. Nevertheless, all three of the powers which have real use for carriers are proceeding with their construction at top speed.

It frequently happens that one or another power continues to build a particular weapon long after it has outlived its usefulness. It is, however, rare for all to do it. The mere fact that Britain, Japan and the United States are simultaneously building "flat tops" as rapidly as possible should be enough to dissuade those who are already writing the carrier's obituaries.

Although the range of land-based planes and the area they can deny to hostile surface vessels are growing constantly, long-range bombers will never eliminate the sea-going airdrome for a very simple reason: the time advantage which carrier-based aircraft give to a fleet. Ship-borne craft are already at or very near the scene of action; they are not compelled to fly hundreds of thousands of miles to reach their targets. A carrier attack, consequently, can be delivered in a matter of minutes compared with the hours even the fastest of future land-based planes will require. Moreover, the problem of necessary fighter protection remains to be solved and the ultra long-range bomber must still overcome the handicap of its heavy load of fuel. Extremely light fuels will, no doubt, be invented, but until then the carrier plane will be deadly enough to justify extremely heavy losses.

At the start of the war in 1939, the world's navies together had twenty commissioned carriers: Great Britain had six; Japan seven; the United States five; and France and the U. S. S. R., one each. Despite casualties and the fact that the carrier-building race has not yet had time to show real results, at least as many are in service today. Even Germany has added carriers (the *Deutschland* and the *Graf Zeppelin)* to her small but modern fleet, although the Reich has no strategic need for them and has stopped further construction. Within the next year, the "flat top" population of the world—exclusive of converted merchantmen or other auxiliary carriers which are not fleet combat vessels—will begin to increase strikingly. If the war should continue another two years, the carriers will turn the tables on the capital ships and outnumber them.

Of the three building efforts which will bring about this change, by far the greatest—and the last to get under way—is, of course, our own. At the end of last year the navy found itself critically short of carriers because of heavy losses in the Pacific and our slowness in beginning quantity construction of sea-going airdromes. During 1942 we lost four for which there were no immediate replacements: the *Lexington*, sunk following the Battle of the Coral Sea; *Yorktown*, Battle of Midway; and the *Wasp* and

IS THE AIRCRAFT CARRIER NEEDED? DOES IT JUSTIFY ITS HUGE BUILDING PROGRAM? YES—SAYS AN EXPERT WHO ANALYZES THE WORLD'S CARRIER POPULATION AND PROPOSES NEW METHODS.

Hornet in the Solomons. Thus, late last fall, the navy was conducting simultaneous operations against the Japanese fleet and off Casablanca with only three available carriers. (The *Wasp* and *Hornet* had been completed in 1940 and 1941 to raise our total to seven on our own entrance into the war.) But by now the first of the 1940 building program should be entering service. From now on, "flat tops" can be expected to join the fleet at ever more frequent intervals. We may even end with more carriers than the rest of the world together.

Our carrier-building program is based on two principal types. The first is the *Essex* class, begun in 1941. The *Essexes*, of which eleven are to be built, displace more than 25,000 tons and are thus the largest carriers built anywhere since the 33,000-ton *Lexington* and *Saratoga*; the next largest American carrier is the 20,000-ton *Enterprise*, sole survivor of the *Hornet-Yorktown* class. The *Essexes* are right on the beam of the American tradition of ample plane capacity, for they will carry more than eighty apiece. They were probably once meant to carry over 100 planes, but carrier- as well as land-based planes have been growing since 1939.

Four of the eleven *Essexes*—the *Essex* itself, the new *Yorktown*, the new *Lexington* and the *Bunker Hill*—were laid down before Pearl Harbor and have since been launched. They may be expected to be ready for action by summer of this year at the latest. The keels of the remaining seven—the *Franklin, Intrepid, Kearsarge, Randolph, Wasp* (for the lost *Wasp*) and *Ticonderoga*—were probably laid last year. They will be ready by mid 1944 at the outside.

During 1940 the navy ordered forty-two *(Turn to page 58)*

By Leonard Engel

MUSTANG SQUADRON

SPEED, MANEUVERABILITY AND THE ABILITY TO TAKE SEVERE PUNISHMENT ARE NOMINATING THE MUSTANG AS RECONNAISSANCE FIGHTER NO. 1.

By Peter Franklin

NEVER too keen an observer, the American man on the street groaned when it was noised around that the British had assigned their brand-new Mustangs to the Army Co-operation Command; here, he thought, was another American-built plane that the British didn't like. And once again he was wrong. As a matter of fact, the assignment was a sincere compliment to what has turned out to be the fastest fighter at low level in existence.

The Co-operation Command was in a rather bad way until the Mustangs flew to the rescue. Old-style co-operation called for a ship like the Lysander with wing slots and flaps to enable it to hover at low speeds, to pick up messages, to drop food and supplies to hard-pressed troops. But, after Dunkirk, the situation changed dramatically. For the need was for observation planes which had adequate range and sufficient speed to flash around the German posts at minimum altitude, especially with watchdogs like Messerschmitt Me-109s and Focke-Wulf Fw-190s waiting to get their teeth into whatever appeared over the horizon. No self-respecting Lysander would hop the dangerous Channel into the spider's parlors beyond. Came the Mustang with its laminar flow wing and smooth streamlining.

Nearly every day Mustangs sweep over France, Holland, even into Germany. Two nose guns and six .50-caliber wing guns deal out terrific punishment to enemy troops, locomotives, barracks. Their flashing speed enables them to get pictures which can be

Mustangs in the clouds; their resemblance to Messerschmitts made them targets of British fire at Dieppe. New versions have two 20-mm. shell guns.

Designed and built in 100 days, the Mustang is powered by an 1,150 h. p. Allison engine. Laminar flow wing and clean design give it high speed.

had in no other way. And the Mustang has maneuverability in proportion to its speed. It is the only other fighter comparable to the Spitfire; the area of its stubby wings (236 sq. ft.) almost matches that of the Spitfire (242 sq. ft.), assuring its being a more maneuverable plane than the clip-winged German jobs. But it is such a clean craft that its very ample wing area does not reduce its speed below that of analagous fighters.

British pilots call the Mustangs miniature Fortresses when it comes to taking punishment. Fighting so close to the earth makes the Germans resort to heavy fire from machine guns; they are unable to swing their heavier rapid-fire antiaircraft guns on the low-flying ships. Flak towers near important objectives give warm receptions to the apparitions from Inglewood. But Mustangs come back—and nearly always—with perforated wings, shattered tails, punctured cockpits and tanks. Without three feet of its port wing, one Mustang returned to England and landed at 40 m. p. h. faster than it was meant to; unable to stop, the pilot turned the plane over on its nose on the far side of the field. But he wasn't hurt and soon he was flying again—in his repaired wonder. Flight Lieut. R. E. Baring, who flew one of the Mustangs at Dieppe, thinks the plane is unequaled. Said he: "We couldn't ask for a better plane. It's perfect: more than adequate range, plenty of firepower and speed to spare."

Range is a particular forte of the Mustang. One squadron made a 700-mile trip to attack the Dortmund-Ems Canal in Holland. A raid into Germany made fighter-plane history. The planes machine-gunned a military camp from a few feet above the ground. On the canal they swept down on a factory and a gas depot at Lachen. They flew along the canal and scored hits on several barges. A 500-ton ship was left burning in the Zuyder Zee. And every plane came back! All this by a plane which has the interesting distinction of having been designed and built in 100 days.

Although the Mustang has made its particular mark at low altitudes, it should make a marvel of a fighter up above. One severe limitation of many of our fighters has been the lack of two-stage supercharging, especially in those which, like the Mustang, have Allison motors. Once this has been rectified, our low- and medium-level fighters should go right to town at higher levels. Its generous wing area and laminar flow wing should make the Mustang one of our strongest bets in this category. Its maneuverability is, of course, beyond question. When it is able to get up into thin air at high altitudes, it may even live up to the example set by the Spitfire, for its wing gives it the lowest drag coefficient of any fighter yet designed. Putting all these together, the answer adds to an expectation that the Mustang will play a stellar role in the heavy air fighting to come.

Flying at high speed and zero altitude, Mustangs penetrate deep into enemy territory, attacking enemy ground installations. Shown below are its two nose guns and tunnel radiator under the fuselage.

Briefing of a Mustang pilot. Air liaison officer showing vulnerable points of a Nazi tank. The fast fighters often act as vanguards for ground attack troops, are attached to Army Co-op Command.


FRANK TINSLEY

THE MOSQUITOES STING HARD

By An RAF Correspondent

SHEARING OFF RADIO MASTS AND TREE BRANCHES, THE NEW LOW-LEVEL BOMBER SKIMS OVER THE ASTONISHED GERMANS.

"WOOF! WHAM! PLONK AND AWAY! The bits and pieces fly high and the flames roar up, but the Mosquitoes keep low. They are often twenty miles away when the bombs burst, but they're still at treetop height. It's grand sport!"

Thus a young RAF pilot became articulate describing the new and devastating means of attack—low-level bombing.

The bomber command is completely sold on low-level attack, which started spasmodically with the roaring of the Boston Havocs low over the sands of Libya and occupied Europe. Hurricanes and Kittybombers took it up and were followed by the Lancasters. Now come the Mosquitoes, which the British describe as the fastest fighter bomber in the air and the ace of low-flying destroyers.

A statement of the Air Ministry becomes almost rhapsodic as it compares the Mosquito to the Spitfire in climb and maneuverability. Its wooden construction is more of an asset than a liability. It can fly exceptionally fast; and it can climb on one engine, which gives it a high margin of safety.

The Mosquitoes have already distinguished themselves. They tear over France at thirty feet above the ground, sweep on their targets with incredible speed, free their bombs with split-second timing as the target flashes beneath them, and then take violent evasive action, banking to right and left with wing tips skimming the ground, zooming and diving in a manner hitherto considered suicidal and strictly prohibited. They make their way home dodging trees, pylons and chimneys, and undertaking a special type of horizontal evasive tactics which make fighter operations against them exceedingly difficult. They even seem to have some of the characteristics of tanks. One Mosquito recently got home with a tree branch in its fuselage. Another cut off the top of a German radio mast and brought ten feet of steel tubing with it as a souvenir. The pilots are a bit shamefaced over things like that, however, because it shows they "boobed" a turn. A Canadian pilot literally blushed when some bricks were found in his cabin. "I took them for ballast," he told the intelligence officer, who suspected him of bad turns. What had really happened was that he came in over the target too soon after the man ahead and his machine literally flew through the house that sprayed the air with bricks as a result of the explosion of a delayed fuse bomb.

"Once the target is located," said a high official of the bomber command, "there is a complete absence of difficulties usually experienced in high- and medium-level bombing, such as trajectory variations, drift and changing visibility. The main requirements are speed, marked maneuverability and high navigational skill. Speed is essential to *(Turn to page 46)*

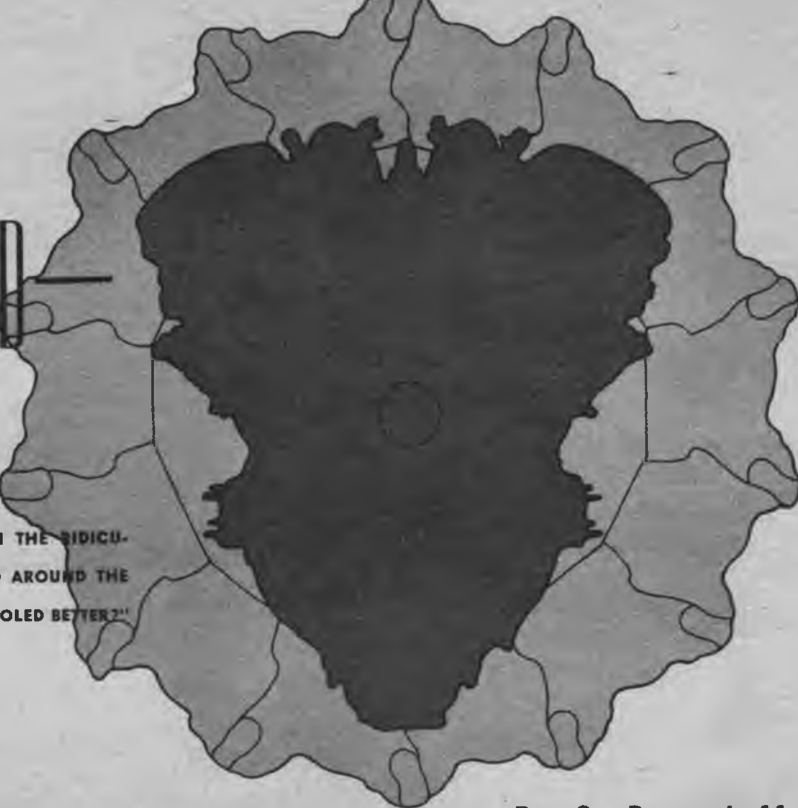
KINGFISHING

THE excellence of our dive-bomber pilots is clearly indicated at the Jacksonville Naval Air Station in Florida. Vought-Sikorsky seaplanes of the type used on catapults aboard cruisers and battleships are the training ships. Fifty-pound water-filled bombs are used in initial practice dives from altitudes ranging upward from 3,000 feet. These first dives use floating buoys as targets. The pilots circle for a favorable position, nose directly on the target and center it in the dive bombsight. At about 1,000 feet the bomb is released and the pilot pulls out, simulating a get-away under pretended enemy antiaircraft fire.

Vought-Sikorsky Kingfisher used by cadets of the Jacksonville Naval Air Station for dive-bombing practice. Top picture shows ship on the way to target. Below: Approaching target, the ship is put in diving attitude which is gradually steepened until (right) the target is lined up in bombsight and the fifty-pound practice bombs are all released.

Fulfillment of every dive-bomber pilot's dream. A Jap heavy cruiser bombed in the Solomon area seen through the sight.

THEY'RE BOTH GOOD—



POINTLESS ARGUMENTS VERGING ON THE RIDICULOUS HAVE FOR MANY YEARS RAGED AROUND THE QUESTION, "IS THE LIQUID- OR AIR-COOLED BETTER?"

By A. Dawydoff

AVIATION well substantiates the platitude that it takes two to make a fight. Bloodied noses, black eyes and skinned knuckles in profusion mark the discussions of the silly argument, "Which is better, the liquid- or air-cooled engine?" The irony lies in that people who really know consider the question just about as intelligent as that about the priority of the chicken and the egg. Points pro and con range from the fantastic to the ridiculous, seldom showing even an acquaintance with the facts. Most obvious has been the wholesale misinterpretation of fundamentals.

A classic bit of foolishness was the contention that aircraft powered with liquid-cooled engines have higher ceilings than jobs sporting radials. Lieut. Apollo Soucek of the navy punctured this old wheeze by setting a national altitude record of 43,165 feet in June, 1930, in a Wright Apache fighter with a 450-h. p. Pratt & Whitney Wasp. The most frequent thrust at the radial was that its large frontal area creates excessive drag. World War I rotary-powered airplanes had cowls, but they were used rather as preventives than to better performance. These engines were lubricated with castor oil which was flung out by rotation and carried by slipstream into the cockpit—causing the pilot to make unscheduled landings into the nearest hay field. The torque effect of the rotary engine was a greater problem than streamlining; this effect was small in the liquid-cooled engine which, toward the end of the war, was used more and more on both sides. After the war, in the days before Townend rings and N. A. C. A. cowling, the stationary radial, sitting out in front with its bare cylinders, created the problem of reducing drag and smoothing the airflow. The neatly cowled, liquid-cooled engine was eyed with favor, although its pre-Prestone and ethylene-glycol radiator caused considerable drag. Water was used as coolant, and its low boiling point required a large radiator.

The air-cooled radial engine has been an American favorite since the navy used the first Pratt & Whitneys. The army, once a strong advocate of liquid-cooling, began to use the radial extensively, but 1939 saw it swing back to its first love for pursuit planes. At present the Allison V-12 powering most of the army's fighters is doing yeoman service under climatic conditions ranging from the subpolar colds of Alaska to the burning African desert.

The latest trend is back to air-cooling. The causes for its comeback are the remarkable development of cowling, the increased power output of the air-cooled engine (which now tips the dynamometer scale at 2,000 h. p. without increase in frontal area) and growing dimension and weight of fighters. In fighters of the five-ton class and over, the over-all dimension of the airplane is large enough to house the 2,000-h. p. radial and still retain low drag characteristics; the engine has comparatively small frontal area in relation to the size of the airplane. However, so large a fighter plane is at a disadvantage, for it cannot maneuver so well as one smaller and more compact.

England has always championed the liquid-cooled engine and it builds the best in the world. Its Rolls-Royce-powered Spitfire is deservedly famous. Although its twelve-cylinder type doesn't approach the 2,000-h. p. mark, the latest version, powered by a Mark 61 Rolls, outperforms in speed, altitude and maneuverability ships with radials of higher output. Use of a two-stage supercharger with intercooler, small frontal area and tunnel-type radiators with jet-propulsion effect are responsible for this performance.

The development of turbo-supercharging offers another possibility of increasing the horsepower of the liquid-cooled engine without augmenting its size and cubic-inch displacement and keeping the over-all dimension of a fighter plane within reason. In bombers, such an engine would increase effective wing area, allowing shorter take-offs and more capacity. This article omits the in-line air-cooled power plant because it has the advantages of both types and because it is of comparatively low horsepower (except for the English Napier-Halford which is little used). The following pages present the facts of the cases so that you can convince yourself that—they're both good. *(Turn to next page)*

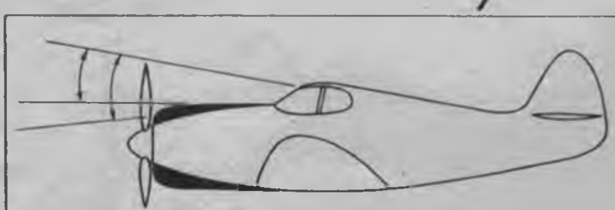
PRESENTED HERE ARE SOME OF THE FACTS ABOUT LIQUID AND RADIAL AIR-COOLED ENGINES FROM WHICH YOU'LL SEE THAT THERE ARE PROS AND CONS TO BOTH DESIGNS.

VULNERABILITY

VISIBILITY

WEIGHT

Radiator, plumbing lines and water jacket of the liquid-cooled engine are vulnerable to gun fire. A puncture by bullet causes coolant to run out, seizing up the engine. Badly shot-up air-cooled motors have brought many a plane safely back home.

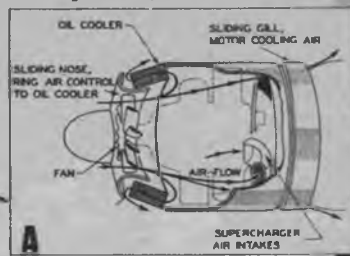


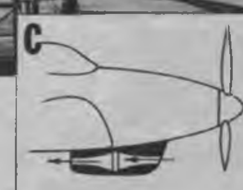
Good visibility is a vital factor in any airplane and especially a military one, whose pilot should be able to look in all directions at once. The narrow, sloping cowling of a liquid-cooled engine permits better downward and sideward vision ahead than possible with large-diameter radial.

Although dry weight per horsepower of both engines is almost alike, the liquid-cooled power plant ready to fly outweighs the radial. Added weight is due to radiator, coolant, pumps and assorted pipes necessary for the circulation of liquid which might total up in high-power output motors to as much as 100 pounds.

