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A STREET & SMITH PUBLICATION

JANUARY
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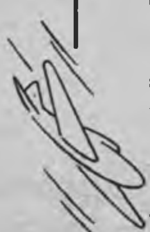

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A STREET & SMITH PUBLICATION

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CONTENTS

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Reentered as Second-class Matter, June 27, 1942, at the Post Office at New York, N. Y., under Act of Congress of March 3, 1879. Subscriptions to Canada, $2.50; not sent elsewhere.

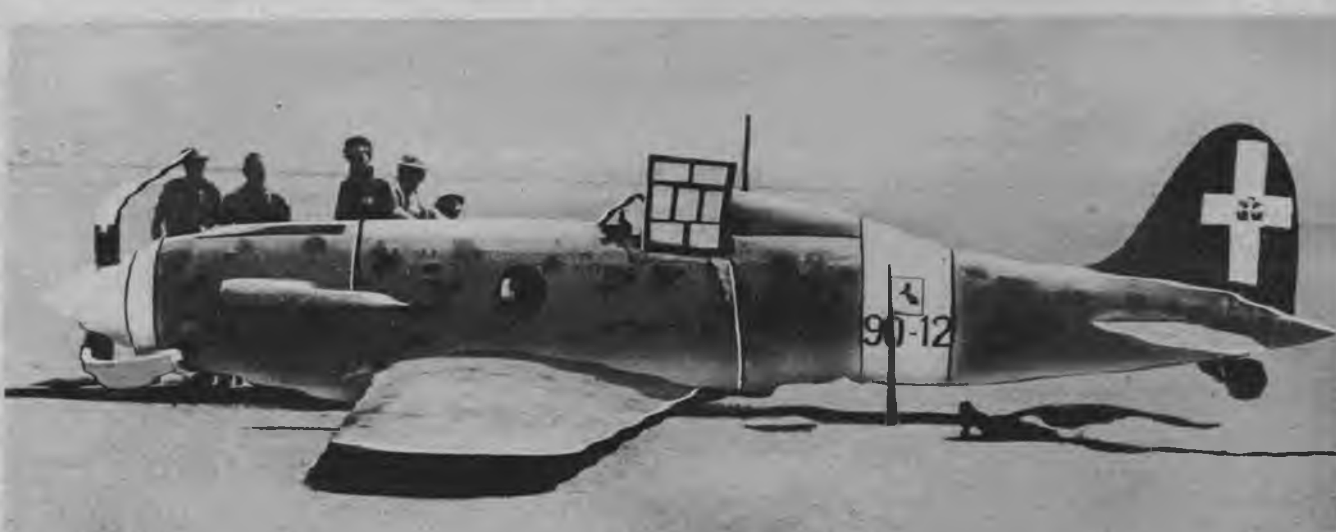
England's De Havilland Mosquito bomber is of wood construction. Powered by Rolls-Royce, it is very fast, has cannon, machine guns.

This Zero, shot down in Aleutians, was rebuilt and flown by our experts. Speed with 900 h. p. engine is under 300 m. p. h.; very maneuverable. Newer Zeros are faster.

FRIEND AND FOE

THESE NEW AXIS AND UNITED NATIONS HEADLINERS STRESS SPEED AND FIREPOWER.

Now coming off the production lines, Vought-Sikorsky's F4U-2 has a Pratt & Whitney engine of at least 2,000 h. p. Bomb racks are visible beneath wing which houses guns. Oil radiators are in wing root.



Italian Macchi 202 with German Daimler-Benz motor was shot down at El Alamein. American ace Lance Wade said he would rather fight Messerschmitts than 202s.

At the Wright Aeronautical foundry, the molten aluminum is poured into waiting engine molds. As each group of four molds is filled it is moved away to cool.

AVIATION CASTING

By H. E. Linsley

IN CASTING, THE SKILL OF THE FOUNDRY WORKER ADDS TO THE PERFECTION OF AVIATION ENGINES.

ONE of the oldest and still most widely used methods of metal working is that known as casting. Briefly, this consists of melting the metal and pouring it into a previously prepared mold made to the desired shape. Of course, it is not really quite as simple as that, and the entire process demands a very high degree of skill and experience.

The first step is the making of the pattern. This is a model, made of wood and formed to the exact shape of the required part. In making it, the pattern maker must know the kind of metal to be used for the finished part in order to make the necessary allowances for shrinkage when the metal cools. Cast iron, for example, shrinks about one eighth inch per foot, while aluminum shrinks about one quarter inch per foot, so that obviously a pattern made for a cast iron part cannot be used for aluminum unless the part is so small that the difference is not noticeable. *(Turn to page 48)*

Smooth finishing of intricate sand molds needs skilled touch.

Using pneumatic breaker, the sand mold is shattered away from the cast cylinder head. Casting will now be cleaned and burred.

Hundreds of fine nails inserted by hand strengthen delicate sand mold of fins.


Member Aircraft War Production Council, Inc.

Though most always lost, each Catafighter is a good investment. For each Kurier downed, the profit is $220,000—not counting ships saved in the convoy.

CATAFIGHTERS

By Keith Ayling

UNSUNG HEROES ARE THE ROYAL AIR FORCE PILOTS WHO ARE CATAPULTED FROM FREIGHTERS IN THEIR LAND-PLANE FIGHTERS TO SHOOT DOWN THE FOCKE-WULF BOMBERS AND HEINKEL TORPEDO PLANES. THE ICY SEAS ARE THEIR LANDING FIELDS. AND THRILLING ARE THE TALES TOLD.

SOMETIME early in 1941, a big four-motored Focke-Wulf Kurier, capable of operating 1,500 miles from its base in Norway, sighted a convoy in mid-Atlantic some 1,000 miles from the coast of Ireland. It was flying at about 10,000 feet when it saw the widespread formation of freighters. Here was what the Kurier's crew regarded as a routine job.

In the middle of the formation sailed a 12,000-ton merchant ship which the captain of the Kurier saw as his particular oyster. He put the plane into a dive, and the bombardier got busy. Everyone was concentrating so busily on his "easy" work that no one saw a small black object streak from the rear of the convoy and climb like an arrow into a cloud bank to windward. A moment later the Kurier's control cabin gaped with a hole a foot in diameter as cannon shells gashed into the fuselage. The startled tail gunner saw the fighter flash past—it was probably the last thing he saw—and he was still firing at it madly when the German machine heeled over and crashed into the ocean a mile away from the convoy it had intended to attack. The Focke-Wulf had met the Catafighter, the answer of the British navy to the challenge raised by the long-range aerial commerce raiders which Germany had been sending far out over the Atlantic.

From their first appearance, the Kuriers, big four-motored bombers developed from the prewar German Condor airliners, did considerable damage. Not only did they act as scouts for submarines, but they sank or damaged several ships. The high speed and long range which enabled them to attack vessels well out of range of land-based fighter protection made these sea raiders a growing menace to transatlantic shipping. In winter, when the Atlantic pre-

sents hundreds of miles of unbroken cloud, they become a serious factor. The lookout on a ship is always at a disadvantage in spotting an airplane; the noise of the ship and the sound of the sea make it difficult to locate the invader. In some cases German planes flew down under the protection of the clouds and dropped their bombs without showing themselves save as vague silhouettes.