COOLING

Drawing Courtesy of "The Aeroplane"





Large radials heat up excessively on take-off and climb. German BMW-801 (A) has a geared fan to assist cooling. (B) shows adjustable gills which provide better air circulation to engine. This condition is not so severe in liquid-cooled because of uniform circulation of cooling agent. Jet effect of new type radiator (C) adds to plane's speed.

DRAG

The sleek, streamlined nose of an airplane with liquid-cooled engine (A) presents less drag than the large frontal area or a radial (B). Lately, though, improved cowling makes it possible for the plane mounting a radial to assume a similar shape, as shown on the Vultee Vanguard (C) equipped with a Pratt & Whitney long-shaft engine.

FLEXIBILITY OF INSTALLATION

A great advantage of a liquid-cooled engine is the different types of installations possible with it. A good example is the Bell Airacobra (A) whose Allison engine is located behind the pilot. The horizontally opposed 1000-h.p. Lycoming (B) presents interesting possibilities of locating engines in wings (C) as airplanes grow in size.

THE MONTROSE GHOST

IN THE EERIE DIMNESS OF A SCOTCH AIR FIELD PROWLED AVIATION'S FIRST AUTHENTIC GHOST.

By Keith Ayling

ONE day in the autumn of 1916 an instructor was walking toward his quarters in the old mess building at Montrose Field in Scotland. Montrose sits in a bleak, windy spot near the North Sea. On gray mornings the buildings jut like crags on the barren plain. Through the dim air the instructor saw, at the door of his quarters, a man in flying clothes. Thinking him one of his friends, he hailed him. No answer. Suddenly a queer feeling stole over the officer. His hair seemed to bristle and he felt a damp cold. He tried to move, but he was rooted to the spot. Swallowing, he summoned up a little courage and yelled shrilly, "Hey, there! What do you want?" The strange man in flying clothes regarded him for a second and then, half turning, he disappeared.

For fear of being accused of seeing hallucinations, the instructor kept the story to himself. But, late that evening, he was returning to his quarters from the mess hall and there, in the twilight, he saw the same man. This time he determined to stand for no nonsense. Briskly he walked toward him. The figure opened the door and the instructor quickly ran after him. And inside the room there was no one. As he stood in the room he remembered that he himself had opened the door. He passed his hand over his head and, sitting down, indulged in a good session of worrying. The poor fellow was beginning to get really frightened, but he was much too good a soldier to spread scare rumors.

One night the same instructor was obliged to share his sleeping quarters with a member of a naval squadron which had unexpectedly dropped in at Montrose. Both of the officers were very tired and went to sleep quickly. Sometime in the middle of the night, the instructor woke to find a man in uniform sitting on the end of his bed. He sat up straight and yelled, "What are you doing there?" The man vanished. He was suddenly aware that his roommate also was sitting up. The two officers looked at each other. "Did you see anything?" they both asked simultaneously. The naval officer also had seen the strange visitor. Both of them were mildly frightened and afterward related that their bodies had showed evidence of fright. They leaped out of bed and ran to open the door behind which the man had vanished. There was no one there.

Next day in the mess the two officers told their story. To their utter amazement, three more officers stated that they had also experienced a queer, unhappy feeling while in the building of the "old mess." One, Major Scott, who was a complete skeptic and a realist, related that one evening, when he had been alone, he had seen a man in a flying suit walking up the corridor and opening the door of the commanding officer's office. He had followed, but the man disappeared. That evening he summoned the sergeant of the guard, and together they searched the entire building. There had been no trace of the interloper. The major had forgotten the incident until he heard the story of the two officers. Eventually it was decided conclusively that at least five of the officers in the Montrose station had seen the ghost.

Unexpected events began to happen—not at Montrose, but in the British Parliament. Mr. Pemberton Billing, one of Britain's air-minded politicians and himself a flier of some note, stood up in Parliament and accused some person unknown of "the murder of a certain Lieutenant Desmond Arthur," a member of the Royal Flying Corps, who had been killed in a flying accident at Montrose a year before the war broke out. Lieutenant Desmond Arthur, according to reports from the commanding officer and his fellow pilots, had been an expert flier. He was, in fact, considered to be one of the best pilots in the country. As such he was employed as instructor, and for any task that required expert handling. Arthur seems to have been ideal flying material. He was Irish, exceptionally good-natured, and with a good deal of the devil in his make-up.

One morning in the autumn of 1913 he went up on a routine flight in a B.E. 2E which had just been delivered from the Royal Aircraft factory. It was a biplane with a long top wing and a shorter lower one. Arthur was doing aerobatics at about 4,000 feet when the onlookers were horrified to see that the top wing of the plane was beginning to buckle; parts of it were falling away. The machine suddenly heeled over and spun down to a crash.

Members of the squadron insisted that the acci- *(Turn to page 46)*

Glider is being carried out of a hangar by A. T. C. cadets, who are taught to handle the ship without injuring it.

It is then hooked by rope to the towing car, taken down to the take-off site and pointed into the wind.

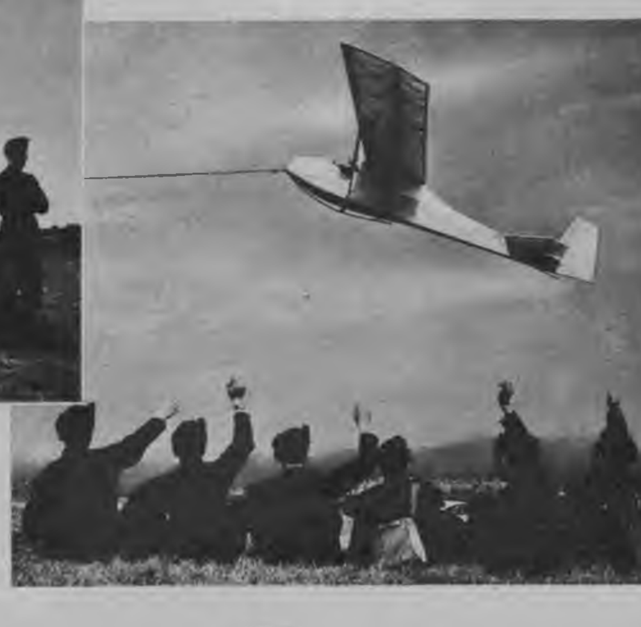
SAFER THAN FOOTBALL

Prior to training hop, instructor shows student correct method of holding stick. Student in cockpit holds rank of sergeant.

YOUTH IN AVIATION

"LEARN by doing" might well be the motto of the British Air Training Corps, in which boys aged fourteen years and over are taught aviation from the ground up. Flying is done in single- and two-place gliders. Safer, under proper supervision, than some school athletic activities, gliding ought to play a definite and important role in our national program of aviation education for youth which, up to now, has been wholly one of unpracticed theory.

Part of the curriculum is operation of the winch. Two cadets are signaling to winch crew with flags for take-off.



After a series of short hops comes the thrilling moment when cadet is allowed greater altitude to practice turns.

"EDUCATION" FOR VICTORY

By Leonard Engel

YOUTH IN AVIATION

THE VAGUE OUTLINES OF THE VICTORY CORPS DO NOT ENCOMPASS THE PRACTICAL TRAINING THAT SHOULD BE THE ONLY REASON FOR ITS EXISTENCE.

DURING the last year, thanks to the war, we have at last begun to prepare our youth for the air age. Under a program worked out by the CAA, more than half our high schools are now conducting classes in basic aeronautics and other aviation subjects for a million and a half teen-age boys and girls. Three years ago, only a handful of the schools included the air among their studies.

On the face of it, this is a striking advance. It shows that aviation is finally finding its way into our educational system, where it has always belonged. Yet we have no cause for real satisfaction, for, whether judged on the basis of immediate war needs or a longer point of view, we have actually accomplished little, and part of that is neither sound nor well done.

Just how much and what kind of air training Young America should receive is a matter of opinion—practically everyone's opinion. There are some who would go so far as to make every high school student an aviation specialist. There is no necessity for this; belief in sanitation doesn't require us to make every citizen a plumber. The minimum, however, is a program which would provide tens of thousands of future army air (and ground) mechanics and technicians with a practical, working knowledge of the elements of their specialties (power plants, radio and so forth); a smaller number of future pilots with at least preliminary flight training; and every student with an understanding of what it means to live in the air age. This would meet not only our wartime requirements, but amply prepare youth for the post-war air world as well.

Against these standards, the CAA program—the only one of many proposed which is in actual operation—is not adequate. It is built largely around a single course, preflight aeronautics, which is practically the equivalent of the old Civilian Pilot's Training Program ground course. Perhaps the CAA, at one time, intended to extend the CPTP to high-school students. Now, however, there is no flying program open to them. Nor is any likely, for the CPTP has now been reorganized as the War Training Service, a branch of the army, under Brig. Gen. Luke Smith.

The War Training Service is actually a variety of screening test to determine flight aptitude. It is a known fact that a number of those selected for flight training (cadets, they're called) by the air forces, are having a dull time sitting around waiting for flight training. Now they will be sent to schools where they will be taught mathematics, history, physics and enough associated subjects to make their backgrounds as closely equivalent to two years of college training as possible. They will also be given ten hours of flying in the W. T. S. on light planes. In order to be acceptable as flying cadets, they must solo in this period of time; if they don't—out they go. The Naval Air Service has always looked with favor upon the CPTP and most of the naval air cadets are graduates of it.

But it can hardly be said of the CAA high-school program that it is making a valid contribution to the preparation of our prospective pilots. Under the present arrangement, most of the comparatively few preflight aëronautics students who do take up pilot training later must relearn their groundwork when they finally take to the air. There is a great step between theory and practice and the army demands much fuller knowledge of certain subjects when they must be continual parts of a pilot's everyday living. Moreover, almost no provision is made for classes in engines, radio and other all-important subjects. And, finally, the CAA has prepared air-age studies for the general student—but generally unsatisfactory ones. Work on them was completed in a mad sprint in which the publisher borrowed aviation articles from every conceivable nook and cranny—surely no way to prepare textbooks and one which has justifiedly gained no wide acceptance. We are, in short, almost as far as ever behind the great powers of Europe in effective air training for our youth.

The high-school program's lack of balance is due in part to the fact that several government agencies are concerned with air education and, as happens so often under such circumstances, they proved unable to make carefully co-ordinated plans able to meet war and peace needs both. The CAA's current activities are actually part of a long-range program conceived entirely in peace-time terms which is being carried out now. That it is not the best possible program for the present moment, therefore, is no occasion for surprise. The CAA's educational planners, however, had little choice. Their hand was forced by circumstances beyond their immediate control.

Among the most important factors which shaped the current high school program was want of well-qualified instructors. The army, navy and War Training Service have absorbed literally every experienced aviation teacher in the country. The program, consequently, had to be designed to permit the use of teaching resources still at hand—in other words, of high-school science teachers. General science teachers cannot be expected to become proficient in practical air work overnight, but they can learn quite quickly to teach a textbook course in what is, after all, another field of science. Another obstacle faced by the CAA was lack of money.

In the years that we in aviation have been pleading for a place in high-school curricula, we have fallen into the easy habit of blaming our lack of progress on the "old fogies who run the schools." Lack of funds, however, was the primary reason why air education made such slow headway for so long. Unfortunately, because of the equipment required, proper aviation training, ground or air, is expensive, and the schools, socked hard during the depression, could afford it no more than they could afford other equally desirable and expensive innovations. They required either a financial miracle or an air program that was ready-made, easy to execute and cheap. The CAA chose to provide the latter, for neither it nor any other government agency has been in a position to extend financial help and the schools themselves are still in poor shape, for a rise in the local taxes on which they depend is impossible in war time.

Besides the CAA, the organization most active in promoting air training for Young America is the Office of Education. The Office of Education is a Federal bureau charged with helping the schools to improve their standards and to carry out missions of national importance such as training defense workers. It functions by means of publicity among school heads and teachers and by providing study course materials and subsidies. The subsidies, of course, are its most efficient tool. The Office has not, however, had the money to back air education or make good the deficiencies of the CAA program. Consequently, it has confined itself to the secondary job of "selling" the CAA program to teachers and students through the High School Victory Corps.

It is strange that in-school aviation training should want for funds in an America which is pouring out billions of defense dollars in truly prodigal style. The only possible explanation is indifference on the part not only of the public, but among a considerable number of aviation leaders as well. Perhaps neither body realizes the urgency of the task or how much remains to be done.

Under the Civil Aëronautics Act of 1938, the CAA is charged with fostering as well as regulating civil aviation. To this the CAA has devoted a great deal of attention throughout its five years of existence. The high-school program is only the latest of its many efforts to create an air-minded citizenry.

In addition to preflight aëronautics, the high-school program consists of a number of other standardized courses, such as biology of flight, air-age geography, elementary meteorology, aviation in literature, air-age social studies and aviation mathematics, either taught separately or worked into courses which the schools are already giving. All are based on study materials prepared under the joint direction of CAA officials, headed by *(Turn to page 52)*

In decided contrast to our almost entirely theoretical courses, British Air Cadets receive practical experience under the actual supervision of the RAF.

The Air Training Corps gave practical instruction in trial schools, but was replaced by Victory Corps, set up for "land, sea and air."

Right flight training can be given safely as proved by successful CAA test program in twenty-two high schools. Problem is lack of instructors.

AIR YOUTH GLIDER NO. 2

By W. F. Tyler

A WELCOME CLASS PROJECT IS THIS PROFILE-TYPE GLIDER MADE OF BRISTOL BOARD AND HARDWOOD.

THE second project in this series of classroom designs has a more authentic resemblance to full-scale gliders, though it retains the simple construction of the first hand-launched project because of the easy-to-build profile-type fuselage. Two-ply Bristol board and pine replace the usual balsa-and-tissue construction, but the additional weight does not handicap performance. The plans are reproduced in full size.

Make accurate tissue patterns of all surfaces; then, using carbon paper, transfer all surface outlines onto ordinary two-ply Bristol board (obtainable in any art supply store). Use shears to cut out these outlines. Remember that there are two sides to the fuselage and two wing panels. Now cement the pine framework in place as shown by the plan, using plenty of cement on all joints to assure adequate strength. When thoroughly dry, cement the other fuselage side in place, and complete by adding the cockpit cover (Cellophane from a cigarette package) and tow-line hook (an ordinary paper clip). For details of fuselage construction see Fig. B.

The wings are made by bending back the additional area shown on the leading edge of the wing and cementing it in place; this serves to reinforce the wing structure. Using 1/16" pine, cut out the wing ribs from the full-size templates and cement into their proper locations as shown on the drawings. Use straight pins to hold the Bristol board in position during this procedure; Scotch tape is handy for holding the edges in place. Note that the end rib (A) is set with a slight bevel to correspond with the one-inch dihedral angle. Figs. A and B illustrate wing construction.

While the wings are drying, cement the stabilizer into position on the fuselage. Note that the fuselage has, at the point of attachment, a convex contour, which is transferred to the stabilizer (giving rigidity) when the latter is cemented in place. See Fig. C. If this does not stiffen the stabilizer sufficiently, fashion two pine struts from 1/16" pine, cementing one end of each strut to the bottom of the stabilizer and the other end to the bottom of the fuselage. After the stabilizer has dried thoroughly, add the rudder, taking care that it is cemented in line with the fuselage when viewed from the top of the fuselage and along the front. Again, if the rudder seems too flexible, correct by attaching pine struts from the middle of the rudder to the stabilizer. The grade of Bristol board used will determine the necessity for using struts.

Cement one wing panel in position and add the two pine struts (Fig. D). While this is drying, sight along the leading edge of the wing to make certain the wing panel is not warped; any such warping may be corrected by adjusting the struts at the point where they attach to the wing. Complete the model by adding the other wing panel.

The model should balance at a point approximately one third of the distance back from the leading edge of the wing. To obtain this adjustment, weight (solder scraps are ideal) must be added to the nose of the model. Now try gently launching the model from the hand to the ground. If the model stalls, more weight should be added to the nose until an even glide results. If it seems nose heavy, part of the weight must be removed; experiment with several trial glides to get the correct balance. If the model tends to be heavy in either wing, correct by slightly bending down the trailing edge of the heavy wing.

After these preliminary adjustments, thrilling flights can be made by using a catapult launching method. Drive into the ground a stake to which is attached a short length of 1/8" rubber band tied to about thirty feet of string. See Fig. E. Tie a small wire ring, fashioned from a paper clip, to the end of the string. Place this loop over the hook on the bottom of the model, walk backward several steps, then release the model and she'll zoom up to an altitude of about thirty feet, at which point the string falls off and she's on her own.

A

YOUTH IN AVIATION

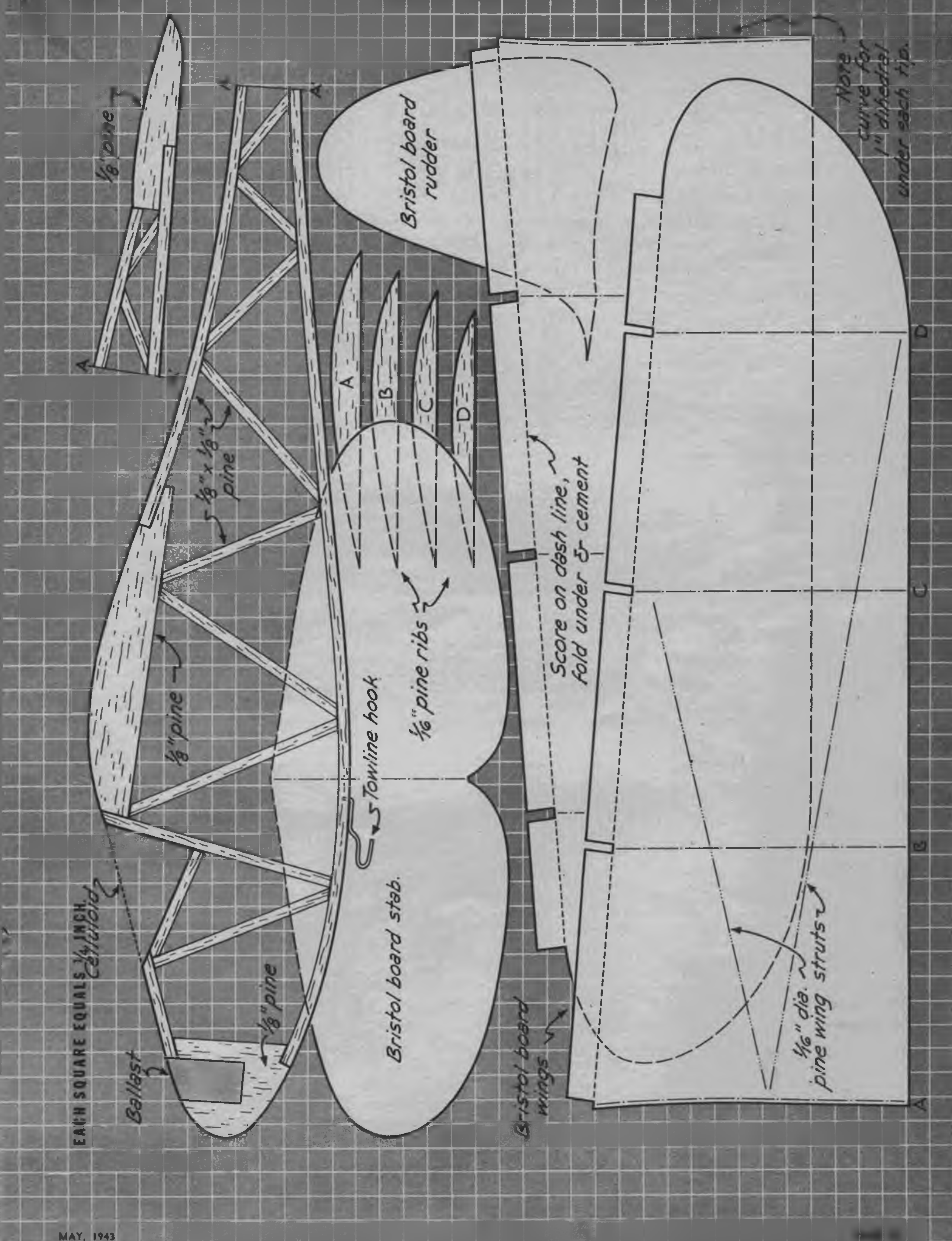
B

D

C

E

"HI-START"—Short length of rubber and long string catapults glider, string drops off at peak of climb...


EACH SQUARE EQUALS 1/4 INCH
Ballast
1/8" pine
Celluloid
1/8" pine
1/8" x 1/8" pine
1/8" pine
A
A
Bristol board rudder
A
B
C
D
1/16" pine ribs
Towline hook
Bristol board stab.
Bristol board wings
Score on dash line, fold under & cement
1/16" dia. pine wing struts
A
B
C
D
Note curve for 1" dihedral under each tip.

WALKER—THE UNPREDICTABLE

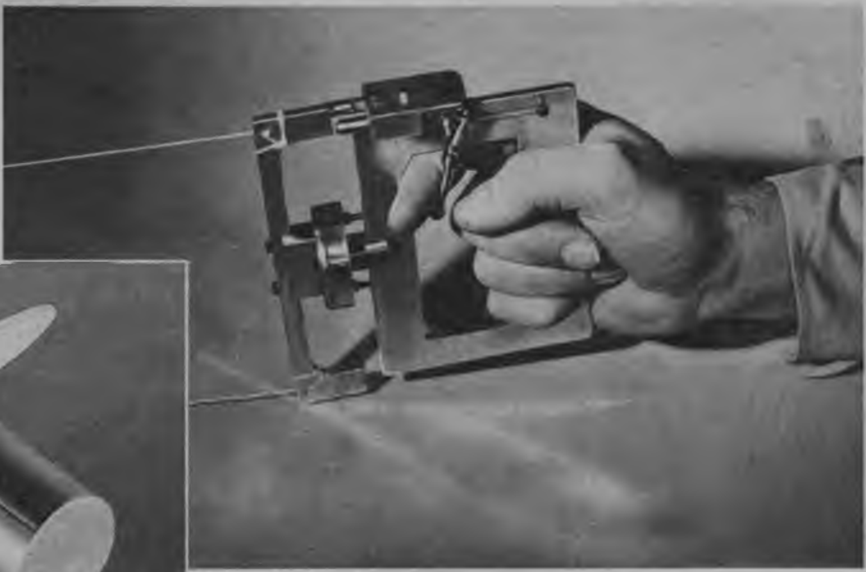
THREE developments highlight the growth of model building in America: the use of balsa wood, the gas engine and control-line flying. The first two, improvements in material and motive power, were taken for granted. But what the daddy of U-control is doing now with controlling a model in flight is really something. His newest wrinkles are previewed here in the hope that they will stimulate the lagging interest in gas-model flying. You can apply these stunts to your pet thermal sniffer to keep it flying—in the back yard. Walker is a storehouse of invention and produces everything from all kinds of gliders to radio-control jobs that actually chase birds. We know what he sits up at night to read, but we'd certainly like to know his brand of breakfast cereal.

WALKER'S latest development is a model plane which can be flown at terrifically high speeds entirely without the aid of an engine and will perform any maneuver with the exception of a barrel roll. A regular U-control handle is held in the left hand and a standard-size fish pole in the right. The model is so designed and balanced that, merely by turning around, the ship will zoom at the end of a thirty to forty-foot line. Maneuvering, of course, is done by using the standard U-control handle, just as in powered flight.

FISH POLE GLIDER

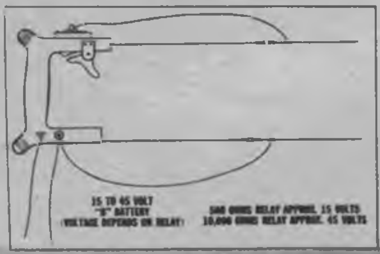
TWO AT A TIME

NO, you're not seeing double. It's just another Walker stunt—flying two Fireballs at the same time. This trick requires a good motor equipped with throttle control. The plane held in the left hand is kept at constant speed, below the top speed of the following plane. This allows the other to fly in perfect formation, for it can gain, fly over or under its mate at will.



INVERTED FLIGHT

UPSIDE-DOWN flight requires a swiveling gas tank so that gas will flow in any direction. Picture, left, shows this type of tank installed on a Bunch Aero Tiger. Two handles are also needed, but Walker has devised a new type of handle that incorporates a trigger. As the plane is brought forward into the top of a loop, the trigger releases the forward portion of the handle 180 degrees and the plane is flown as though it were right side up. The procedure is repeated to bring the model back to a normal position.



SPEED CONTROL

THIS is the perfect answer to motor control for control-line models. The diagrams and pictures show technical details. You will note two timer points on timer case and, in the fuselage proper, a Sigma relay which is operated by current shot through the wires by means of a battery and a trigger handle. All in all, this device adds as much again to controlled flight as we had before. You can do take-offs with an idling motor, change speed in the air, make innumerable landings, refuel and zoom off. Some fun!


FLYING
Kit X6—Lockheed "Lightning"
Kit X1—British "Spitfire"
Names
that are making
AVIATION
HISTORY...
Megow
PHILADELPHIA, PA.
Kit X3—Blackburn "Skua"
Kit X7—Grumman "Wildcat"
Kit X11—Henschel


WARPLANES 95¢
Kit X8—Grumman "Skyrocket"
Kit X9—Westland "Lysander"
Kit X10—Focke-Wulf
CORSAIR, WILDCAT, SKYROCKET, LIGHTNING, SPITFIRE . . . these are names that are writing history in the skies . . . and all, plus many more, are among the 95c Megow Flying Models that every model builder wants today!
With 30-inch wingspan, they are *impressive* in size, fascinating in design . . . and boy! the way they fly! Easy to build, too . . . with Megow plans that picture every detail.
Build a few of these Megow Warplanes now —develop your skill with tools and learn more about aviation, while you familiarize yourself with the air fighters of the great warring nations. See them at your dealer's, or write direct to us.
Kit X12—Fairchild Trainer
Kit X2—Republic "Guardsman"
Kit X5—Vought "Corsair"
Kit X4—Douglas 8A5

THE CASE FOR PUSHERS

By Maurice Schoenbrun

AERODYNAMICALLY, THE PUSHER IS FAR MORE EFFICIENT THAN THE TRACTOR. HOWEVER, STABILITY STILL REMAINS PROBLEM. USE THIS INFORMATION TO DEVELOP SUCCESSFUL DESIGNS FROM THESE IDEAS.

EVERY modeler talks about pushers, but, like the weather, no one does anything about it. Tractor types have been favored, despite the loss of propeller efficiency and other disadvantages.

The greatest concern on the pusher type gas model is that of stability arrangements. In our first design, the wing was high above the fuselage. The center of resistance was low and the C. G. was very low. Since the thrust line was high and the C. G. and C. R. were low, the ship would climb only until the resistance became great enough to cause a tripping tendency and then dive in. The nose moment arm was not long enough to correct this error even partially, so a swept-back wing was used to move the center of pressure closer to the C. G.

The tail moment should not exceed 50% of the span, or the ship will be too hard to balance. The center of lateral area should be directly above the trailing edge of the wing and slightly above the center of gravity which, in turn, should be directly on the thrust line, if possible and preferably 50% behind the leading edge of the wing.

A rather slow-speed airfoil (such as the N. A. C. A. 6409, RAF 32 or Eiffel 400) should be used. A slightly lifting tail and about 40% to 45% of the wing area is suggested. The fuselage should be so designed that about 8% or 10% of the wing area acts as a rudder. The center of resistance should be close as possible or slightly above the thrust line.

Since sidethrust is rather critical, flying with no thrust adjustment is suggested for first flights. If possible, the ship should be flown to the right with power and in the glide. Upthrust in a pusher is the same as downthrust in a tractor. And, in spite of their many peculiar aspects, pushers do fly and may be the coming type of contest model.

Above—Pixie. Center-of-gravity problem is solved by highly swept-back wings. Below—Pusher plane. Standard canard setup. Model flew at '41 national contest.

PIXIE

This model, a twin-boomed, tricycle, gas-engined pusher, was developed for several reasons. Primarily, we wanted a model that didn't break props on rough landings; Pixie measured right up to our expectations. The prop is protected in any position of the model, in relation to the ground—either static or turn over. Its size, portability and low maintenance cost worked together to fulfill the requirements of the final design. The construction time was twenty-five hours, good enough proof of its simple design, both aërodynamically and structurally. The completed model has a span of only 40" and is powered with a Class A Atom engine. The flying weight is approximately 18.5 ounces. And, speaking of flying, this model is one of the fastest ones we've seen for its size and power. Conversely, it has an extremely slow, flat glide, with power off, due to its large wing area. One of the slight design bugs is the nearness of the tail surfaces to the prop slipstream—which means that they are very sensitive; a very slight movement of the tabs has a tremendous effect on the model's adjustment.

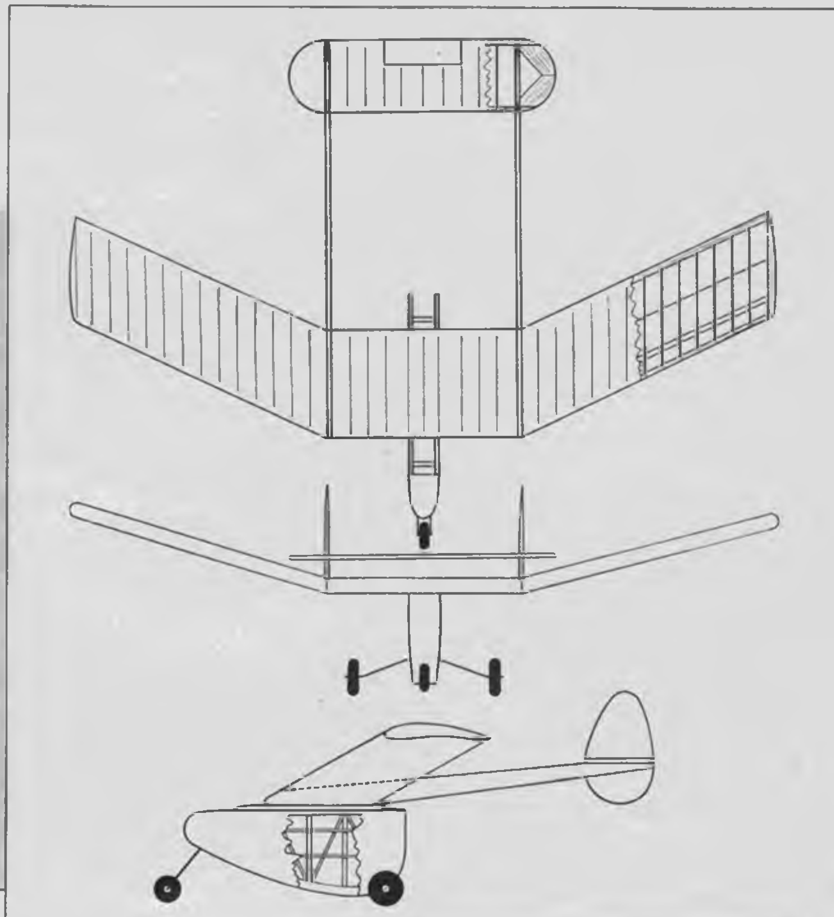
PUSHER PLANE

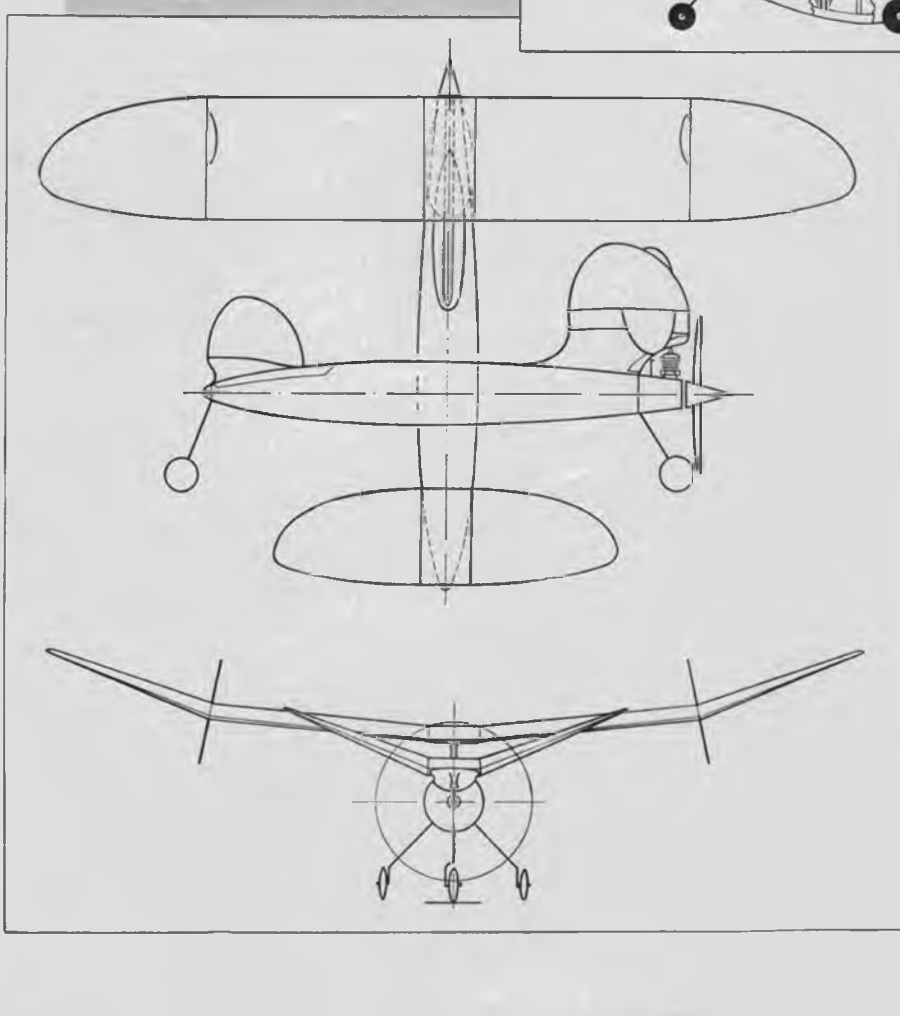
On its very first flight—at the last Nationals, incidentally—this canard looped, rolled and Immelmanned all over the sky. The bronco was tamed easily by reducing stabilizer incidence to three degrees, moving the coil and batteries all the way forward and tilting the propeller back five degrees to alter the line of thrust. Spiral tendencies were corrected by adding tip rudders (they proved indispensable). After that it climbed in steep, tight, right circles, followed by a roll into a flat glide. Since none of the plane is in the slipstream, drag is at a minimum. Forty percent of the load is carried by the "tail." The high wing position at the rear was used for several reasons: the pylon acted as rudder, the low center of gravity as a pendulum for both longitudinal and lateral stability. The stabilizer arm and wiring could be shorter. The fuselage is built up on a box $^1/_{16}$" sheet balsa, faired and planked at stressed points, with stringers elsewhere. The wing is planked and capstripped, the tail capstripped. Weight was about 16 ounces. Eventually, we found that the C. G. should be at 30% of the moment arm. Canards usually require long moment arms (long fuselages) and at least six to nine degrees incidence in tail, though excessive incidence causes mushing. We think the pylon a cure-all for the ills of the canards, just as it proved for tractors.

PIXIE

By Stuart Collins and Frank Squire

This model meets Class A specifications. Span—40", wing area, 228 sq. in.; wing loading, 12.6 lbs. per sq. ft. The total weight is 18.5 ounces. The original model was powered with an Atom motor. 9" prop with 5" pitch.





PUSHER PLANE

By Jack Levedahl

Wing area—288 sq. in. Span—46 7/16". Overall length—28 11/16". Max. cross section—9.6 sq. in. Stabilizer—span, 21"; area, 86 sq. in. Moment arm—21". Powered by Bantam. Weight 16 oz.

DE HAVILLAND MOSQUITO ENGLAND'S SENSATIONAL ALL-WOOD BOMBER

Full-color Photo for Air Trails Pictorial, Courtesy De Havilland Aircraft Co., Ltd.

NOTED FOR ITS SPEED AND MANEUVERABILITY. MADE FIRST DAYLIGHT RAID ON BERLIN.

PUSHER PURSUIT By Aviation Cadet Fred Tuxworth

ANY WAY YOU LOOK AT IT, THIS BEAUTIFUL TETHER JOB PROVES CONTROL-LINE FLYING IDEAL FOR TESTING THOSE DREAM SHIPS. THE AUTHOR'S PET IS AN EFFECTIVE BLEND OF LOOKS AND REALISM.