But the British have shown themselves masters of the art of meeting a difficult situation, in this war as well as in the last. One day, on the deck of a small freighter in a convoy, there showed what might have been an extra-large packing case covered with tarpaulin. Actually, it was a Spitfire fighter plane with eight Browning guns mounted in the wings. Unlike most planes which cross the Atlantic lashed to the decks of freighters, this Spitfire traveled with its tail up in position and mounted on a catapult!

Aboard the freighter, in addition to her usual complement of gunners and crew, were an RAF fighter pilot who had flown against the Luftwaffe in the Battle of Britain, and a couple of fitters. All through the daylight hours the small task force kept the lone airplane ready for action. The pilot wore his flying gear and Mae West life jacket. Members of the navy crew were at hand to tense the massive springs of the catapult. The pilot, who had volunteered for the job, had his instructions. When an enemy plane was sighted he would be catapulted from the runway on the ship's deck. He was to climb and attack the enemy. If successful, he was to fly for the nearest land base, provided his extra gas tank gave him sufficient range. If not, he was to land on the sea as near as possible to a ship in the convoy and be picked up.

On all this he may have been pondering when the alarm came. In a matter of seconds he was in the cockpit. A mechanic slammed down the "greenhouse" cowling and the Merlin engine burst into a roar. The catapult twanged and he was off!

The Spitfire dropped its nose a bit as it cleared the bow of the ship, but the Merlin with the boost pulled wide open was up to the job, and soon the plane was climbing normally. Ahead and above he saw the big four-motored Nazi plane, soaring toward the center of the convoy, its crew quite oblivious of what was coming to them.

"I was feeling queer," said the pilot, relating his experience, "rather like a bee with a single sting. However, I saw the German aircraft ahead and made short work of him. I gave him three

A seagoing eight-gun Hurricane on the S. S. Empire Tide. Flight Lieut. D. R. Turley-George (pilot), left; Flying Officer C. Fenwick (spare pilot), right.

bursts for all eight guns, and then another, and down he went, with two engines smoking and holes in just the right places. It was really easy, much easier than shooting down an ME-109. The Focke-Wulf is a big fellow and a much bigger target than the 109, and of course it moves more slowly." He continued: "I watched him go down, and you can bet I was feeling pretty good, but then came a really unpleasant moment. I was so far from land that I knew my gas would not get me anywhere near where I wanted to be. That was a shock, and then I knew I would have to dump my aircraft into the sea and bail out. But somehow it didn't work out that way. I circled the convoy and chose a convenient spot in which to hit the sea. As I flew down I changed my mind and decided that instead of bailing out I would try and land on the water.

"Well, to say you're going to land on the water and to do it are quite different. When the plane touched, the air scoops filled with sea water and the machine dived like a fish. I *(Turn to page 44)*

Now ships go down to the sea in ships. These Hurricanes are in the M.S.F.U.—Merchant Service Fighter Unit. Royal Navy Fighter Defense Officer in control.

AIR SCHOOLS ARE INGENIOUS

TEACHING AVIATION IS AN ART. THESE SCHOOLS UTILIZE MANY CLEVER GADGETS.

So that's how a twin row works! Ryan School of Aeronautics students learn about radial from cut-away engine.

Parks Air College has students build working models of plane parts. This is retractable landing-gear model.

Seeing is believing. At Ryan School of Aeronautics, students study the flight characteristics of various types of scale models in the school wind tunnel.

In order to make clear the subject of acceleration and the forces found in pull-outs and spins, Parks Air College instructors use centripetal in classes.

At Roosevelt Aviation School plumb bobs are used to check repairing of a fuselage. Owner buys material, students under supervision rebuild planes.

At the California Flyers School of Aeronautics all sorts of gadgets are on hand to teach aerodynamics. This device tests airfoil section reactions to fan.

PARATRAINERS

THE FIRST JUMP OF A PARATROOPER IS DUCK SOUP AFTER HE HAS BEEN THROUGH THESE TRAINING DEVICES.

Yippee! The technique of leaving troop transport is taught with this dummy. Note 'chute trolley on cable.

Like the real thing. From these towers, paratroopers get first taste of what a jump is like. Exciting but safe.

In this conditioner trainee pulls rip cord and falls 25 feet before being stopped by harness. This accustoms him to sensation of 'chute opening after free fall.

And now the real thing. Well trained, in the pink of condition and equipped with two 'chutes, the trainee makes his graduation jump from an army transport.

The only kind of pull useful in the navy. Recruits use plenty to top wall.

Across the water hazard, almost! Building good health builds good pilots.

THE NAVY TRAINS TO WIN

LIKE a peacetime factory converted to war production, the navy is throwing itself into high gear for victory. The American at peace, whose standard of living was better than any other in the world, must be hardened and tempered into an American at war. Four preflight schools have therefore been established to condition mentally and physically the future navy pilots who must be stronger and more alert than the pilots of the Zeros or Messerschmitts which will appear in their gun sights. And more, the navy pilot on the land, in the air, on the sea must be always the pilot officer, indoctrinated with the traditions of the service and thoroughly a part of them. This, too, is an integral part of the preflight schools.

General director of the schools is Captain A. W. Radford, head of aviation training for the Bureau of Aeronautics. Active head of the aviation physical-training program at the stations is Lieut. Commander Thomas J. Hamilton, one-time Naval Academy football coach and a qualified naval aviator. Parent institutions are the universities of North Carolina, Iowa, Georgia, and St. Mary's College in California.

The term at the preflight school is approximately twelve weeks. After graduation, a cadet is assigned to a naval reserve aviation base for preliminary flight training. The latter successfully completed, he goes to an advanced flight-training center from which his diploma is a commission. Before being assigned to combat duty, however, he must serve two or three months with an operational unit, polishing his new skills under actual wartime conditions. The entire course may be successfully completed in approximately twelve months.

Although the twelve weeks at the preflight school are devoted almost wholly to physical training, the cadet is required to continue his program of exercises and sports throughout the entire period of preparation for his wartime profession. Even after he has been assigned to the fleet or to line duty, he is expected to keep himself in excellent physical condition.

The naval aviation cadet arriving at the preflight school is a rather good specimen, both physically and intellectually. His heart and lungs are sound; his vision is normal; his reflexes are good; his intelligence is above average. Twelve weeks later he graduates almost as another person. He has put on weight—not the fatty tissues of easy living, but the supple muscles of a trained athlete. He thinks better and faster because his body is made up of more efficient parts. And he thinks differently: "I'm going to beat the other fellow" is his first thought, be the stakes money, marbles—or his life!