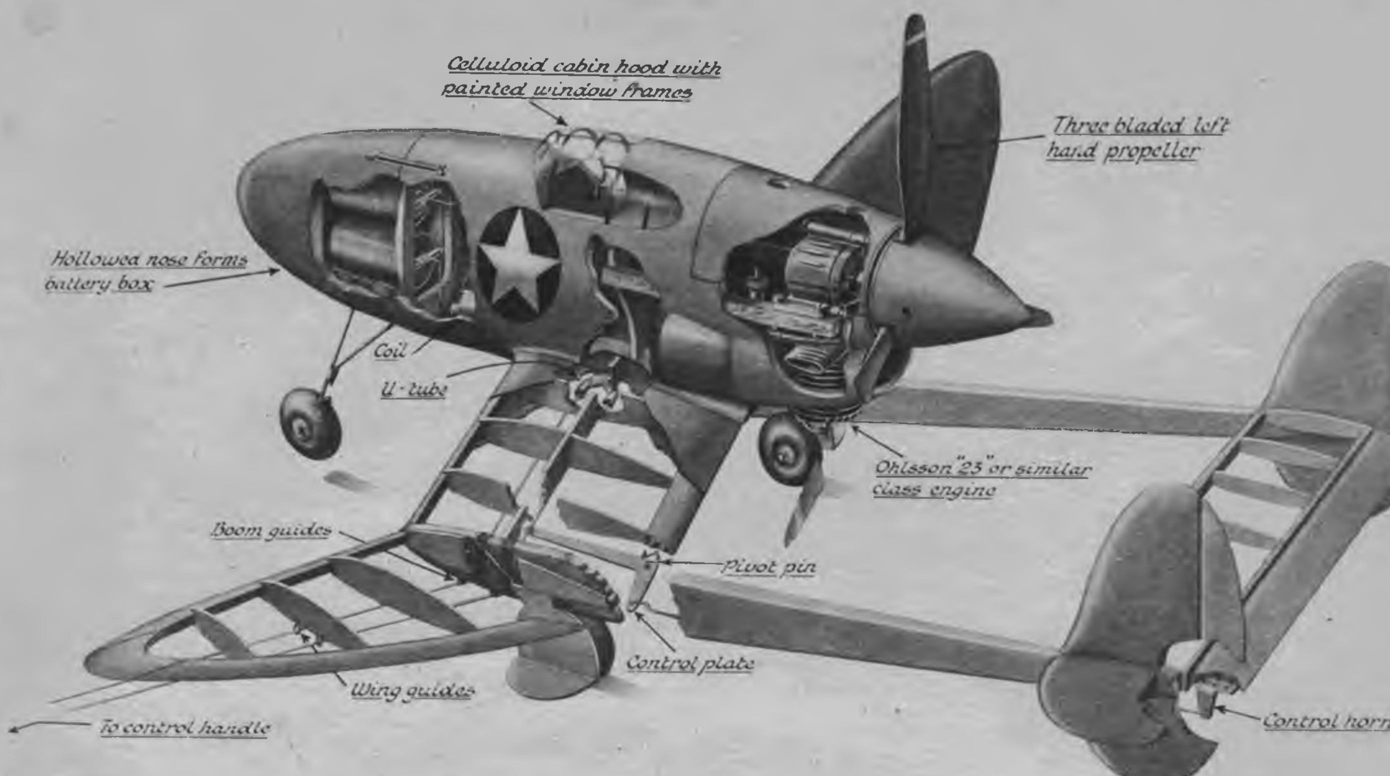
THIS model, although of unusual arrangement, is excellent for the beginning tether flier. Being a pusher, it goes a long way toward preserving engines and propellers. Its tricycle landing gear makes high-speed taxiing quite safe, thus simplifying test flying. The detachable nose section is designed to snap off in the event of severe impact. Since the nose section houses the batteries, the most concentrated portion of the plane's weight, most of the energy of impact is absorbed when it is dislodged. The control system is simplified and entirely external. The U-tube carries the entire control-line load and, since it is stationary, it is very simple to mount securely. This system also allows long levers on the rest of the control system, which minimizes the effect of lost motion and friction.

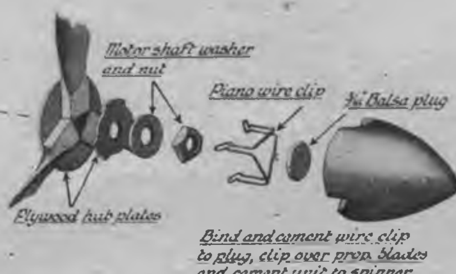
The cockpit and engine nacelles are carved from two blocks of soft balsa temporarily joined with dowel pins; this is the fastest and easiest method of construction. If two blocks of the correct thickness are available, join them with the pins to form a split line down the center of the nacelle. If only one block of the total thickness is used, saw it down the center and join the halves with the smooth faces together to form a straight split line. If you have a jig or band saw, lay out the top and side views on their faces and saw them out. Replace the scrap after cutting one face to keep the block square in cutting the other. Without a jig or band saw, it is best to separate the blocks, lay out the side view on the split-line faces and cut out the profile on each block separately with a knife. This will make the profile correct at the split line, upon which the accuracy of the balance of the carving depends. The plan form will automatically take shape as the block is cut to conform with the templates.

The nacelle is now ready to be shaped. The split line acts as an indestructible center line to which the templates are fitted. Mark at the center line the positions for the templates. Start the whittling by cutting the block to fit each template at its position. This is done by cutting a groove around the block until the wood contacts the template at all points and the template corners are at the center line; a small wood carver's gouge is a great help. As each template position is finished, draw a pencil line around the block where the template has been fitted to indicate an accurate section; this line should remain intact until the entire carving is done. When all the templates have been carefully fitted, cut away the surplus wood between each template position to give smooth flowing lines. The block need be sanded only roughly at this stage.

Separate the halves and hollow them to about 1/8" to 3/16" thickness. The after end, which houses the engine, should be slightly thicker for strength. The nose section is cut off and hollowed only enough to form a battery box. While the (Turn to page 48)

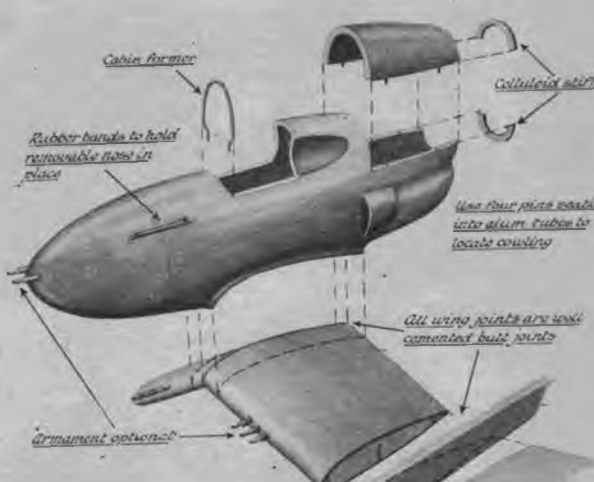
This semiscale job is a real prop saver because of pusher arrangement with tricycle landing gear. Note detail of guns and exhaust.





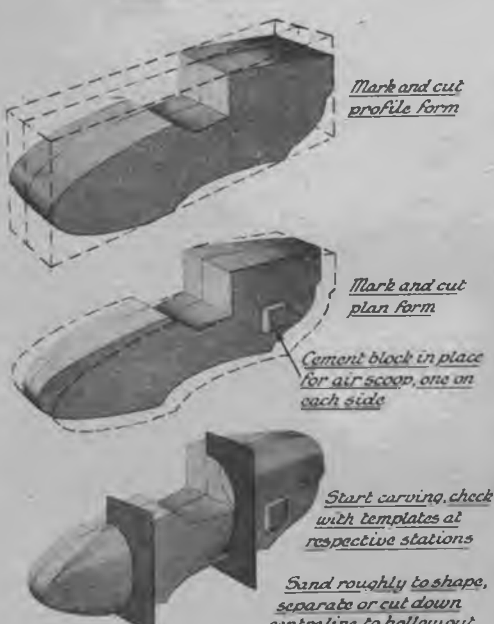
Propeller Assembly

Drawings by Lorne Williams

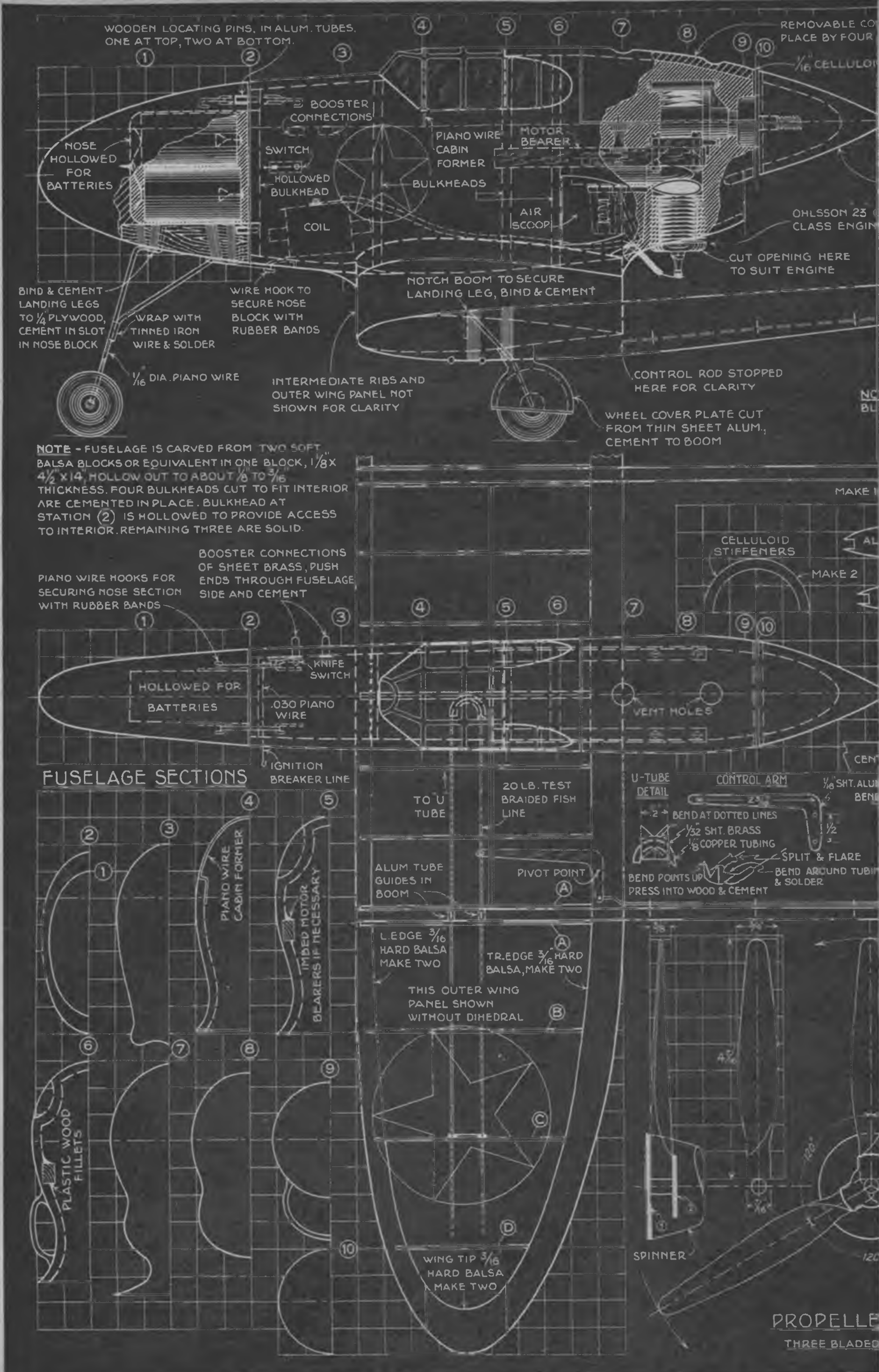


Main Assembly

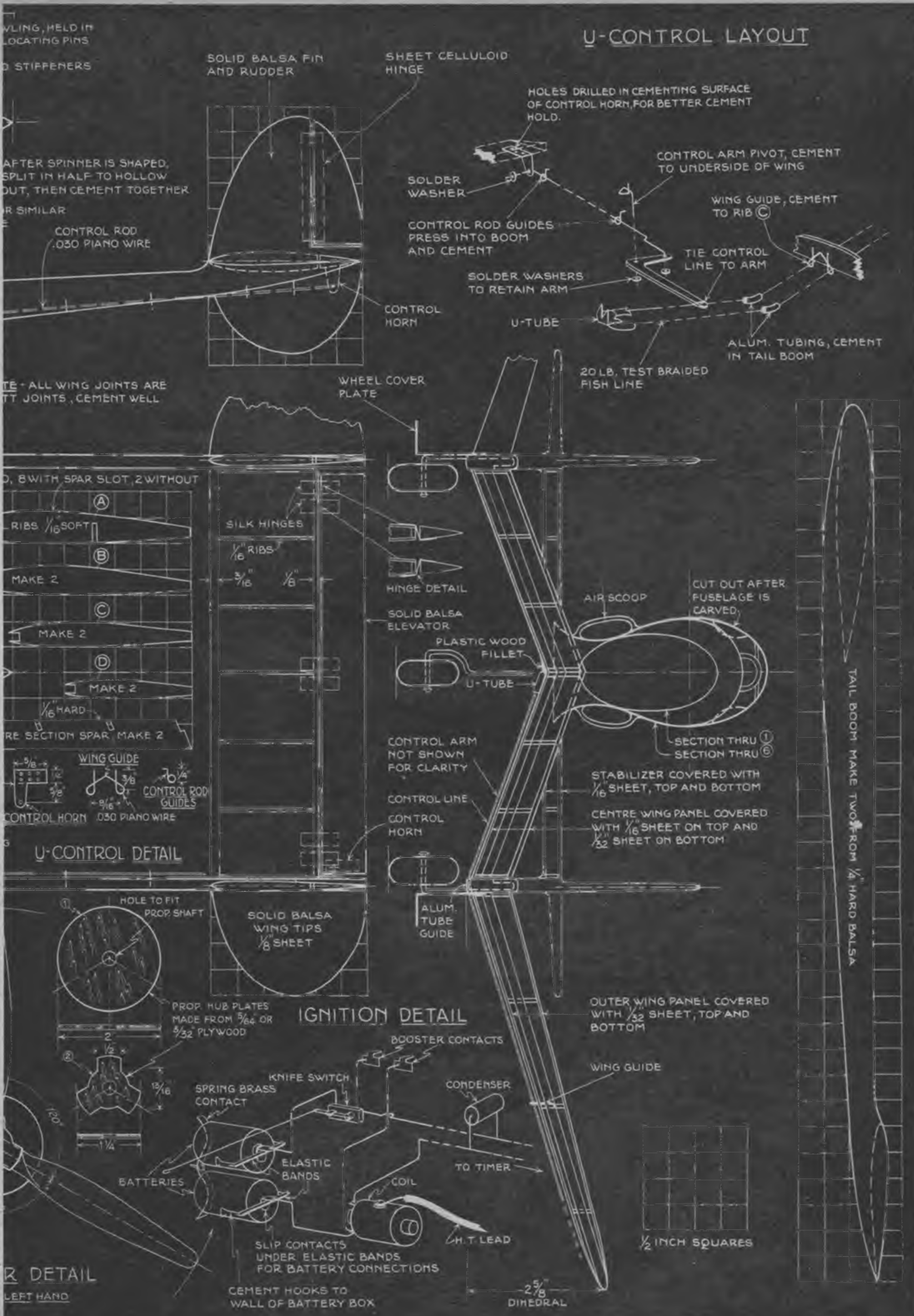
Carving Procedure



Tail-Group Assembly



FULL-SIZE PLANS of this model may be obtained by sending fifteen cents to **AIR TRAILS FULL-SIZE PLANS, 79 7TH AVE., NEW YORK, N. Y.** **15c**



U-CONTROL LAYOUT
WLING, HELD IN
LOCATING PINS
D STIFFENERS
SOLID BALSA FIN AND RUDDER
SHEET CELLULOID HINGE
HOLES DRILLED IN CEMENTING SURFACE OF CONTROL HORN, FOR BETTER CEMENT HOLD.
AFTER SPINNER IS SHAPED, SPLIT IN HALF TO HOLLOW OUT, THEN CEMENT TOGETHER
R SIMILAR
CONTROL ROD .030 PIANO WIRE
SOLDER WASHER
CONTROL ARM PIVOT, CEMENT TO UNDERSIDE OF WING
WING GUIDE, CEMENT TO RIB Ⓒ
CONTROL ROD GUIDES PRESS INTO BOOM AND CEMENT
TIE CONTROL LINE TO ARM
SOLDER WASHERS TO RETAIN ARM
CONTROL HORN
U-TUBE
ALUM. TUBING, CEMENT IN TAIL BOOM
20 LB. TEST BRAIDED FISH LINE
TE - ALL WING JOINTS ARE
TT JOINTS, CEMENT WELL
WHEEL COVER PLATE
D, 8 WITH SPAR SLOT, 2 WITHOUT
Ⓐ
RIBS 1/16" SOFT
Ⓑ
MAKE 2
Ⓒ
MAKE 2
Ⓓ
MAKE 2
1/16" HARD
RE SECTION SPAR MAKE 2
SILK HINGES
1/16" RIBS
5/16"
1/8"
HINGE DETAIL
SOLID BALSA ELEVATOR
AIR SCOOP
CUT OUT AFTER FUSELAGE IS CARVED
PLASTIC WOOD FILLET
U-TUBE
TAIL BOOM MAKE TWO FROM 1/4" HARD BALSA
SECTION THRU ①
SECTION THRU ⑥
WING GUIDE
CONTROL ROD GUIDES
CONTROL HORN
.030 PIANO WIRE
CONTROL ARM NOT SHOWN FOR CLARITY
STABILIZER COVERED WITH 1/16" SHEET, TOP AND BOTTOM
CONTROL LINE
CONTROL HORN
CENTRE WING PANEL COVERED WITH 1/16" SHEET ON TOP AND 1/32" SHEET ON BOTTOM
U-CONTROL DETAIL
HOLE TO FIT PROP. SHAFT
SOLID BALSA WING TIPS 1/8" SHEET
ALUM. TUBE GUIDE
PROP. HUB PLATES MADE FROM 5/64" OR 3/32" PLYWOOD
IGNITION DETAIL
OUTER WING PANEL COVERED WITH 1/32" SHEET, TOP AND BOTTOM
BOOSTER CONTACTS
WING GUIDE
KNIFE SWITCH
SPRING BRASS CONTACT
CONDENSER
ELASTIC BANDS
TO TIMER
BATTERIES
COIL
H.T. LEAD
SLIP CONTACTS UNDER ELASTIC BANDS FOR BATTERY CONNECTIONS
1/2 INCH SQUARES
R DETAIL
LEFT HAND
CEMENT HOOKS TO WALL OF BATTERY BOX
2 5/8"
DIHEDRAL

Oops! Inventor during '20s uses compressed air model to test brainstorm of variable area wings. Results? Guess!

Model Matters

THE DOPE CAN

Last January a leather-lunged Atom job (8-lb. boy) checked in at the Yulke household at Baldwin, Long Island. The old man has come through in fine shape, and by now has resumed his engineering at Republic, model building and contest directing. . . . Hal Roth (Lakewood, Ohio) landed his Phantom-powered gas job smack-dab atop an unclimbable tree and then proceeded to cut down the tree—only to have it crash on the model. Unthinkable! Poor lumberjacking. . . . Tether-flying speeds are going so high that manufacturers should include goggles and flying helmets in each kit. . . . Add the Robbers to the hobby's famous model-building families which include such tribes as the Romaks and the Potters. Harvey S. is president of the Oakland (Calif.) Cloud Dusters, Mrs. H. S. and three sons, Donald, James and Harvey, Jr., make up this quintet that has turned out a load of recognition models for the army and navy.

Twin-engine control line by C. H. Grayson.

Substitute materials turn up in the funniest places. Recently a Spanish airplane tried out a pair of cork tires and reported successful take-offs and landings. Maybe the youngsters don't remember; but cork wheels used to be quite the thing for models. Hope the Spanish inventor has better luck with his cork wheels than we did. Our dog chewed up ours—along with the model, unfortunately.

Cool off if you're getting upset about the increasing shortage of balsa wood. It's finding its way into important war products. Much of it has been sent to England. DeHavilland is reported using considerable quantity of balsa in their new Mosquito bomber. Marine products use even more balsa—life rafts, belts, buoys and all sorts of flotation gear. This country buys and distributes balsa for all the United Nations. The West Indies and Central and South America are being combed for balsa by experts sent out by this country. Facilities are being set up for more and better balsa. So struggle along with the hardwood. After the war the hobby will really have a field day.

Hal Roth suggests compulsory landing gears rugged enough for unassisted take-offs and adequate for a landing when glided from more than just a few inches off the ground; restoration of the cross-section rule with provisions for special types which cannot be handled under the fuselage rule; and boosting the weight rule to 100 ounces per cu. inch.

Ed Yulke plugs the ratio system as the best yardstick for measuring a contest model's efficiency. Ratio system is an importation from Virginia. The rebels have been using it for several years and like it. The model builders working at the N. A. C. A. labs at Langley Field use the rule and they represent a good cross section of builders from all parts of the country. Ratio of engine run to total flight is scored. Use any engine run. One of the major problems had been timing. Using two watches on each flight tied up too many timers at a large contest. Cure this by having one man time all the engine runs, which ties him up just about one minute per flight. The regular timer handles the total flight time in regular fashion. The engine-run man should have two watches for additional accuracy. The engine run, when di- *(Turn to page 61)*

ANGUS ON RULES

To the Editors of Air Trails Pictorial:

"Early in 1941 a cloud could be seen rising in front of model aviation. The businessman in the model industry and the businessman using model building and flying as a diversion or hobby could, from experience, see that something drastic and quick would have to be done to save the sport.

"Meeting after meeting always brought the same results. Motors, parts and supplies must be placed on the essential list. Building and flying of model aircraft must be sold to all concerned as the one most important thing. Nothing could be allowed to happen that would in any way hamper or hinder the regular 'business as usual' in all production of model kits or what made up the kit. All this was talked over from every angle. Well known was what was wanted and really needed, but there is little doubt that the powers that be heeded the urge for profit before they saw the value of model education possible.

E. N. Angus, chairman of AMA contest board.

"This writer was trying his best to make first downs at the very time the forward pass was written into the football rules. The game was swell up to then, or at least a great many players and writers thought so. 'Such a great upset would ruin the game and in a few years football *(Turn to page 65)*

THIS DEPARTMENT IS DEDICATED TO THE SUPPORT OF CLUBS, CONTESTS, AND MODEL ENTHUSIASTS

WHAT DO YOU THINK?

Right now I don't feel like talking about the 1942 mess that was conceived under the heading: "AMA Gas Model Rules for 1942."

Back in 1941 I received a letter from Al Lewis, and under the AMA he appointed me head of the gas-model rules committee for 1942. Included in the letter was a list of members of my committee: Leon Shulman, Bill Gibson, Dick Everett, Elbert Weathers and Henry Struck. You've heard of all of them. I was elated at the appointment and immediately wrote letters to all committee

Carroll Moon and his noted Buzzard Bombshell.

members. That was in November. I received answers from Dick Everett and Bill Gibson almost at once, and had a long talk with Leon Shulman and Hank Struck. From these letters and talks I boiled down a summary report, which I planned to submit.

In the meantime, Bruno Marchi, AMA Contest Director, had been drafted. A war had been declared and things were in a turmoil. One Monday in February the wife called me at my office in New York, informing me that a special delivery letter had arrived from the AMA in Washington. I asked her to open it and read it; to my surprise I learned that a special meeting had been called at the home of Mr. Angus in (or near) Trenton, N. J., on the day before. Trenton is 150 miles from my home.

Of course, I had missed the meeting. My report had not been delivered, and within a few days I was informed that the 1942 model rules had been drafted by Messrs. Angus, Irvin Polk and Al Lewis. It seems that Mr. Angus had been appointed contest director to succeed Mr. Marchi. Mr. Polk, as vice president, and Mr. Lewis, as director of the Academy were, of course, ex-officio members of the committee. They had the power, but shouldn't at least one member of the committee have been present?

Our recommendations, which were mailed to the Academy at a later date, were never acknowledged. They specified ten-second motor run, 100-ounce-per-square-foot wing loading per cubic inch and a flight time limited to five minutes. Well, the war prevented their consideration, or so we all believed. Dick Everett boiled. Struck and Shulman ceased to speak to me. Bill Gibson was properly infuriated.

The AMA 1942 rules, I am in a position to state, have been ignored in most cases. Read the results of contests in current magazines. High times are listed, with complete disregard for minimum flight time. Modelers pay little or no attention to the AMA, for the circumstances under which the 1942 rules were made hardly instilled confidence.

In the first place, consider the rule-makers. Al Lewis, director of the AMA at that time, was knee-deep in personal affairs, including a bride and the possibility of being drafted. Al has had plenty of contest experience, but executive matters had prevented him from actively entering into competition for a long time. In the first place, Al wasn't a gas builder, but specialized in flying-scale rubber jobs. The Polk brothers were builders at one time, but in 1942 they were only commercially interested in the game. Angus ran several large contests in lower New Jersey. Twice I tangled with him when he scheduled a big Jersey meet on the same day as Skyscraper Eastern Championship meets. Both meets were AMA-sanctioned—but only 150 miles apart, definitely against AMA contest principles.

So, fellas, those men made your rules. They may have contacted army officials, but in view of our personal experience with air spotter patrols, we are convinced that they had been given only a part of the picture. Perhaps for seaboard conditions their fears might have been well upheld, but as for a contest beyond fifty miles inland, the rules were absurd.

It so happens that 1942 was the last year in which model builders might have flown in contests "as usual," without restrictions as to materials, et cetera. Despite that, contests were dismal affairs. The AMA had definitely cast a wet blanket over the whole business of model flying. Even England allows rubber-job contests, and as there were no (or few) gas jobs in that country, such competitions were not encouraged, although they were not definitely prohibited.

In 1942, shortly after the *(Turn to page 69)*

CLUB CHATTER

Model leaders in a certain area were asked recently what they thought model building contributed to the knowledge of students of the new preflight training course in the local high schools. One fellow's answer—"more than the preflight course ever did"—was rather irritating to the instructors, but it was backed up by facts. The school course had operated only a half year and the fellows under discussion had been building models for an average of three years. After the facts had been discussed and the instructors' eyebrows had returned to their normal altitude, the subject of model plane clubs as preflight training was discussed. The value of building and then flying the model planes was immediately recognized, but the main stumbling block seemed to be that many clubs do not allow members to be under sixteen or even eighteen years of age. This minimum-age limit prevents fellows from joining clubs where they can mix with builders of more experience and knowledge and thus add to their own basic information. From the writer's own experience, there are many fellows under sixteen who are just as seriously interested in model flying as the older fellows. The sooner the older fellows in model aviation realize that just a few years ago they themselves were under eighteen or under sixteen years of age and that, in a few years, the fellows who are now "too young" may be working in an aircraft factory or flying planes, the more valuable will they become to the national aviation drive.

Despite the ban on pleasure driving in the East, certain clubs have kept on flying at their favorite fields, getting there by way of thumb, bike or feet. Among those who have been able to get to the field on bikes are the Elm City Gas Bugs, New Haven, Conn. Bike trailers, thought to be rare, are coming to light everywhere. The Gas Bugs have one that's towed by a fellow who's too energetic; the resultant spill was written up in the club publication entitled *Flypaper*. This interesting four-page issue had a page of cartoons. Among them was a sketch of a fellow flying a U-control job, with a skunk on the ground beside him. (We wonder what the odor applied to.) A sign says,

Heads up! Spring contests are usually windy.

"This way to bomb shelter." Is this a place to get away from bombshells?

Since the gentle zephyrs that blow in the winter washed out gas-model flying for several Sundays in a row, the Long Island Sky-Lancers decided to hold an indoor contest recently. An eight-and-a- *(Turn to page 62)*

THIS AND THAT

Our own Balsa Butch comes through with the best question of the 1942 season. Asks some reader, whose name we'll withhold for obvious reasons, "What is a moment arm, and after I have got one, what do I do with it?" Butch also wants to remind you fellas that all letters written to us by members of the overseas armed forces will be answered, wherever possible, by V mail.

Still the replies pour in for Al Lewis' arti-

Ohlsson-powered P-47 by Bob Ferraez, St. Louis.

cle, "Ideas Wanted." Lynn Christman, Thirty-fourth T. S. S., Scott Field, Ill., sends us an idea for using dress snaps to hold the wings to the fuselage in small models. He has worked it out on three ships and the idea has stood up very well. He reports he has used condensed milk to attach covering to small models (that's a new one), but warns against using it too heavy. Another Christman idea is using the *(Turn to page 64)*

THESE DIFFICULT DAYS OF WINNING THE WAR. HELP YOURSELF AND OTHERS BY WRITING REGULARLY.

TWO TIMERS IN ONE

USE THIS CLEVER ARRANGEMENT TO RUN BOTH IGNITION AND DETHERMALIZER OFF THE SAME TIMER.

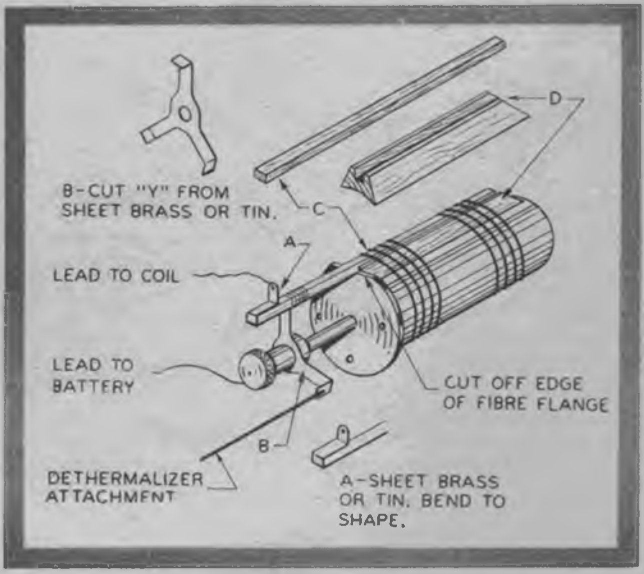
By Gregory Kohn

WHY play with two timers? Why not make one timer do double duty and save some weight as well as cash? Here's a simple method by which one timer can be used as both the ignition and dethermalizer unit.

Get a piece of balsa or soft pine $2^1/_{16}$ x $^1/_4$ x $^1/_2$" and carve a track (D). This track is glued and bound with thread to the side of the timer. Remove the point system from your timer and cut off the fiber on one side of the top, leaving an edge of $^1/_{16}$" Now take a piece of pine (C), cut it to $^1/_8$ x $^1/_4$ x $3^5/_{16}$" and attach a piece of brass or tin to the notched end as shown. This slide (A) is one of the points.

A piece of phosphor-bronze or tin is used for the "Y." See (B). Cut the "Y" as shown and curl the end of one leg, which is the other point. The second leg is bent at a 90-degree angle and is the dethermalizer wire attachment point. The third leg is the terminal for the battery lead. The "Y" is attached between the lock nut and valve nut on the timer. Fit the slide into the track and fasten together with rubber bands. The points should touch lightly enough to slide smoothly but tightly enough not to vibrate loose.

Set your timer according to the amount of time you want on the dethermalizer; then set the ignition to the motor-run time by sliding the slide upward for a short run and down for a long one. In this way one timer takes care of both units at once.

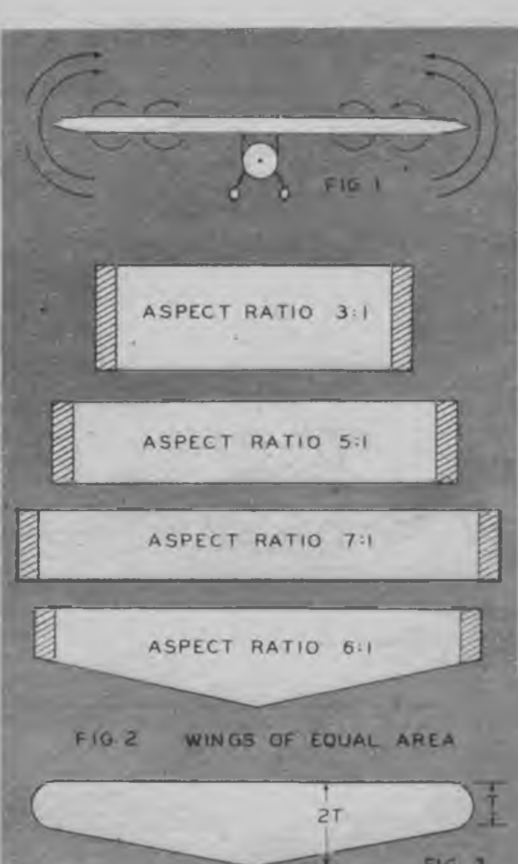


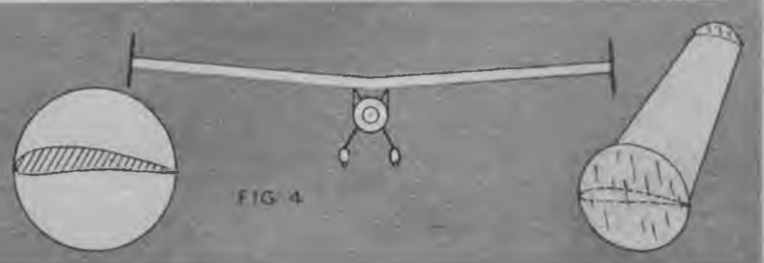
TRY TIP PLATES

By J. R. Custin

SOMETIMES it seems as though aerodynamics is a good thing not to know anything about if you want to build model airplanes. Take the matter of wings, for instance. If you want to build a really efficient wing, aerodynamics says that it ought to be elliptical or tapered. But intuition—let's call it that—tells you that a straight wing is a lot easier to build. So if you didn't know anything about aerodynamics you'd build a straight wing and be happy.

Incidentally, now that you've put in all those hours building a perfect elliptical wing, did you know that certain wind-tunnel tests have shown that an elliptical wing is actually no more efficient than a properly designed wing with straight taper? And did you know that it's possible to make a perfectly rec- *(Turn to page 67)*

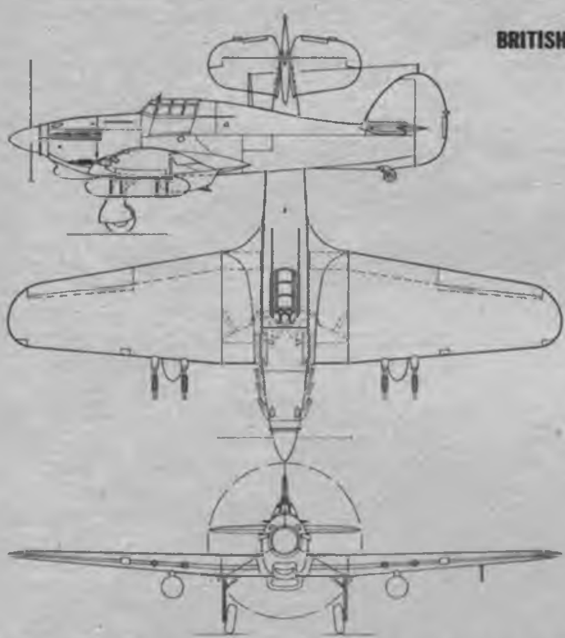




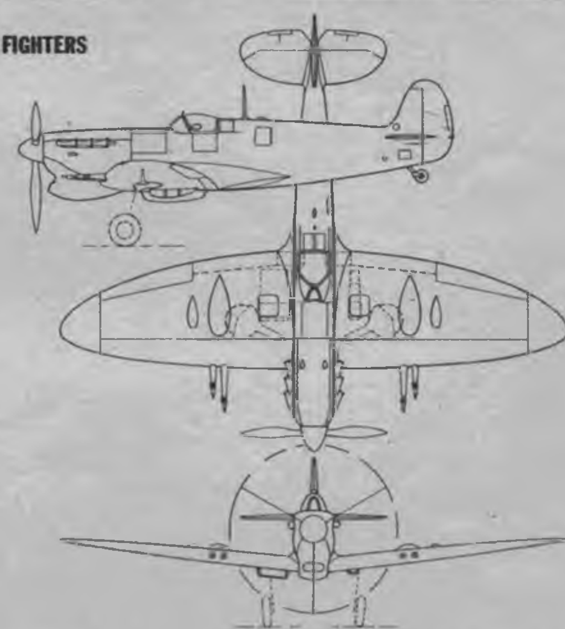
AIR TRAILS PLANBOOK NO. 3

DRAWINGS BY THOMAS A. NAYLER

BRITISH DESERT FIGHTERS

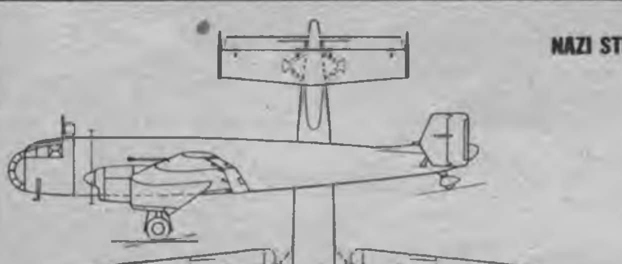


HURRICANE II-C, tropical version, has a special filter installed on the carburetor air intake, shown under the ship's nose. Its range for ferrying and escort work is increased by two auxiliary fuel tanks.

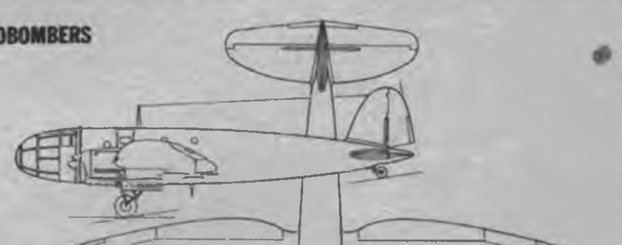


SPITFIRE V-C is essentially the same as the standard model, with the exception of an intake filter for desert fighting located under its nose. Powered with a Rolls-Royce Merlin XLV. Top speed is 360 m. p. h.

NAZI STRATOBOMBERS



JUNKERS JU-86P. Power, two Junkers Jumo 207 Diesels, developing 1,000 h. p. at 26,250 feet. Uses turbo-superchargers and pressurized cabin for ceiling of 45,000 feet. Span, 77 feet. Speed, 280 m. p. h.



HEINKEL HE-116P. A former transport job, now converted to a high-altitude bomber, with specially supercharged engines and pressurized cabin. Span, 72 feet. Maximum speed, 233 m. p. h. Japan bought one.

The Montrose Ghost

(Continued from page 24)

dent had been caused by faulty construction, but the army hushed up their complaints. The War Office, however, appointed a committee to examine the circumstances of the accident.

War broke out and the inquiry was delayed. But at the beginning of August, 1916, the committee came out with an interim report that the witnesses' opinions that faulty repair had caused the accident was totally unfounded. They inferred that the officer's death resulted in an error of judgment on his own part.

But the ghostly events at Montrose Field were highly disconcerting. The officers of the station, which was then in full swing training pilots for both services, were convinced that their five fellow officers had seen something. All kinds of suggestions were raised concerning the ghost's identity. One theory was that the apparition was a manifestation of a pupil who had been killed in flight because he had been sent up into the air with too little training. There had been a lot of newspaper criticism that pilots were being sent to France with hardly enough hours to enable them to leave the neighborhood of their airfields. Weight was added to this theory because the unfortunate pupil seemed to be haunting the quarters of the instructors. Some suggested that his attempts to enter the commanding officer's room were made to obtain his flying log book.