Every minute of a cadet's day at the preflight school is budgeted. He studies two academic subjects, physics and mathematics, for two hours a day. He learns to march in the military manner; how to stow a locker so that it is shipshape; how to police his quarters so that they will pass rigid inspection. He learns to give—and take—orders. He works away at the none too easy job of making his body a skilled machine. He eats huge quantities of energy-producing food of high caloric content, and he sleeps a sleep that is the reward of hard work.

Page Mr. Darwin, or is it Tarzan? This helps condition men for aerobatic flying.

A nice, long hike to build stamina and appetites. Cadets have both.

By William Flynn

NAVY PREFLIGHT CONDITIONING INCLUDES THE PHYSICAL TOUGHENING OF THE CADETS. PHYSICALLY FIT MEN ARE BETTER ABLE TO MEET GROUND AND FLIGHT TRAINING.

Each day of the school term, except for Saturday afternoon and Sunday, is predominately given to athletic drills and the physical-education program. Formal instruction in physical education is given for two hours and forty-five minutes every day; competitive sports take another two hours. Other periods are scheduled for body-building exercises and sports which the cadet may choose for himself.

Nine sports or forms of athletic activity—each selected because it enables the cadet to develop his natural agility and the spirit of competition—are included in the preflight-school curriculum. They are: basketball, boxing, hand-to-hand combat, football, track, gymnastics and tumbling, soccer, swimming and wrestling.

These sports are similar to those included in *(Turn to page 50)*

Hm-m-m, that dagger looks rubber to us, but the training is dead serious.

Wanna rassle? Nope, not with these huskies. The navy sure builds pilots!

AIR POWER IS IMPORTANT, *but...*

By Lucien Zacharoff

IMPRACTICAL AIR-POWER THEORIES WHICH IGNORE OTHER SERVICES MAKE THIS PICTURE OF RUSSIAN AIR CONCEPTS DOUBLY INTERESTING.

Though the airplane strikes enemy industry, transportation—as Douhet foresaw—complete defeat results from occupation by ground troops.

THE latest variety of armchair strategist is heatedly arguing the place of air power in modern warfare, partly because of the popularity of certain recent best-sellers. While laymen gape, understandably favoring any proposed shortcut to victory, these self-appointed prophets, with their garbling of facts and misinformed and dogmatic statements, do great disservice to aviation and the war effort.

Nor is there anything strikingly original in these doctrines of air power so generously dispensed from air-minded Isaiahs and Jeremiahs. They are a streamlined revival of theories circulated shortly after World War I in the writings of General Giulio Douhet of the Royal Italian Air Force.

Douhet's best-known book was *"Il dominio dell 'Aria"* ("Mastery of the Air"), published in 1921. With it, he became the founding father of the modern doctrine of air power and a great influence on the eventual practice of building separate air forces.

Douhet saw the air arm as the decisive weapon of future wars. Fictionizing his views, he visioned an independent air armada of standardized, powerful bombers, reinforced by combat craft. He believed that a properly organized fleet of bombers could, provided that an enemy's land and naval forces were on the defensive, crush in a few days the hostile air force, and destroy the vital centers of the invaded country. The resulting air superiority would bring the enemy to his knees.

When first propounded, this independent air force theory was divorced from reality because few planes were available, and those were obviously disappointing to the sponsors of air power and air power alone.

However, not long after Versailles, rearmament again became a great world concern. Progress in aircraft and aero-engine design proceeded at such a rate that Douhet's disciples began to press the question of subordinating the army and navy to air power—or even liquidating the traditional branches.

The Axis general staffs were particularly enthralled by the proposition. A strategy of swift, unexpected blows of undeclared war, the element of surprise almost promising of victory, was an answer to Fascist prayer. Nazi strategists came nearest to Douhet's vision. They concentrated on developing bombardment aviation, and cultivated the theory that mastery in the air would insure a prompt victory for the Third Reich. Even before Goering's rise, German theorists clamored for the highest development of the air arm, though it be at the expense of the other military arms. Before the era of appeasement, *Deutsche Wehr*, the mouthpiece of Berlin militarists, spoke of "our own decision to utilize the theories of Douhet." In accordance with such plans, the Luftwaffe's structure and composition were channeled toward independent offensive operations.

German air power which haunted Europe (remember Munich?) was most effective when used in co-operation with the tank in Battle of France.

Russia, too, has often employed airplanes in close harmony with other branches of her armed services. Here, I-153 dive bomber is loaded.

The only great power to keep aloot from the debate was Russia. Actually, it was the first to put air power into practice; it was developing an air force which was to provide the Luftwaffe with a grievous shock.

Official documents in Russian archives show that Lenin, first head of the Soviet Republic, had recognized in the much too inadequate aerial performance of World War I prophetic rumblings of what was to come. Stalin, his successor, was even more air-minded. Years before World War II, designers and builders of Russian aircraft, distinguished test pilots and fliers visited the Kremlin, giving first-hand accounts of their progress, carrying away unlimited encouragement and canny suggestions. The *Osoaviakhim*, civilian aviation and antichemical defense society with 20,000,000 members, was a great factor in making the Soviet Union the world's most air-minded nation. Parachuting and gliding became Russian national pastimes. And what counted for much in the air-conditioning of Russia was that there were no brass hats to hinder progress—no traditions, vested interests or official indifference.

Proof of the efficacy of Soviet air theory is nicely evident in combat with the Nazis. The new generation that from nothing erected its military strategy and philosophy, including the Red Air Force, has given the Wehrmacht little time even to lick its wounds.