Who started the belief that the ghost was that of Desmond Arthur no one knows, but the story went round that the unfortunate lieutenant was haunting his old airfield because of the report that smeared his memory, particularly since the first appearance of the "ghost" was made a few days after the report had been made.

Whether he was influenced by the report of the apparition or not is not known, but Pemberton Billing, backed up by the Aero Club, proceeded to haunt the War Office and the committee that had issued the interim report.

The result was a series of blasts in Parliament. The Royal Aero Club's Public Safety and Accidents Investigation Committee got busy and established beyond all doubt that the presence of a concealed and unexplained repair in the machine—a repair that had failed and caused the accident—completely vindicated the officer's memory. The Montrose ghost became the leading topic of conversation in flying circles.

In the face of the Parliamentary storm, the interim committee of the War Office decided to issue its final report, which, for some reason or other, although dated November 17, 1916, was not given to the public until a few days before Christmas.

Some people allege that the reason for this was that with the Christmas spirit prevailing, the report would be easily overlooked by the public, who at that time were occupied with the general war effort.

The report came out on December 23rd. On Christmas night the Montrose ghost appeared in the "old mess." He showed himself to two officers who were on duty in the operations room. According to the story, the apparition seemed to be smiling. Early in January the ghost appeared for the last time. It was said that Arthur made a final appearance to tell his brother officers that the affair was ended to his satisfaction.

The actual report of the Aero Club's committee showed that the spar of the airplane had been broken, probably by collision with the hangar door or another aircraft, and had merely been glued together without binding or taping. Therefore, no blame could be attached to the young officer.

Letters have recently flowed into British aeronautical journals giving all kinds of commentary on the Montrose ghost. One maintained that the spirit of Desmond Arthur should undoubtedly be adopted as the patron saint of RAF mechanics engaged on maintenance.

C. G. Grey, who was editor of the British magazine, *The Aeroplane*, which published a full report of the affair in December, 1920, when a rumor was circulating that the Montrose ghost had appeared again, wrote: "Desmond Arthur was rather by way of being a friend of mine. He was a little, black-haired Celt from County Clare, given to extremes of elation and depression. In the latter state he often gave me the impression of being what the Scots call 'fey.' He was a singularly lovable person and yet distinctly wild—in the current phraseology of today's 'psychic.'" Grey, probably one of the most informed writers on aeronautics in Britain, suggests leaving it at that. Other people, however, had much to say on the matter. Although popular opinion holds that the ghost retired from active duty in January, 1917, because he was content with the report, others say that the disappearance was due to a religious exorcising service which was held by the vicar of a neighboring church. The Church of England still has in its ritual a special service for exorcising, or the casting out of evil spirits from one who is haunted. An unofficial report circulated during 1917 said that the good vicar had undertaken the appropriate rites to allow the soul of the young Irishman to rest in peace.

Whatever is the undiscoverable truth, the Montrose ghost certainly existed, doggedly prowling around the secluded airfield. And it gives to aviation the unquestionable prestige of having acquired its own ghost.

The Mosquitoes Sting Hard

(Continued from page 19)

insure surprise and evade pursuit, before and after completion of a bombing raid."

Those are official words. But an RAF pilot put it another way: "You come in at a hell of a lick, so low you can't miss, and let go without bothering about any of the copy-book lessons of bombardment."

"And we certainly fly low," grinned a ginger-haired bombardier. "On the last raid, we went over a Hun machine gun nest. The German officer put up his hand to give the signal to fire and he knocked one of my bombs right off in his lap."

A more serious-minded pilot outlined the advantages of low-level bombing. It is exceedingly safe for daylight attack, much more so than medium-altitude flight. Pilots approach their target hedgehopping fifteen to fifty feet above the ground pursuing a zigzag course, dodging between trees and houses with comparative safety. Few fighter pilots are trained to operate at this height; usually they are warned to keep high and remember that height is the essential advantage of normal combat.

Mosquito pilots get special training to sharpen their judgment in flying between obstacles. One of these is to take the 54-foot span of the machine safely through a gap between easily destructible obstacles, usually of paper or canvas. The gap, about 200 feet wide in early training, is gradually narrowed to 100 or 75 feet. A later test demands that the pilot zigzag at high speed through a series of poles set 50 to 100 yards apart to simulate the avenues of poplars and other tall trees found in occupied Europe.

Another advantage of low flying is that the machines are usually too low for the enemy to use antiaircraft fire against them. Only machine-gun fire and pom-pom fire is effective and, unless the gun crew is warned of the direction of the approach of the aircraft, they have little chance of hitting effectually. A pilot who knows his territory can hoodwink the gunners by cross-country swerving, then roaring in over the target from whatever angle he chooses.

Mosquito bomber crews are given special information before leaving for a raid. This includes a study of land contours on the route, positions of trees and houses, and suggestions as to the best spot to cross the coast.

On bombing accuracy, a Mosquito sergeant bombardier says, "It's just like dropping an apple in a bucket when you're standing on a chair. The odds on a hit are greater than on a miss. The bombs have delayed fuses, of course, to give you a chance to get clear.

"The way the fellows throw the planes about is nobody's business. My pilot put the wind up me at first. We were being chased by an Fw-190. He had guts and came down low 'on the deck.' My pilot went slap into an avenue of trees and he kept flying in and out of them for a mile or so. I thought he would scrape a wing off any moment. The Fw-190 followed us, and he got in a hell of a mess. He was so busy dodging trees that he did not get a chance to shoot. When we got out of the wood and he came on, my pilot went up. These busses climb so fast that it's really frightening. We were up 4,000 feet before I knew what was happening. You talk about a Zero standing on its tail and going straight up. I bet those Jap machines have nothing on the Mosquito. As for the bombing, it's like giving candy to a baby. You choose a juicy spot, let them go *plonk—plonk*—and you beat it home."

Low-flying attack is likely to develop in intensity as 1943 progresses, and experts say that the Mosquito-type bomber will replace the dive bomber. One reason is that the Stuka type of aircraft is vulnerable to antiaircraft fire, for it has to fly over its target at medium altitude. For the same reason, it is easy meat for fighters. Fast low-flying bombers also score because their course cannot be determined by radio location or spotters. If a spotter does get wind of the direction of a plane zipping over the land at 400 m. p. h., the pilot will have changed his course fifty or a hundred times by the time he reports. The development of low-flying attack was the result of an idea by one of the RAF's crack bomber pilots who chose this method to accomplish what seemed an impossible mission. The target chosen was Augsburg, a hitherto peaceful little Bavarian village employed in brewing beer. In 1942 British Intelligence discovered Augsburg was making Diesel motors and parts for submarines, as well as motors and armor for tanks. The flattening of Augsburg would help a whole lot in the Battle of the Atlantic, and it would have to be really flattened.

Twelve Lancasters, Britain's fastest heavyweight carrier, were chosen. The raid was to be decisive. At the briefing of the crew, the squadron leader made a significant gesture. He held his hand palm down a few feet from the table where he sat. "Boys, we'll go that high."

The next day they set out on what

(Turn to page 48)

Airborne Commandos

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PIPER POINTS THE WAY TO WINGS FOR ALL AMERICANS

(Continued from page 46)

was one of the most extraordinary raids in the history of the RAF. Said one of the pilots: "I took my formation down to a height of 25 feet above the ground and we flew the whole way in formation to Augsburg at that height. Near Paris we got into a fierce running fight with enemy fighters. Our job was to get to our target, so we kept in tight formation, wing tip to wing tip, to support each other as the gunners blasted a terrific barrage of cross fire. We went roaring over the countryside, lifting over hills and skimming down in the valleys. Once when a fighter got in close and opened up with cannon shells, we were over the roofs of a village. I saw the shells that had missed us blowing holes in the walls of the houses and smashing the shingles on the roofs. The fighters ran out of ammunition and we tore on. There was no more trouble until we reached the target. We skirted the borders of Switzerland, climbed over a hill and slid down on Augsburg. Then we had trouble. We were so low that the Hun was firing into his own buildings with his leveled anti-aircraft guns."

The hero of that raid was Squadron Leader Nettleton. Four of his formation were shot down, and his own machine was severely damaged. Nettleton made three deliberate runs across the target during which his air gunner and co-pilot were wounded. Only five Lancasters returned. For his courage and leadership, Nettleton received the V. C.

The RAF now has a crack squadron equipped with Mosquitoes and commanded by Wing Commander Hugh Edwards, V. C., D. S. O., D. F. C. Edwards is one of the pioneers of RAF low-flying strategy. As commander of a Blenheim squaddron he made a daylight raid on Bremen on July 4, 1941. Bremen is one of the most heavily defended spots in Germany. Edwards led his squadron to the target flying fifty feet above the ground. He flew smack through the cables of the balloon barrage. In spite of a terrific fire put up by machine guns and pom-poms he made several runs over the target and undertook what the citation describes as "careful precision bombing." All the bombers taking part were hit; four of them were shot to pieces.

Every member of Edwards' Mosquito Squadron, including the medical officer, is a decorated bombing ace. Squadron Leader Ralston, D. S. O., D. F. M., has made 75 bombing trips, and his observer, Flight Lt. Clayton, D. F. C., D. F. M., is a veteran with 92 operational trips to his credit, a record in the bomber command. These two men are the officers, who, flying in a Mosquito, sealed up a tunnel in occupied territory after a German supply train had gone inside.

One pilot described his recent Mosquito outing. "We saw a train going in the opposite direction, so the air gunner gave the cab of the locomotive a burst. Two men tumbled out of the cabin. Then we banked and suddenly a church spire rushed out of the murk straight ahead and well above us. I just turned aside to miss it—my air gunner says only by a foot, but it was enough. After flying down in the yard of a big brick works, which didn't seem worth bombing, we went back to the railway and found another train. We flew at it head on, but our combined speeds were too great. The bomb missed the train itself and dropped into the tender of the locomotive. As we turned to come back again, the tender exploded and bits of coal spattered the aircraft. We made another run and dropped two more bombs. There wasn't much left then of the train."

The Mosquito Squadron pilots already have several spectacular raids to their credit. They have wrecked the Gestapo headquarters at Oslo and smashed up the Phillips radio works at Eindhoven, Holland. Soon they will be buzzing in swarms over Europe, and if there's a special mission to Berchtesgaden, Hitler's mountain hide-out, it will probably be a Mosquito that will roar out of the valley and climb the steep hill on which the "evil spirit" lives. The pilots hope so, at least.

Pusher Pursuit

(Continued from page 38)

halves are still separated, install the engine bearers and the bulkhead halves where indicated. The engine-bearer spacing will, of course, depend upon the engine used, and the walls of the nacelle may have to be cut to fit the bearers. Mount them securely with cement and fill any gaps between the engine bearer and nacelle wall with wood blocks or plastic wood. All the bulkheads are solid except the forward one, which is cut out just enough to provide access to the interior. It is advisable at this point to install small blocks to hold the coil in position. The halves may then be reassembled permanently.

The outer wing panels contain no spars other than the leading and trailing edges. Cut out these edges from $^3/_{16}$" sheet and assemble as shown. Cement in the ribs. Shape the leading edge, trailing edge and tip after assembly. Give all joints a second coating of cement and cover with $^1/_{32}$" soft sheet balsa, top and bottom. Cement the covering sheets together edge to edge to form a large sheet before cementing to the frame. The center-section panels are assembled similarly except for the spar and $^1/_{16}$" covering on the top surface to take the landing stress. Before applying the covering sheet to any of these panels, go over them with a large sanding block so that the covering will go on smoothly.

Cut out the tail booms from hard sheet. Bend the landing gear from $^1/_{16}$" piano wire. Cut the grooves for the landing-gear wire and bind

(Turn to page 50)

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(Continued from page 48)

and cement them into place. Assemble the two wing center-section panels and the tail booms. Check carefully to see that the tail booms are parallel. The stabilizer is built directly between the booms by cementing in the leading edge and rear spar. When dry, add the ribs and $^1/_{32}''$ soft sheet covering. The elevator is made from soft $^3/_{16}''$ sheet balsa and mounted on silk hinges.

Install as much of the ignition system as possible before cementing the fuselage nacelle to the center section. The outer wing panels, stabilizer tips and fins are butt-joined in place with cement. Check alignment and dihedral carefully. The assembled model should now be sanded with fine sandpaper and covered entirely with silkspan or tissue. When the curves are sharp, small strips of covering should be used. Give the model three coats of clear dope; use very fine sandpaper after each coat.

The forward landing-gear leg is bent from $^1/_{16}''$-diameter piano wire. Bind and cement to a piece of ¼" plywood and cement in a slot in the nose as shown. The cockpit cover is made by cementing celluloid over a wire former. The rest of the frame is simulated by paint. On the original model, the entire canopy was covered with masking tape and the portion to be painted was drawn in and then cut away with a razor blade.

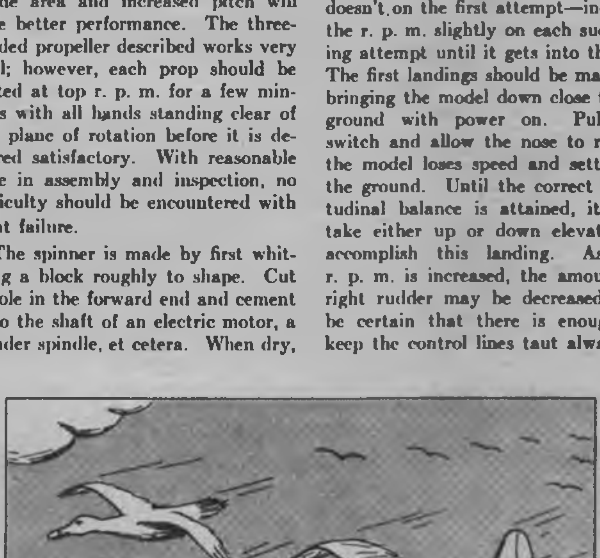
A two-bladed propeller can be used. If it's possible on your engine, as it is on some, to set the timer or the timer cam so that the engine will rotate in the opposite direction, a conventional right-hand prop may be used. If opposite rotation is not possible, a left-hand prop will have to be purchased or carved. To carve one, use either a commercial blank or take the dimensions from a right-hand prop and cut out a blank. Because of the small size of the model, slightly decreased blade area and increased pitch will give better performance. The three-bladed propeller described works very well; however, each prop should be tested at top r. p. m. for a few minutes with all hands standing clear of the plane of rotation before it is declared satisfactory. With reasonable care in assembly and inspection, no difficulty should be encountered with joint failure.

The spinner is made by first whittling a block roughly to shape. Cut a hole in the forward end and cement it to the shaft of an electric motor, a grinder spindle, et cetera. When dry, turn it to shape with a piece of coarse sandpaper. To hollow it, split it in two and reassemble when finished.

Cement the U-tube and control-arm pivot securely into place. All pivot holes should fit as closely as possible to avoid lost motion. A little friction in the joints will be unnoticeable with the ample leverage available. Friction in the U-tube can be greatly reduced by rubbing the portion of the fish line that runs through it with the point of a soft pencil, which will deposit graphite on it. The rest of the control system, the lines and control handle, is conventional.

Because of the unusual system of forces on this model (high thrust line and low center of resistance) it was found that the center of gravity should be between fifty and sixty per cent of the chord aft of the leading edge. If the finished model does not turn out this way, it may be corrected in several ways. The C. G. can be changed by weighting with wire solder (probably to the extreme forward end of the nose block). The stabilizer angle can be changed by cutting the ends loose from the tail booms and recementing them. For small changes, the length of the control rod can be changed by increasing or decreasing the angles bent near the control-lever end; this will cause the elevator to act through new positive and negative angles. The exact arrangement for each particular model can be determined only by careful test flying.

For the first few flights a heavy linen thread should be run from the knife switch to the free hand of the pilot so that the engine can be cut at any time. Use hard right rudder and reduced r. p. m. for the first trial. Allow the model to taxi nose down, which it will do quite safely, until it picks up speed. Ease the elevators up gently and see whether it will take off. If it won't—and it's best if it doesn't on the first attempt—increase the r. p. m. slightly on each succeeding attempt until it gets into the air. The first landings should be made by bringing the model down close to the ground with power on. Pull the switch and allow the nose to rise as the model loses speed and settles to the ground. Until the correct longitudinal balance is attained, it may take either up or down elevator to accomplish this landing. As the r. p. m. is increased, the amount of right rudder may be decreased; but be certain that there is enough to keep the control lines taut always.



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"Education" For Victory

(Continued from page 27)

Bruce Uthus and a CAA-Office of Education advisory committee of educators and airmen, and published as the "Air Age Education" series of textbooks by one of the big textbook houses in New York, MacMillan.

The program was announced last spring. Only the preflight aëronautics course, however, as measured by the best of indicators, sales of the textbook used, has gained real acceptance. More than a million copies of "Science of Preflight Aëronautics for High Schools," by the Columbia University Teachers College Aviation Education Research Group, have already been sold. Sales of the others, however, have not been large.

The preflight aëronautics course covers the ground-study subjects required for the private pilot license: civil air regulations, elementary navigation, elementary meteorology and general servicing and operation of aircraft. The CAA, in fact, permits students in the high-school course to take the private pilot's written examination. If they pass, they receive Certificates of Aëronautical Knowledge exempting them from the ground test if they take flying lessons and come up for their private licenses within twelve months.

Last spring, at almost the moment it was launching its textbookish regular program and when it still controlled the CPTP, the CAA tried out flight training for high-school students on a small scale. Full CPTP primary instruction was given an average of ten students (minimum age —seventeen, and written consent of parents required) in twenty-two high schools throughout the country.

The record these over 200 compiled, according to the CAA, was as good as that of college CPTP trainees. When the test was concluded last fall, therefore, it was widely expected that flight training would soon be given to high-school students. None, however, has materialized. As time goes on without word from Washington, where the results of the test, it is said, are "under study," the likelihood that any will be and that the textbook curse will thus be removed from the studies of at least some of the high-school lads grows less and less.

CAA officials, off the record, blame their failure to extend the CPTP (now W. T. S.) on the schools, asserting that the schools oppose flight training for fear of lawsuits arising out of accidents. The CAA also says that it fears parental opposition to any high-school flight program. To say the least, however, both arguments are specious. The high schools' objections are no more insoluble than the objections of the colleges and universities, which are in the same legal position and which have been conducting CPTP classes for three years. As for the parents, there are certainly thousands upon thousands with a realistic view of the war and willing to give their consent in order to give their children a better preparation for the uncertain world conditions today.

A more legitimate objection is the scarcity of instructors and planes. But no such difficulty stands in the way of another type of training which the CAA might institute—gliding and glider construction. Students could make their own gliders, thus training a very large number in the elements of flight and an even larger number in the principles of aircraft construction. The CAA's education group is indeed interested in a glider program, but it is opposed to CAA Administrator Charles I. Stanton. No national glider program has therefore been formulated, although Minnesota has already taken a forward step in its State education. The city of Appleton has, notably, established a glider-construction course, and all shop courses in the higher grades deal with aeronautical construction.

No training for future mechanics and other ground-crew men whatever is provided under the CAA program. As a matter of fact, the CAA has, generally, made only limited efforts to train ground men. Late in 1940, a joint CAA-WPA-Office of Education program for training airport servicemen was started. So, also, at a later date, was a similar scheme for mechanics. Both died at the end of last year, however, for want of qualified candidates (the qualification: that they had been on WPA). No attempt was made to revive either for the benefit of high-school students, who would stream into such courses the moment they were opened.