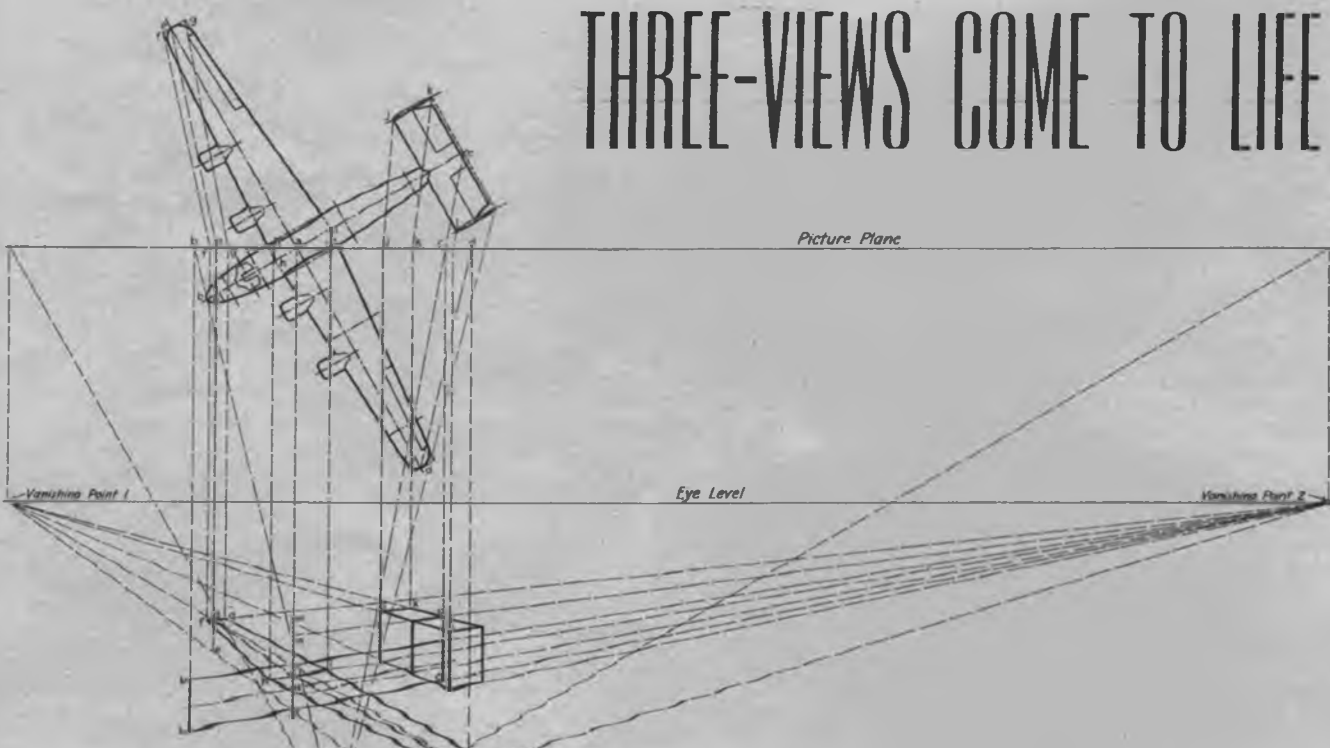
Because Russian theorists had few traditions to consider, they found it easy to acknowledge that Douhet had his points. General V. V. Khripin, deputy chief of the Russian Air Force, wrote in his preface to the Russian edition of Douhet, 1935:

"Although his conception is on the whole untenable, a good many individual points present the greatest practical interest for us also. The experience of development of modern armaments shows that quite a few of the ideas earlier expressed by Douhet *(Turn to page 57)*

Norway invasion was supported across the Baltic by swarms of Junkers transports. Luftwaffe could wage air war or, whenever needed, assist army, fleet.

YOUTH IN AVIATION

THREE-VIEWS COME TO LIFE



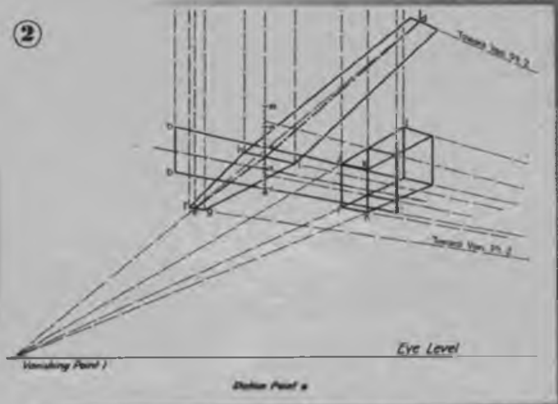
1

PRATT INSTITUTE STUDENTS USE THREE-VIEW DRAWINGS TO DEVELOP AUTHENTIC PERSPECTIVE COLOR RENDERINGS.

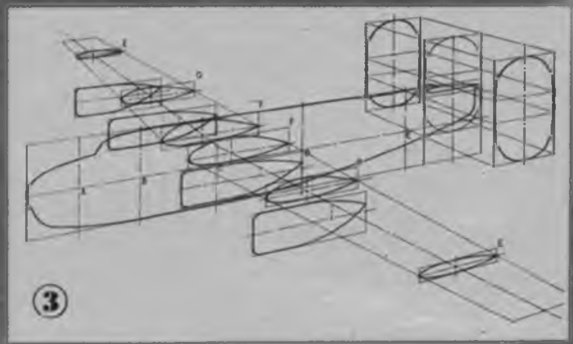
By Philip J. Lawson

AT Pratt Institute we have made a practice, in some classes, of assigning certain subjects for perspective drawing, giving the students mechanical drawings to work from rather than having them draw directly from the object. This makes it possible for students to do part of their work away from the school without the need for carting home unwieldy still-life material, and, more important, it emphasizes the structural side of the work.

The type of drawing required in aircraft drafting is much more difficult than that involved in other mechanical subjects. Straight lines and simple circles are less common in airplanes, and the subtle curves of wings, fuselage, nacelles, et cetera, are not easy to draw by ordinary methods. Since the best way to learn how to do a certain job is to *do* it, we looked around for mechanical drawings



Different views are obtained by varying the vanishing points.



Determine the height of each fuselage cross-section and location

of aircraft which could be used as the basis of a class problem. Actual blueprints, naturally, cannot be released for use in such work, as the need for secrecy in design details makes it impossible. Fortunately, the three-view drawings published in the 1942 Air Progress Annual, and in various issues of Air Trails, were ideal for our purpose. They give all the information needed to demonstrate the principles of this kind of drawing, and have the additional advantage that they can be used as the basis for illustrations.

With this material, the problem assigned to each student in the department of Advertising Design was to take one of the three-view drawings, and from it make a complete and accurate perspective drawing, then to use the result as the basis for an illustrative picture. As there were ten types in all, it was possible to have considerable variety in the work without stepping outside the aircraft field. The enthusiasm of the students was remarkable, especially since the problem was quite difficult.

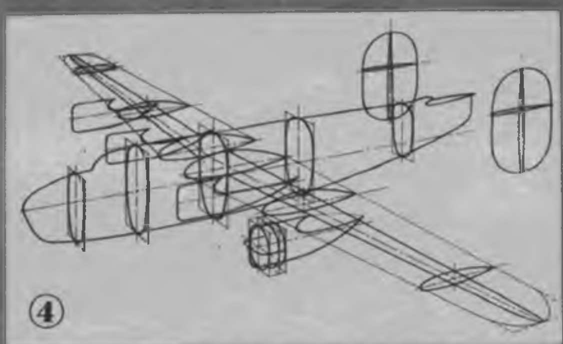
These students are training primarily to be advertising illustrators and designers, so we made the problem cover two objectives. First: learning to convert an orthographic into a perspective drawing, and second: practice in the use of aircraft as subject material. The problem required much hard work from both students and teacher, but we feel that the results have been worth it.

In projection, the first step is to set the top view of the craft at the desired angle. The wings and tail assembly are boxed in next. Boxing the fuselage is not necessary, but the center line should be drawn. Next a line representing the picture plane seen edgewise is drawn horizontally across the paper. This may be placed anywhere; if it is lower than shown here, a smaller perspective would result, and vice versa. In Figure 1 it is passed through point "a" for convenience in getting heights.

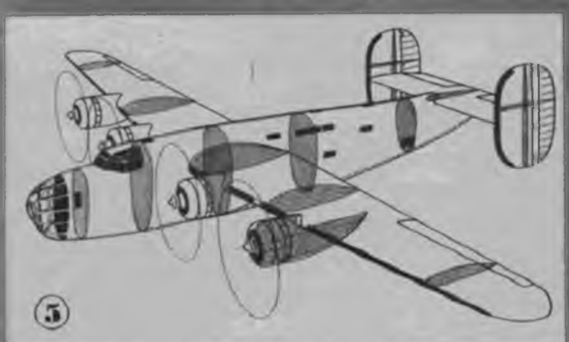
Next, a station point, representing the observer's position, should be chosen nearly opposite the center of the craft and far enough away so that the angle of vision is not more than thirty degrees. The eye level is now drawn horizontally. If the plane is to be seen from above, this should be near the picture plane. Then a line is drawn from the station point parallel to the wing center line. Where it meets the picture plane a vertical is dropped to the eye level, determining vanishing point 1. A similar line from the station point parallel to the center line of the fuselage determines vanishing point 2.

The various points needed will lie on vertical lines determined as follows: A straightedge is laid so that it is in line with the station point and the desired point in the top view. Where the straightedge crosses the picture plane a vertical is dropped. The perspective of the point will lie on this vertical. Lines indicating the straightedge have been drawn for points "b" and "c" in Figure 1, but for the other points only part of the line has been indicated in order to avoid confusion.

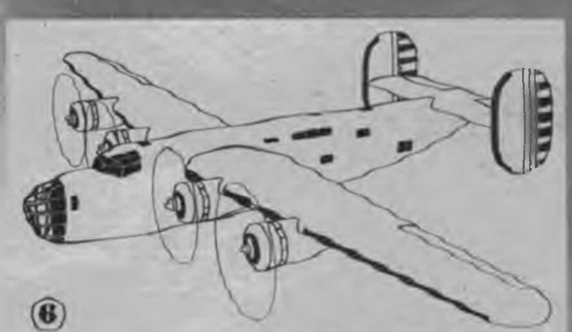
The perspective position of point "a" may be placed on the vertical wherever convenient and the positions of the other points will then follow as described below. The lower this point is placed, the sharper the perspective. Since point "a" is in *(Turn to page 68)*



Work out the width of fuselage cross-sections by rectangles.



Complete all cross sections on drawing. Add decorative details.



Ink outlines, remove construction lines, and add color rendering.

NOW A JUNIOR C.A.P.

SOMETHING NEW HAS BEEN ADDED TO THE MANY EXISTING YOUTH PROGRAMS. NOW WE ANNOUNCE THE CIVIL AIR PATROL CADETS.

By Al Lewis

CAP Cadets will have the unique opportunity of working directly with and under sponsoring members of the CAP itself, most of whom are active pilots.

THE latest development in America's program to encourage more interest in aviation is the formation of a young people's volunteer aviation corps—the Civil Air Patrol Cadets.

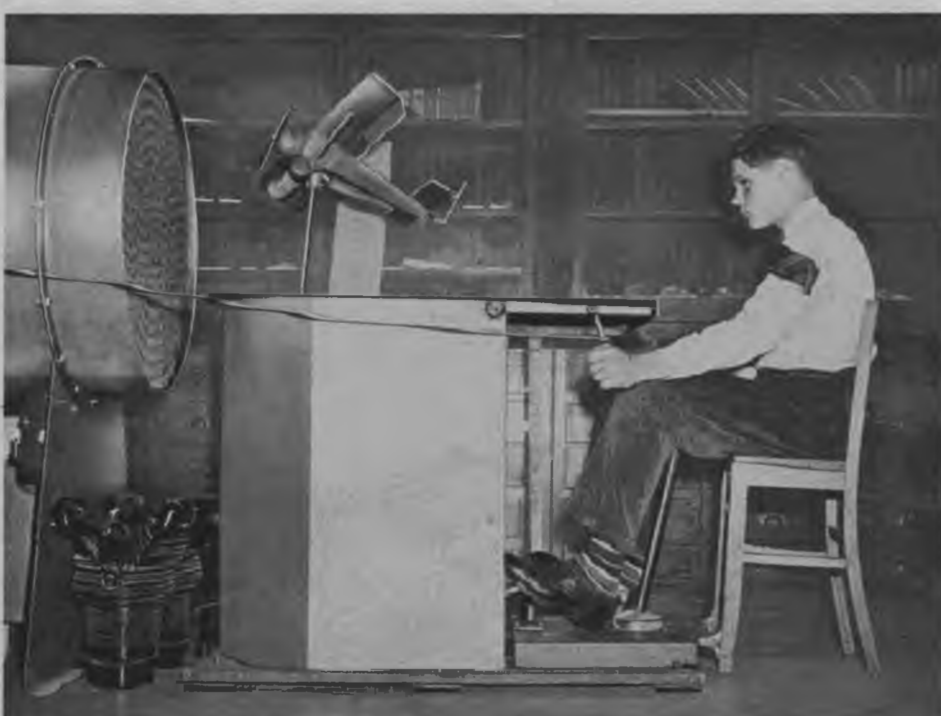
In the official announcement detailing the organization of the CAP Cadets, Director James M. Landis of the Office of Civilian Defense under which the CAP operates, said the purpose of the new unit is to extend to a younger age level under the guidance of seasoned air men the same opportunity for training as has been given senior CAP personnel. Membership in the Cadets will be limited to American-born students now in junior or senior years of high school. Although the young volunteers will not be assigned to flying duties immediately they will be eligible for full membership in the Patrol upon completion of their training and graduation from high school.

All candidates must be physically fit and in good scholastic standing at school. Applications for membership will be much the same as for the senior Patrol and must be accompanied by passport photos, evidence of physical fitness, and scholastic standing. Young men in the CAP Cadet corps will be uniformed in khaki shirts and trousers; girls will wear khaki shirts and skirts, and both will wear the overseas-type cap.

The Cadet corps is essentially a copy of the senior organization, and the long-range purpose is recruitment for the CAP, which is the same thing as saying interesting youngsters in aviation, training them thoroughly under the direction of skilled air men and women, and giving them actual flight experience in the Civil Air Patrol to ready them for service in the armed forces.

While it is too early to present any news of the CAP Cadets, it is heartening to know that the inauguration of the corps went off without a hitch while attracting much favorable national publicity. The CAP with its tie-in with the armed services would not undertake a junior program without the full consent of the services. Consequently, it is expected that the army and navy look upon this as an extremely valuable way of bringing more youngsters into aviation and giving them a thorough schooling in all its fundamentals.