In striking contrast to the haphazard character of our own youth air training is the record of what is being done in Europe. Germany and the Soviet Union are well known for their systematic programs over many years. The Reich has long made air work of one kind or another—model building, mechanics, gliding and the like—compulsory in both its grammar and secondary schools. And even the British, who slept very nearly as long as we, are also well ahead of us.

England's air-minded youth are trained in the Air Training Corps, a volunteer organization supervised by the RAF. Although it is a strictly spare-time outfit, the ATC provides its members—more than one in every three sixteen- and seventeen-year-old Britons—with excellent preliminary training which is geared with precision with the needs of the RAF and the Fleet Air Arm.

Although gliding is the only flight training given, ATC members receive thorough practical training in the various fields of military aviation. The courses are prepared by the Air Ministry and the instructors are RAF men. All ATC cadets, for example, learn Morse code, not merely from a textbook, but with radio and signaling equipment identical with RAF apparatus, and with service-type messages. ATC members headed for flight training take the RAF primary ground course a short time before their entrance into the RAF so that

(Turn to page 54)

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(Continued from page 52)

most of the work need not be repeated.

The ATC is not a school organization, because many British youngsters leave school at a comparatively early age and a school scheme would not reach them all. Yet its methods could certainly be adopted here. The CAA is probably not the organization to do the job. Fortunately, the organization for it does exist, although it has accomplished virtually nothing to date and is currently quite disorganized. This is the High School Victory Corps.

The Victory Corps was set up by the Office of Education under a sponsoring committee representing the office, the army and navy, the department of commerce and civilian aviation, for the purpose of promoting high-school defense activities such as air education by giving recognition to students preparing themselves for a useful place in our war effort. Students who, for example, take a high-school course in physics, three years of mathematics, physical training, military drill and preflight aeronautics or an aviation trade course are eligible for the Air Service Division of the corps.

The corps, however, has never properly carried out even this absurdly limited program. By some strange oversight, its formation was announced before the Office of Education had secured funds for its operation, and it still hasn't any money. The only divisional director so far appointed is Dr. Frank Hart, Air Service Division chief, whose salary is paid by the CAA. Dr. Hart's is, of course, the only functioning division. The corps has no field officers or staff of field organizers to visit the nation's schools and aid in the establishment of local units.

Nevertheless, the corps would make an excellent instrument for an air program along ATC lines, for it has at least a skeleton organization in the immense majority of our schools. Moreover, the Office of Education itself has the necessary set-up and contacts for carrying out such vital measures as distributing funds and study materials to the schools in which corps air units exist. The CAA, on the other hand, not only lacks the organizational machinery, but its own program has already gained so much momentum that it would be difficult to change.

But before the Victory Corps can be so used, certain changes must be made. The Office of Education requires overhauling to inject into it the vitality to carry out an effective program. At present the office is a quite leisurely going agency. Second—money from Congress is required—perhaps $50,000,000 at the start. A bill on air education, by Representative Maas of Minnesota, is now before the House of Representatives. The Maas Bill, however, merely proposes a limited glider and glider construction program which is, moreover, to be placed in the hands of the anti-glider CAA. Only $5,000,000 is to be provided for the program—and the bill does not touch upon the phases of air education at all.

Third—the active co-operation of

(Turn to page 56)

(Continued from page 54)

the army and navy must be enlisted. The services are represented on the sponsoring committee of the Victory Corps, but they are actually completely indifferent to it. This indifference is due partly to its present ineffectiveness and partly to traditional hostility of the army to participation of civilian agencies in educational projects designed to do part of the training. A case in point is the army's persistent refusal to credit CPTP graduates with any primary preflight training time. (The navy, on the other hand, starts CPTP-trained cadets from the point at which they left off.)

But army and navy collaboration is absolutely vital, for the courses which should be taught through the Victory Corps must be designed to fit into military requirements. Preferably, at least, some of the instructors might be army men, too; if the RAF can spare the men, so can we. The program might include practical training in: engines, structures, radio (operation and repair), glider construction, meteorology, navigation, and, for selected students at least, flying. Such a program is entirely feasible, as the experience of other countries proves, and it would snap youth air training out of its present rut and build for present and the future. It's unnecessary to add that *there's no time to lose!*

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Page 20—All by Harold Kulick.

Page 22—U.L., British Combine; Cen., Wright Aero. Corp.; L.L., Harold Kulick; L.R., Harold Kulick.

Page 23—T. (drawing)—*The Aeroplane;* U.R., Wright Aero. Corp.; Cen., Wide World; L.C., Curtiss-Wright Corp.; R.C., Curtiss-Wright Corp.

Page 25—All by International.

Page 26—Free-Lance Photographers' Guild.

Page 27—Cen., British Combine.

Page 28—Zoltan Farkas.

Page 30—R.C., Photo Art.

Page 31—All by Photo Art.

Page 42—T., Herbert Photos.

Page 43—U.L., Harold Kulick.

JIM WALKER ANNOUNCES

Whip-Power U-Control

A New Motorless Plane that You Control in Flight

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Climbs, Dives, Banks and Loops

JIM WALKER'S research at American Junior Aircraft has developed a new star performer!

It is the amazing new Whip-Power U-Control. A fishing rod, bamboo pole or other long stick takes the place of a motor. And what speed! Whip-Power planes have been clocked at 98 m.p.h.

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Your Whip-Power plane is a sturdy craft, made of non-critical balsa wood, with a wing spread of 19 inches. It comes to you in a kit with all parts cut to size. All you need is a knife, sandpaper, cement, dope and thread for the controls.

American Junior Aircraft is producing these planes as fast as possible after filling orders for planes for the armed forces. They will be ready for shipment on April 15. Possibly your dealer will not have enough Whip-Power planes to fill your order immediately, but your patience will be rewarded amply by the fun you will have when you try out your own ideas of aerial gymnastics.

New U-Control Model to be Announced

Still another Jim Walker model made of non-critical balsa and flown by U-Control is nearing completion. This plane, the Firecat, will be announced in the near future.

AMERICAN JUNIOR AIRCRAFT CO., Jim Walker, President, PORTLAND, OREGON

The Carrier Question

(Continued from page 15)

10,000-ton light cruisers (the *Cleveland* class) and, in 1941, made plans for the construction of twenty-six more; these fifty-eight cruisers are the largest number of identical cruisers ever projected. When Pearl Harbor drove home the terrible lesson learned from sea-going air power, however, a large number of the *Clevelands* (probably the entire second batch) was ordered changed to 10,000-ton carriers. None of these had actually been begun. They constitute the second quantity type of American aircraft carrier. The navy has made public no details of these vessels whatsoever. Five, however, the *Independence*, *Princetown*, *Belleau Wood*, *Cowpens* and *Monterey* have been launched. Some of these may be in service by the end of this year. Their capacity is likely to be about fifty planes each.

It is perfectly possible, of course, that this huge program, which may involve the building of nearly two-score carriers, is not all. Even without any additional units, it is more than adequate to meet our needs in the Pacific, where we must defeat a foe well equipped and versed in a use of naval air power and where we have few convenient bases for offensive employment of land-based bombers. For, though Japan is making a herculean effort to turn out "flat tops" in quantity, she cannot begin to hope to match our increasing output.

Before 1941, Japan was credited with nine fleet aircraft carriers: two old and small—*Hosyo* and *Ryuzyo;* two old and big—*Kaga* and *Akagi;* three new and small—*Hiryu*, *Soryu* and *Koryu;* and two new and big—*Shokaku* and *Zuikaku*. It is now known that she had at least two more by Pearl Harbor Sunday or very soon thereafter, and she may have had still another three, making eleven to fourteen in all. In the Battle of the Coral Sea, American pilots spotted two, the *Takesago* and the *Ryukaku*, sister ships whose existence had never been publicly acknowledged previously. The *Takesago* and her sister are big, with 800-foot flight decks, and bear a suspicious resemblance to our *Enterprise*. The other Jap "flat tops" are the three *Shohos*, which our pilots may or may not have encountered, about which extremely little is known and which may possibly be converted luxury liners rather than fleet vessels.

American forces have sunk five or six Jap carriers. (One claimed by U. S. fliers may actually have been an auxiliary craft; exact identification of carriers from the air is extremely difficult.) At the beginning of this year, therefore, the Japanese navy had a strength of five to nine carriers and may have held a definite margin of superiority over us. In the face of our construction program, this margin cannot last more than a few months. Nevertheless, the Japanese margin cannot be ignored. First, Japan may lose some of her carriers in action—but so may we. Second, six to nine of Japan's "flat tops" were built between 1937 and early 1942. The enemy thus has a proved ability to produce better than one carrier a year, including large types. If he sticks to 10,000-tonners, he may be able to complete two annually, despite the steel shortage which is a perennial problem of Japanese shipbuilders and which has recently become more acute because of the lack of new steel-making resources in the conquered territories and the rising steel demand of the ship repair yards.

Of the three major naval powers, Britain has the least need of aircraft carriers. The Royal Navy's chief function has been the maintenance of supply routes and the blockade of Nazi-occupied Europe. The present German fleet is not strong enough to battle in the high sea. Hence the British have had little opportunity for ocean warfare out of the reach of land, the kind of fighting which particularly requires aircraft-carrier participation. Yet carrier construction in Britain is proceeding. Sometime last year the royal navy commissioned the *Indefatigable* and *Indomitable*, the last two of the *Illustrious* class begun in 1937 and the first large group of carriers ever ordered by any navy. Since then, other British carriers laid down since 1939 have been completed; for Britain now has, according to a statement by First Lord of the Admiralty A. V. Alexander, more carriers than she had in 1939. The completion of the *Indefatigable* and the *Indomitable* gave the royal navy seven, more than those commission in 1939. No information on the new carriers is available, however, in keeping with the London policy of not revealing any details whatever on warships larger than destroyers and begun since September, 1939. Britain's carrier forces remain sizable in spite of the heavy losses of the last three years *(Ark Royal, Courageous, Eagle, Glorious, Hermes* lost; present carrier strength, seven) and, barring abnormal casualties, will grow. Altogether, Britain, Japan and the United States will double the existing number of carriers within the next two years.

Most of the claims that the aircraft carrier is on its way out, along with the battleship it has supposedly killed, are based on the belief that the vulnerability existing carriers have displayed is inherent in the nature of the carrier. It is obvious that the "flat top," which offers an inviting, almost unarmored target to both the dive bomber and torpedo plane, is indeed more liable to battle damage than other men-of-war. Yet, on closer examination, some of this vulnerability turns out to be not so unavoidable. Six of the carriers lost so far (three British, two Japs, one American) were not legitimate carriers; they began life during or immediately after the first World War as something else, generally a battleship or battle cruiser; as a result, they could not be expected to perform as maximumly efficient aircraft

(Turn to page 60)

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(Continued from page 58)

carriers. The loss of others may be attributed to improper use of the ships. Antisubmarine measures were deficient. The ships were brought to within a stone's throw of enemy air bases. Such mistakes, of course, were due in part to the newness of the aircraft carrier art. At the same time, some of the newer craft, like the famed *Illustrious*, have successfully withstood fearful poundings. In other words, proper design can make the carrier considerably more rugged than it appears, resulting in minimum risk of loss.

One approach, obviously being taken by the United States, is the use of smaller carriers, each of which is not only handier and harder to hit fatally than the larger craft, but places fewer eggs in one basket. A second also exists, but, so far as is known, is not being tested by any navy; it is aircraft carriers of vastly greater tonnage than any ever built, on the order of fifty to sixty thousand tons.

In the history of naval architecture, it has been proved over and over again that the larger a vessel, the greater the protective features which can be engineered into it. The most striking example of this theory is the Nazi battleship *Bismarck*, which absorbed countless 14-, 15- and 16-inch shells at close range (hitting with far more penetrating power and destructiveness than aërial bombs) as well as nine torpedoes before finally succumbing. There is no valid reason not to apply the same principle to aircraft carriers.

The super carrier, for example, could draw 35 feet of water and still ride high enough to provide a flight deck safe enough for flight operations in heavy weather. So great a draft would impose no vital limitation of the "flat top's" movements, for carriers have no business operating close to shore. The deeper draft would permit a much improved distribution of weight and the allocation of a greater percentage of it to the upper decks. Aircraft carriers today must have relatively lightly built upper works or risk topheaviness, for they must ride high out of the water to give the flight deck adequate clearance. Antifire and antibomb compartmentation of hangar decks is, consequently, extremely difficult. The improved weight distribution in the super carrier might well allow such compartmentation. Better compartmentation of the hull itself is also possible in the larger ship; present aircraft carriers, as experience has shown, are all too often inadequately protected against torpedo damage.

Large ships are frequently objected to on the ground that a disproportionate amount of power is needed to give them proper speed. This belief, however, rests on a misapprehension. Increases in speed are what eat up power, not increases in size. The increase of power with size is nearly proportional to the increase in size. In other words, the super carrier might require twice the engines now installed in carriers. But that is neither an impossible nor an exorbitant power increase.

In addition, the larger carrier can carry more antiaircraft protection and planes with greater top speed and consequently greater landing speeds can be operated from its larger flight decks. Many an army type now considered much too large for carrier duty, of the size, for example, of the Marauder or the Boston, could be flown perfectly safely from decks not much longer than those of the old *Lexington* or *Saratoga*, biggest existing "flat tops."

Some of these army types might even be put on carriers of the *Essex* class. There is, after all, no rule against assisted take-off devices such as the rocket or the catapult. Landing such planes on present decks offers much greater problems, but they aren't insoluble. The usefulness of an extremely efficient weapon would be much multiplied. Japan, as a matter of fact, has been operating twin-engined planes from her carriers for several years, using her "flat tops" as floating bases for large landplanes since the Chinese war. But whether or not such practices are adopted by all navies, the carrier is here to stay as long as there are navies to fight each other out in midocean.

The Dope Can

(Continued from page 42)

vided into the total flight time must be an accurate divisor. Any error in timing might be serious. Suppose total flight were 70 seconds and engine run were clocked at 9 instead of 10. The ratio would be in error by 10%; $70/9 = 7.77$ instead of $70/10 = 7$, which would be serious in a close contest.

Another Yulke suggestion is revised wing loading. Keep eight ounces for Atom ships, nine for the larger Class A (.10 to .20). Increase Class B loading to ten ounces and Class C to twelve. Increase power loading to 100 oz. Restore unassisted take-off requirements. Bring back the minimum cross-section rule before the hobby is swamped by "pencil bombers." And set up special classes for experimental models.

One of the Northwest's best, Hank Cole of Tacoma, Wash., has practically the same ideas.—"In the past few years I have despaired the lack of originality among model builders as compared to the old days, when the fellows would come to the field with something new every Sunday." Hank is in the navy now, but he'll stay at the University of Washington to get his degree in aero engineering and naval sciences.

Jimmy Metchicas has moved around so much since he left the N. A. C. A. for the army that he has trouble holding on to models and material. There's no space left for a model when a soldier packs up to go traveling. So Jimmy contents himself by whittling small-scale models. At last report, Jimmy was in the Glider Replacement Pool, Lubbock Army Flying School, Lubbock, Texas. His old club in Greenville, S. C.—Torque Fliers—has seventeen of its old members in the air force. Jimmy is proud of his club's record but isn't bragging, because he feels it's only typical of any club's part in the war effort.

A fine time some people pick to start building rubber models again! After years of one-sided gas-model effort, some of the old-timers are oiling up their rusty winders. Fresno Gas Model Association *News* says that interest in rubber contests is running high and the boys are getting ready for F. G. M. A. A. big 1943 rubber contests. For years the high-

(Turn to page 63)

If they win ...only our dead are free

These are our enemies.

They have only one idea—to kill, and kill, and kill, until they conquer the world.

Then, by the whip, the sword and the gallows, they will rule.

No longer will you be free to speak or write your thoughts, to worship God in your own way.

Only our dead will be free. Only the host who will fall before the enemy will know peace.

Civilization will be set back a thousand years.

Make no mistake about it—you cannot think of this as other wars.

You cannot regard your foe this time simply as people with a wrong idea.

This time you win—or die. This time you get no second chance.

This time you free the world, or else you lose it.

Surely that is worth the best fight of your life

—worth anything that you can give or do.

Throughout the country there is increasing need for civilian war service. To enlist the help of every citizen, the Government has organized the Citizens Service Corps as part of local Defense Councils. If there is no Defense Council in your community, or if it has not set up a Service Corps, help to organize one. If one exists, cooperate with it in every possible way. Write this magazine for a free booklet telling you what to do and how to do it. Join the fight for Freedom—now!

EVERY CIVILIAN A FIGHTER

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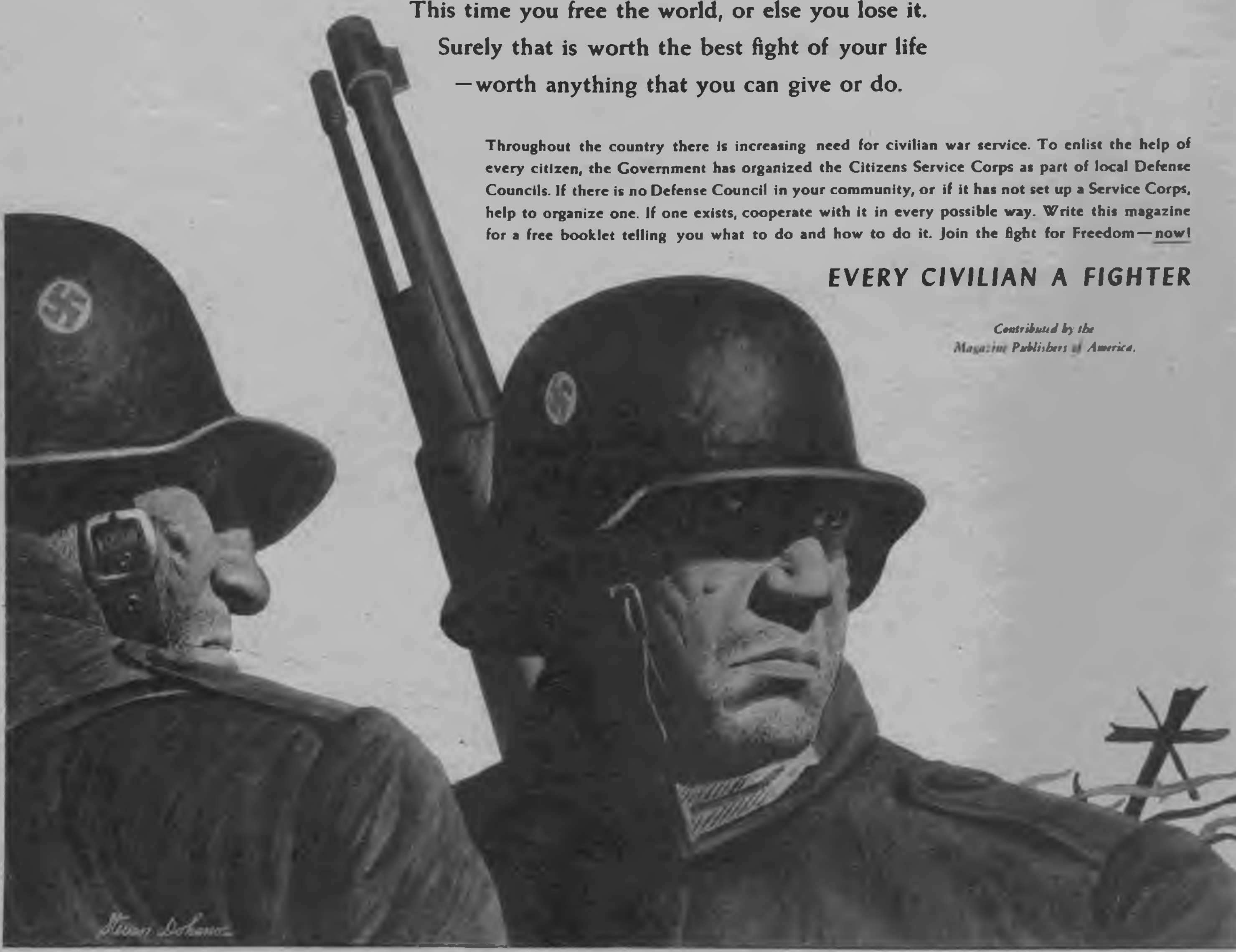

(Continued from page 61)

flying gas boys tolerated rubber as an evil suitable only to those not capable of handling gas. The rubber crowd will be happy to see them back in the fold, but would have welcomed them more cordially if they had waited until rubber was a little more plentiful.