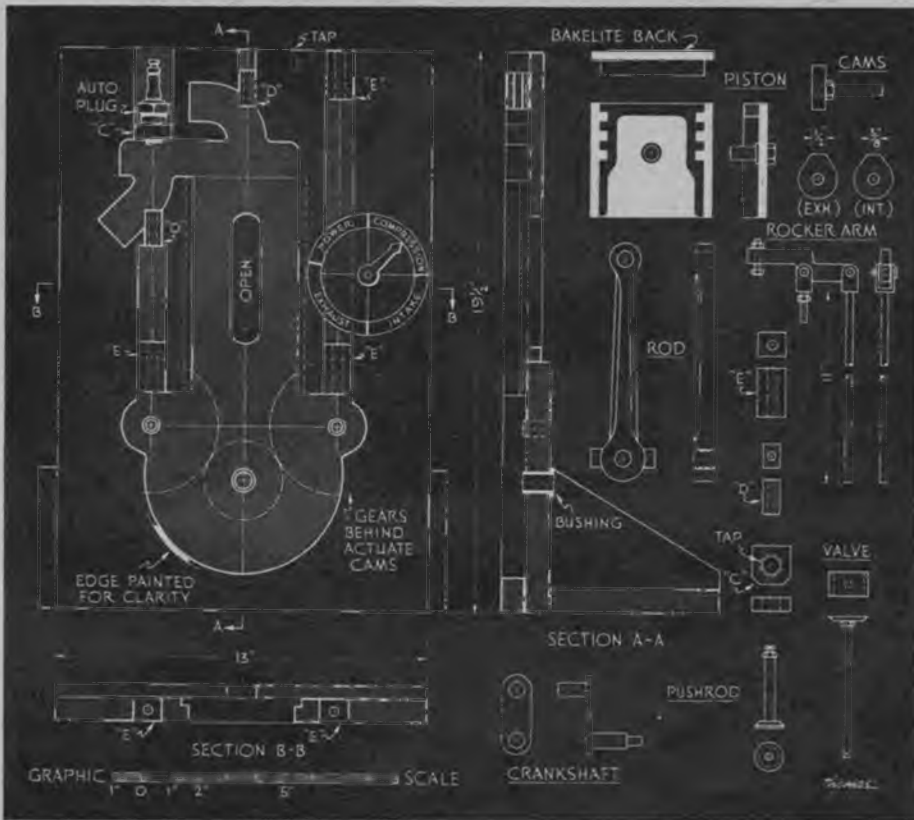
Each member of the senior CAP will be permitted to sponsor one cadet—the young man or woman who the senior member feels is most likely to succeed in aviation work. Men in the Patrol will sponsor boy cadets; women CAP'ers will sponsor girl cadets. The training and drill programs will be under the jurisdiction of local CAP units and to the fullest possible extent train- *(Turn to page 56)*



Facilities of the CAP itself will be open to the CAP Cadets, including trainers similar to this one, where available.

YOUTH IN AVIATION

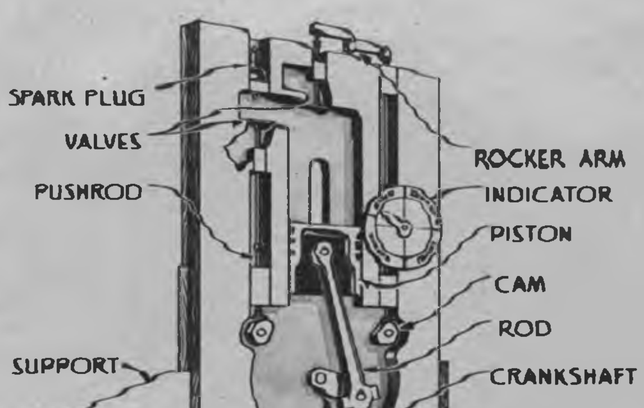
YOUTH IN AVIATION



ENGINE OPERATION DEMONSTRATOR

TEACHERS—THIS VISUAL AID WAS ORIGINALLY DEVELOPED FOR CLASS WORK BY A CANADIAN AIR CADET INSTRUCTOR.

By Bruce Keith



NOW that aviation ground courses are available in the high schools, many students are delving into the mysteries of the four-stroke internal-combustion engine. There is no better way to illustrate the theory of operation and the inter-relationship of parts than to build a model section of an engine. The one illustrated here is simple to build and costs approximately $2.50. Following are the details:

The main part is the cylinder head, cylinder and crankcase section. It is made of a piece of well-seasoned softwood $19\frac{1}{2} \times 13 \times \frac{7}{8}$", the grain running lengthwise. Cut out with a fret saw the section inside the $\frac{3}{16}$" black line and the parts for the inserts, removing thus the hatched portion not required. Nail this section temporarily to the back section as shown in Section AA and BB (grain to run in opposite direction to prevent warping).

The piston, as shown in detail, has a bakelite backing to prevent warping. To it is nailed and glued the piston proper, cut out on a fret saw with $\frac{1}{4}$" square slots to represent the piston ring grooves. The wrist pin is made of steel fitted to the bakelite piece.

The cylinder can now be finished with a sliding fit for the piston, with grooves cut to suit the bakelite piece. Beeswax is rubbed on the frictional parts for smooth operation. The bushings for crankshaft and camshafts may be purchased at any automotive store. Care should be taken in drilling the holes straight so that they are a press fit for the bushings. Glue into place.

The crankshaft is steel and care should be taken that the shafts are fitted correctly and firmly to the $\frac{3}{16} \times 1$" connecting link. Drill and ream holes in connecting rod true for a sliding fit to the crank and wrist-pin shafts.

The valves have flat surfaces so as not to get out *(Turn to page 67)*

AIR YOUTH NEWS

Conducted By Al Lewis

DIRECTOR, AIR YOUTH DIVISION, N. A. A.

OVERWHELMING evidence that the "air age" is upon us is demonstrated by the many new junior aviation groups which have sprung up during the past few months. The newest among these indicates that the gals are not going to be left out in the cold.

The Girl Scouts have announced a Wing Scouting program. Training courses for leaders have been set up in New York City and it is expected that more leader schools will be established in other areas. The Wing Scouting program was devised to give fifteen- to eighteen-year-old Girl Scouts an opportunity to develop interest and skill in ground-work duties.

Among the activities scheduled for the Girl Scouts is model plane building, and study of aircraft identification, meteorology, navigation and aerodynamics.

Also taking an active interest in aviation are the Camp Fire Girls, who have just unveiled a "Horizon Club Aviation Program." At the moment no further details are available, but the Camp Fire Girls can be expected to do a job comparable to the Girl Scouts.

And so it goes—aviation education here, air youth units there. And don't forget the Air Scouting division of the Boy Scouts, nor the Air Service Division of the U. S. Office of Education's Victory Corps. The latter is one movement to keep your eye on. It's official, timely, well set up, and has available a wealth of material in the form of the CAA-sponsored "air age" texts published by the Macmillan Company.

Another new group on the horizon is the Civil Air Patrol Cadets, a description of which appears in this issue.

The schools of the nation are continuing to supply the navy with solid scale models for identification and training purposes. A new set of fifty planes of the fighting nations, both United Nations and Axis, is about to be released. These will be added to the first fifty models which were turned out in secondary schools last spring by the hundreds of thousands.

The new batch of latest-type fighting models will be undertaken by senior and junior high school students in sets of twenty, twenty and ten. The first twenty plans in the new series should be in the hands of school officials by the first of the year. The construction manual presented to each student participating in the project has been revised by its author, Dr. Robert W. Hambrook of the U. S. Office of Education.

A few modifications have been made in the specifications of several planes which were a part of the first series released by the navy earlier in the year. Obsolete models have been withdrawn and additional data are included in several instances. Because the first set of plans was prepared about the *(Turn to page 64)*

YOUTH IN AVIATION

CHARTS FOR TEACHERS

THE position of the schoolteacher, as a leader of youth, must be adapted to the spirit of the times. Air Trails Pictorial offers, therefore, a service which will enable the schoolteacher to meet more adequately the requirements for aeronautical instruction. To each subscriber will be sent six charts covering phases of flying. A *Cloud Chart* shows the structure, height and meaning of the various clouds. The *Anatomy of a Summer Storm* describes with expertly worked-out diagrams training and aerobatic maneuvers that can be executed by an airplane. The *Types of Aircraft* charts fourteen accepted types of airplanes. The *Anatomy of Winter Skies* shows the conditions peculiar to winter flying. A chart on the *Anatomy of Air* explains how air rises, descends and eddies as it flows over the earth's surface. In addition, a special bulletin will be sent each month to every schoolteacher taking the service. Approximately nine such bulletins will be mailed each year. Each will contain interesting factual materials and suggestions for study and class discussion. You will find that these bulletins alone will be worth many times the cost of this service.

A price of fifty cents is charged that we may bring to the instructors the best possible material as quickly as possible.

Air Trails Pictorial is read by twice as many young people as any other aviation magazine. Its editorial staff is vitally interested in seeing that its readers, the youth of America, are correctly and clearly taught modern aviation. To the schoolteachers of America we turn for help in our endeavors to build a more air-minded youth in preparation for tomorrow's world of flight, where air transportation and civilian flying will play an increasingly important part.

A brochure describing the service and the charts in complete detail is now being made available by the editors of Air Trails. To all teachers who write us on their school letterhead, we will send without cost the brochure and any further information desired.

WHAT'S WRONG WITH THE RULES

YOUTH IN AVIATION

WE PROTEST AGAINST RULES THAT IGNORE THE NEEDS OF AVERAGE BUILDERS AND ARE FORMULATED ONLY BY "EXPERTS" FOR "EXPERTS."

By Gordon S. Light

Not a broken fuselage, but just an "expert's" idea of a spiral climb.

Too much trouble making a fuselage? Just borrow a broom, sir; it's legal.

Just figure out a way to hold on the tail and you have an invisible body.

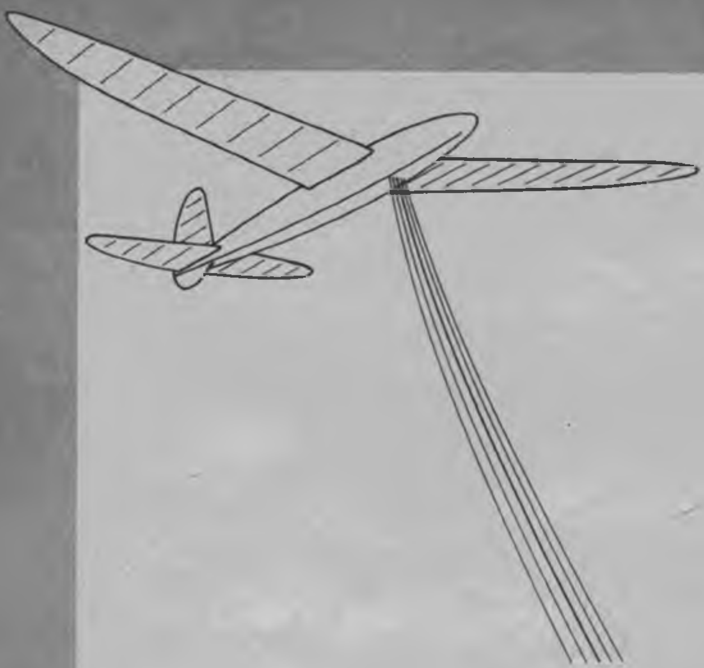
CONTEST rules are off the beam and contest models are in a rut! For the last four years the hobby has bogged down with designs which all follow the same uninteresting formula. What's worse, the designers show no signs of coming out of the Pylon Era which haunts them. Current contest types are a sorry lot. They are not realistic and are entirely out of the running so far as inspiration or imaginative design are concerned. Because of a comparative handful of nearsighted so-called "experts" who make the rules to suit themselves, the average American modeler and contestant must build models that look as much like an airplane as does an old witch on a broomstick. The no-minimum cross section and the hand-launch rule have a peculiar smell. The first was the "inspiration" of one man, the other was a gripe of a few contest directors who were too lazy to cut the grass or provide suitable take-off platforms or runways.

"It'll fly like a crazy pigeon," boasts the happy designer as he contemplates a creation with practically no fuselage trembling on a flimsy landing gear—if it has a landing gear!—with its wing on a pylon barely clearing the prop. He's right. We've seen swarms of them fly away from every national meet during the last few years. But all the hobby has to show after hundreds of out-of-sight flights and a distressing loss of models and motors is a variety of dethermalizing gadgets and a set of ineffective rules limiting the flight.

A contest flier has an unhappy life. First he worries about how to get more altitude. Then he fusses about the best way to lose it. He worries if the model goes too high and frets if it doesn't go high enough. He has become very particular. No longer will any old thermal make him happy. If it isn't just right, he'd rather not have it. He makes himself ridiculous with crazy power spiral dives that splatter engine and crate all over the greensward. He is a power maniac with a none-too-keen appreciation of aerodynamics. Earlybird barnstormer Lincoln Beachey used to say that he could fly a barn door with a motor on it. Contest experts are doing just that with their superdupers. *(Turn to page 63)*

Popularity of models like the New Ruler proved we can have realism and zip.

You're wrong, it's not the front view of a grasshopper, but merely the fuselage of a typical contest job. Any resemblance to an actual airplane is purely coincidental.



TOWLINERS ARE IN

DON'T LET THE RUBBER SHORTAGE HANDICAP YOUR FLYING. TOWLINE GLIDERS WILL EASILY OUTPERFORM ANY POWER JOBS.