We're on the ragged edge of another spring with a return of good weather and contests. Long evenings by the fireside in the easy-chair have probably taken some of the spring out of your landing gear. Take it easy the first time out. Don't start charging around like a gazelle. It takes a while to get into the swing of the cross-country habit. Gone are the good old days (for a while, at least) when you could load up the car and drive a few hundred miles to a contest. There's no national meet to look forward to. It'll be some time before you'll see Ben Shereshaw lecturing on the fine points of engine design to innocent contestants. Capt. Brown is too busy co-ordinating aviation education. Al Lewis is in the Signal Corps. A couple of hundred of our topnotch builders couldn't all have the same week off to fly models. John Dilly and the other lively Canadians are not available—and they're necessary for a successful national meet. Maurice Roddy has other worries than trying to provide a smooth-running happy meet for a few thousand entrants. A country at war has little time for the big model show. Even if all other facilities were available, there'd still be a hitch. Famous aviation personalities wouldn't have any time to award trophies at the final banquets—and who would want a contest without that? Don't despair. Keep in mind the good old days. Even better ones will be coming along soon.—*Gordon S. Light.*

Club Chatter

(Continued from page 43)

half-foot ceiling with the usual lights hanging down didn't allow much time to be made, so the contest was run on a free-for-all basis. No times were recorded officially, but the entire club learned to duck abruptly as one model after the other slid off walls and light fixtures. The club is now holding a design contest for gas models built from pine or other available materials. No balsa allowed, but anything from cardboard to the so-called "soft pine" that requires an ax when over 1/8" square may be used.

Four of the Birmingham (Ala.) Aeromodelers attended the Muscle Shoals Contest a short time ago and came back with their pockets bulging with sixteen prizes. This group conducted the Alabama State Miniature Air Meet last year and are planning a bigger and better affair for this year. This reminds us of a poem written about aeronautical engineers. The engineers decided to study the bumblebee in detail. After many months of calculations, they decided the bee couldn't fly—too heavy, no streamlining, and no directional control. So the bee, tired of all the talk, flew away—no one had told him he couldn't fly.—*Ed Yulke.*

This And That

(Continued from page 43)

brass end of a pencil (minus the eraser), filing down the edges to sharpen and using this punch to cut holes in nose blocks.

Edward Manigault, Jr., Fairmont, W. Va., sends us a sample of yucca wood, stating that the wood is much used by doctors for splints. It is light, pliable and can be molded into almost any form. The sample looks as though the wood might well be used in model work.

Kenneth Ward of Sterling, Kans., thinks we ought to experiment with electric motors. He used a twelve-inch Flo-Torque prop on an old Eureka vacuum cleaner motor and was surprised at the pull.

From Gooding, Idaho, Dan Heidel writes stating that he has been experimenting with cardboard tubes in building. He used a two-inch tube as a fuselage for an Atom-powered ship. The tubes can be obtained from almost any store, and he thinks they might be just as light as balsa construction.

Al A. Armellini, Baltimore, Md., sends in a long letter full of ideas which he admits may not sound practical but which he has proved. He suggests that some of the boys experiment with dry-ice motors such as were used long ago. Well, now there is a definite curtailment of dry ice due to its use in war time in such things as life rafts, fire extinguishers and the like. Dry-ice motors were never very powerful, but the field is wide open there. For framework he has used broom straws, using two and even three straws for greater strength. This idea has been successful on small rubber jobs. For strips and sheet he soaked regular quarter-inch plywood in water for a few days, then took the plies apart and made all size strips up to three inches, using razor and knife for the cutting. The material bends easily and is very strong.

He has another unique idea. He diluted water glass with ether (and thinner) and produced a *very* waterproof glue. The ether and thinner acts as driers. Very strong and waterproof. He used ten-cent store tissue (not wrapping tissue) for covering. It worked very well. For power he tried the spring from a roller shade. The motor had a great deal of power, he reports.

From N. A. C. A. Dick Everett writes that the gang had a big laugh when the local draft board thought that model building was still kid stuff until the members were taken through the laboratories on a tour of inspection. The free-flight tunnel, spin tunnel and machine shops really impressed them, and Dick says they left with a much better idea of how model builders are aiding the war effort.

Speaking of model books, the *Model Aircraft Handbook*, on which William Winter, Paul Plecan and H. A. Thomas teamed up, has broken all records in its field. Readers who have followed the fine illustration work won't be surprised; a collection of their drawings alone is enough to start a stampede.

Angus On Rules

(Continued from page 42)

would be a thing of the past,' said the grumblers. It certainly seems queer that with such a black mark against the rules committee there continued to be the greatest stadium-building boom of all times. Queer, too, is the fact that in these stadiums they are still playing the same game more often and to hundreds of times more spectators. The forward pass was instituted to 'open up the game,' to prevent injury from ever-growing close contact and to give inspiration to the athlete that had speed and ideas. More than mere bulk and tradition was called for on the gridiron.

"The making of things called rules—call them regulations or any other name—is never much fun. Regardless of the final selection, the whole affair becomes much like an elected candidate, some are with him and the rest 'agin' him. The next campaign should mean harder work to bring out more good points for victory but, as usual, a magnification of the bad ones will be just about all you will read or hear. To even attempt to please all concerned is mere folly. To know a perfect set of regulations could be written would stop any further progress along any line.

"The 'War-time Regulations' governing the building and flying of model aircraft were put into force knowing that many would not agree with their purpose. There were, as well, those who asked much more strict regulations, some going so far as asking for a complete ban on anything that would give the slightest hint toward duration flight. It is not necessary to go into detail regarding the method used to decide what shall constitute a regulation. Let it suffice to say that the final decision comes always from a consensus of opinion from all concerned. The one primary thought should be to keep the right to build and fly regardless of limitation.

"Let's take the regulations apart for a few moments. Talk was heard regarding the banning of model flying because it might confuse those watching for enemy aircraft. One might think such a thing very remote and such a thought might be true were all spotters model makers. It so happens that much debate kept actual laws from being enacted along this line. The Academy of Model Aeronautics' attempts to show its willingness to curtail the sport had a much greater bearing upon continued flying than is generally known. Of course there were motors to be lost and more to be bought during the early days of limited flight, but even then it was well known that the day of no motors was not far off. The limited flight is a boom to every modeler and is a reasonable regulation that it is a shame to abolish the moment the war is over.

"Model building teaches the use of the hands. It is possible to learn the art of model building without learning anything whatever of that which it copies. We must make at least two distinct classes of the model hobby, one which copies something now existing, the other the model of an idea new or partly new. Certainly model aviation as we know it should be of the second class. No limit can be imposed upon the ingenuity or ambitions of even the youngest model builder if we expect any form of progress. Any rule or regulation that in any form whatsoever hinders the trial of new ideas in competition will most certainly defeat everything expected and wanted of model aviation. Little is to be gained by the constant copying of something that may be the side show of the world less than ten years from now. Scale-model building is most important, but should and must be kept within itself if it is to serve its purpose. Let's do everything possible to encourage new and novel designs. Perhaps a stick gas job may appear once in a while, but more power to its owner; perhaps he could not afford more material, and then again, perhaps he may be smarter than the rest of us.

"The greatest sight in model flying is the beautiful take-off of a brightly colored seaplane from the water's surface and its perfect landing. It is most unfortunate that equal facilities are not always available for the wheel jobs so the same could be said of them. The question of launching models in competition has never been one of rules. It has been more a question of argument than anything else. No two meets ever had the same equipment for take-off, nor were any two meets uniform as to enforcement of the unassisted take-off. One timer allowed hand assistance, while another allowed none. Models were advertised that, after a one-hundred-foot run at seventy miles an hour, would climb to the ceiling and stay there. During the day a high wind would show itself and scores of fine jobs would be ruined before they had a chance. Given the proper runway, any model will take off unassisted if it will fly at all. In order that the surface used for R. O. G. be in proportion to that used for the full-sized ship, one must visualize a perfectly flat area not unlike a mirror in surface with a length much beyond fifty feet. Given such an area from which to take off and land would present a picture equal to that of the seaplane. Until it is possible, let us be satisfied to know they can fly with any type of launching and thereby create a better feeling between official and contestant and at the same time relieve many small clubs from ridicule because they cannot afford the purchase of runways. Perhaps the time will come when public interest will rise to a point where all meets can be alike."—*Ed N. Angus, Chairman AMA Contest Board.*

CLASSIFIED DIRECTORY

Try Tip Plates

(Continued from page 44)

tangular wing that will be more efficient than either an elliptical or a tapered wing? Of course, there's a little trick in it—we'll get to that in a minute; but first we'd better do some explaining about the matter of induced drag.

This subject of induced drag is often treated by means of fearsome-looking mathematics, yet the essentials of it can be boiled down to relatively simple terms and expressed in plain English. In the first place, we know that the pressure on the upper surface of a wing is less than that below the wing. It is this difference in pressure, of course, which causes a wing to lift. The wing is pushed from the region of high pressure up into the low-pressure area.

At the wing tip the higher-pressure air below the wing spills over the region of reduced pressure above the wing, just as water in a garden hose moves from the region of higher pressure to that of lower pressure. As a result of this spilling action, the pressures above and below the wing tend to become equalized around the tips. Since the lift of the wing is due to the difference in pressure between the air beneath the wing and the air above it, the region around the wing tips contributes much less than its proportionate share of the lift.

The tips continue, however, to contribute their share of the drag. Worse than this, the spillover of air around the tips sets up a new and important kind of drag known as *induced drag*. It's at about this point that the aerodynamic wizards trot out their mathematical peace murderers, but the general idea can be pictured somewhat along these lines:

The air on the underside of the wing is flowing rearward and outward at the tips; the air on the upper surface is flowing rearward and inward from the tips. As these two streams meet at the trailing edge of the wing, the one going outward, the other inward, they set up a series of little whirlpools or *vortices*. (See Fig. 1.) All of the small vortices soon form themselves into one big vortex, something like strands being twisted into a rope. The vortex at the left wing tip is rotating clockwise; that at the right wing tip rotates counterclockwise.

It isn't hard to see that it takes a lot of energy to churn up the air into these vortices, and that means extra drag. The sad part of it is that the vortices don't contribute a bit of lift—they just come along for the ride. So the aerodynamicist is very anxious to get rid of these unwelcome guests. It seems to be impossible to eliminate them entirely, but the aerodynamic engineer has a very handy tool with which he can decide just how much of their presence he is going to tolerate. This tool is a very simple formula, and its simplicity is all the more remarkable in view of the extremely complicated mathematics

(Turn to page 68)

(Continued from page 67)

from which it was evolved. Here it is:

$$L = C_L \frac{\rho}{2} S V^2$$

$$\text{Induced drag} = \frac{C_L^2}{\pi AR}$$

$$AR = \frac{\text{Span}^2}{\text{Area}}$$

therefore

$$\text{Induced drag} = \frac{\left(\frac{L}{\frac{\rho}{2} S V^2}\right)^2}{\pi \frac{\text{Span}^2}{\text{Area}}}$$

The expression $C_L \frac{\rho}{2} S V^2$ will be recognized as the formula for wing lift, in which C_L is the lift coefficient for the particular airfoil at the particular angle of attack, is the density of the air (normally equal to .002378), S is the wing area in square feet, and V is the velocity of the wing in feet per second. Coming down to the denominator, we have our old friend *pi* (3.1416) and the expression for the square of the wing span divided by the wing area, nothing more than the aspect ratio.

To the aerodynamic engineer this formula says that the induced drag of the wing increases with the lift of the wing. Actually, as the angle of attack increases, the induced drag increases a little more than proportionally to the lift; it increases as the square of the lift coefficient. This needn't worry us too much at this time, since we can simply set our wing at the angle of maximum lift-to-drag ratio and work out a sort of practical compromise between the angle of attack for best lift characteristics and the angle for minimum drag.

But the "span²/area" in the denominator of the induced-drag formula *is* important to us. It says that the induced drag varies inversely as the aspect ratio of the wing. In other words, if the aspect ratio is bigger, the induced drag is smaller.

It seems as though the subject of induced drag always brings out the mathematician in one. We could just as well have used plain English to show that the induced drag decreases with increasing aspect ratio. For, as the wing gets longer and narrower, the area around which the tip losses occur becomes a smaller percentage of the total wing area. Hence the drag due to tip losses becomes a smaller percentage of the total wing drag. (See Fig. 2 for a picture of this idea.)

Fig. 2 also shows why a tapered wing is generally more efficient than a rectangular wing. This reduction in percentage of tip-loss area can also be achieved by rounding the wing tips. Extensive wind-tunnel tests have been run on all of these methods of reducing induced drag, and they have been found to be fairly effective, although they must be used with discretion. The most efficient taper, for example, is generally that shown in Fig. 3, in which the chord at the tip is about one half the root chord.

Now the argument begins! All of this induced-drag and mathematical-theory business is very well—but why doesn't it actually work out that way? Why, for instance, do high-speed pursuit and racing airplanes use a low aspect ratio wing, with square-cut tips?

A high-speed plane flies with its wings at a fairly low value of the lift coefficient; hence, as the formula shows, the induced drag will tend to be low even though the aspect ratio may be rather low. Structural strength requirements, too, call for as low an aspect ratio as it is possible to use.

But high-efficiency soaring gliders, which have to get as much lift as possible out of a thermal and are not subjected to extreme load factors, have wings of very high aspect ratio. And heavy bombers, designed to carry large loads for long distances, like the B-24, have high aspect ratio wings with marked taper.

Careful tests with model airplanes will show that high aspect ratio wings, or properly tapered wings, are more efficient. On the model, however, considerations of scale effect make it desirable to keep the aspect ratio as low as possible in order to get a large wing chord for a given area.

Most model builders have been striving to reach a happy medium between low induced drag and low profile drag due to scale effect by using a moderate aspect ratio, something like six or seven to one. Now comes the idea that will permit the use of low aspect ratio wings, with their advantages of structural strength and desirable scale effect characteristics, and at the same time yield lower induced drags.

The theory is very simple. Suppose that we were to put up a wall at the wing tips to keep the high pressure air underneath the wing from coming up where it isn't wanted. Then we would eliminate most of the spilling action at the tips and so cut down the induced drag. Sounds simple, doesn't it? Yet it actually works out that way.

The wall takes the form of a tip plate, something like that shown in Fig. 4. It is merely a thin disk built onto the wing tip. The plate can be cut out of thin sheet balsa and cemented to the tip rib with its grain running vertically to keep it from warping.

The N. A. C. A. has tested tip plates in the wind tunnel and has found that they actually improve both the lift and drag characteristics of an airfoil. A well-designed plate was found to increase the effective aspect ratio of a wing by about twenty percent for angles of attack around the normal flying angle. For higher angles of attack the improvement was even greater. The N. A. C. A. also found that the shape of the tip plate was of some importance. Of the several shapes tested, the most efficient was that shown in Fig. 4, a circle having the chord of the tip rib as its diameter. The findings of the N. A. C. A. are set forth in Technical Report No. 201 (1924) and Technical Report No. 267 (1927).

Tests of tip plates on a gas model have confirmed these data. The tests also brought home an important point concerning the use of tip plates. The model had first been flown without the tip plates; when the tip plates were installed the model showed a tendency to "gallop," indicating a condition of longitudinal instability. This is exactly what induced-drag theory would predict. The trouble was easily remedied by decreasing the

Air Trails Pictorial Advertisers, May 1943

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

angle of incidence by about half a degree.

One other precaution should be mentioned. Tip plates, particularly if they are excessively large, may interfere with the stabilizing operation of the dihedral angle by "blanketing" the low wing in a slip. It is possible, therefore, that a model which is slightly unstable spirally will develop rather severe spiraling tendencies when tip plates are installed. Ordinarily, however, they should give no trouble if a fair amount of dihedral is used and the aspect ratio is not reduced excessively.

So now you can build your wings "by the yard" and still have them really efficient.

What Do You Think?

(Continued from page 43)

war had broken out, I suggested to Al Lewis that model meets be scheduled with air-raid warning officials. Such officials would be furnished with a "model spotter" for each post while a meet was in progress. In this way those out-of-sight flights would be spotted and the presence of such planes in the air would not disturb the elaborate warning system. I was told that the idea, if extended, would only serve to inform all and sundry that models *might* get out of hand and alarm the countryside. However, I question that planes will not be lost with a limitation on flight time. You and I have seen many planes lost with but a few seconds of motor run.

Despite the restrictions, the tough rules, scarcity of materials, et cetera, model building will continue—even gas modeling. In such powered flight is inventive genius displayed that is currently making our country supreme in the air. We've got to keep this thing going, and we will!

There are still lots of motors in the country, and a great many modelers still have excellent contest ships. There should be no restrictions on contests, except for a transportation problem, another matter entirely. We can still hold the old and thrilling contests.

No gas-model chairman has been appointed for 1943. Inasmuch as I am still chairman of this committee (although beneath Mr. Angus in authority according to 1942 AMA rulings), I would like to advocate a new set of rules for 1943:

1. Plane setups as in 1941 in so far as landing gears, cross sections, take-offs, flights.

2. Motor runs restricted to ten seconds. Any flight under forty seconds delayed. Three-flight plan as in 1941.

3. Power loading increased to 100 ounces per cubic inch of motor displacement.

4. No flight over five minutes; maximum for three flights, fifteen minutes.

5. Compulsory dethermalizers limiting any flight to seven minutes.

Under these rules we could and would fly to new accomplishment in the coming year. Under the 1942 rules we'll slowly but surely lapse into a lethargy that will far outdate the end of the war.—*Carroll Moon.*

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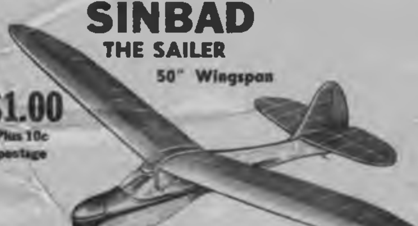

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