By Claude McCullough

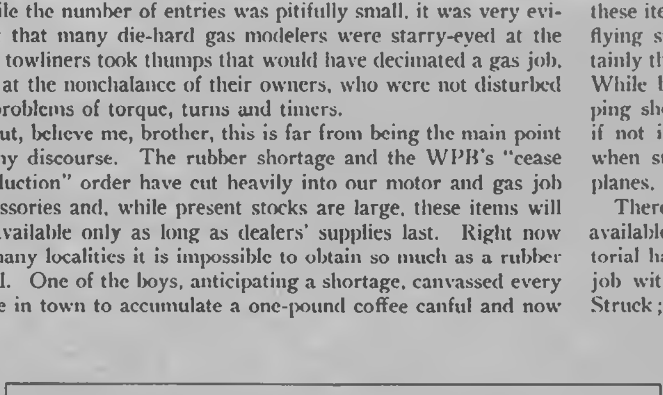
AMID hoots and catcalls from fellow members, one of the boys in our local gas model club brought his new towline glider out to our flying field one Sunday afternoon some months ago. The derisive laughter changed to whistles of amazement when the ship dropped its spiral control stick and towline and proceeded to turn in two and a half minutes of floating spirals. An hour later, when the gas jobs all had been grounded (forcibly or otherwise) the sailplane was still performing without so much as a scratched bottom, surviving encounters with a tree, a fence and power lines, and turning in a thermal flight of six minutes.

At the first contest we attended this season, a towline glider event had been added to the usual list of gas and rubber events. While the number of entries was pitifully small, it was very evident that many die-hard gas modelers were starry-eyed at the way towliners took thumps that would have decimated a gas job, and at the nonchalance of their owners, who were not disturbed by problems of torque, turns and timers.

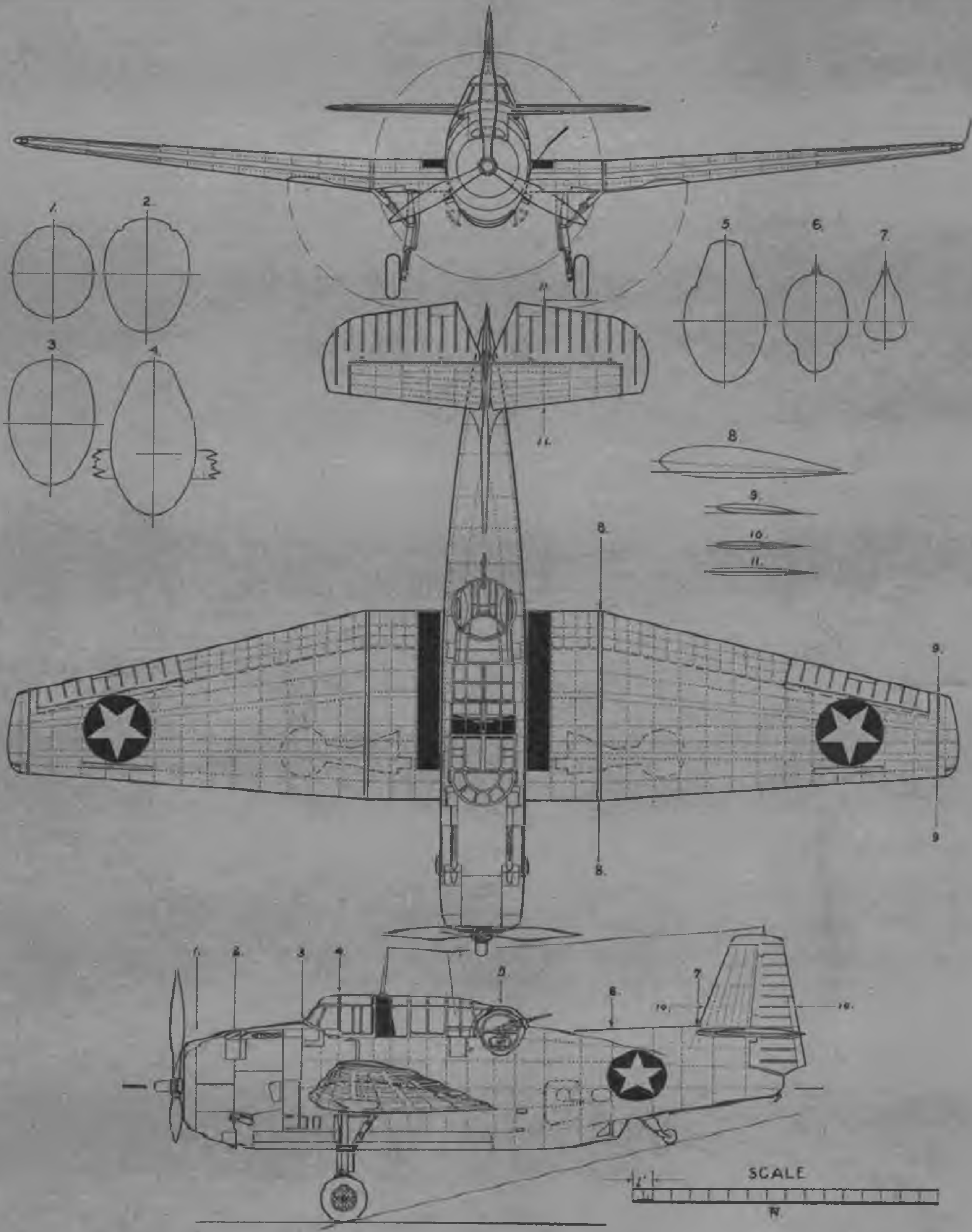
But, believe me, brother, this is far from being the main point of my discourse. The rubber shortage and the WPB's "cease production" order have cut heavily into our motor and gas job accessories and, while present stocks are large, these items will be available only as long as dealers' supplies last. Right now in many localities it is impossible to obtain so much as a rubber band. One of the boys, anticipating a shortage, canvassed every store in town to accumulate a one-pound coffee canful and now is known in local modeling circles as the Rubber Baron. A frantic search for rubber bands is made after every gas job's landing mishap, but our supply is rapidly diminishing, and my Korda motor has more knots than an Eagle Boy Scout test. Helpful Homer suggests as substitutes: shredded inner tube, retreaded girdles or dehydrated chewing gum, but other than that —rubber is out for the duration!

And thus it is that the long-neglected towline glider is coming into its own. Using no rubber, a minimum of steel wire, no brass or aluminum, it is the ideal ship for wartime model building. The AMA rules require a wing loading of three ounces for each 100 square inches of wing area. Since it carries no rubber motor or prop and needs no landing gear, the weight of these items may be put into structural strength. This, plus slow flying speed, makes a towliner almost indestructible, and certainly that is to be desired above all else in these days of scarcity. While balsa wood is still very much available, the acute shipping shortage will make its importation from Ecuador difficult if not impossible. So, brother, if you want something to fly when supplies get scarce, you'd better build a couple of sailplanes, pronto!

There are only a few sailplane kits on the market, but those available are good ones. Recently advertised in Air Trails Pictorial have been Berkeley's 50" Sinbad the Sailer, a slick cabin job with an ingenious spiral control stick designed by Hank Struck; Cleveland's giant 84" gull-winged Con- *(Turn to page 61)*



This puppet device, designed by Frank Ehling, allows rudder operation by a method similar to gas model control-line flying. In addition, the extra strings may be used to release parachutes, drop bombs, do other unusual stunts.



GRUMMAN TBF-1 AVENGER

By Thomas Naylor

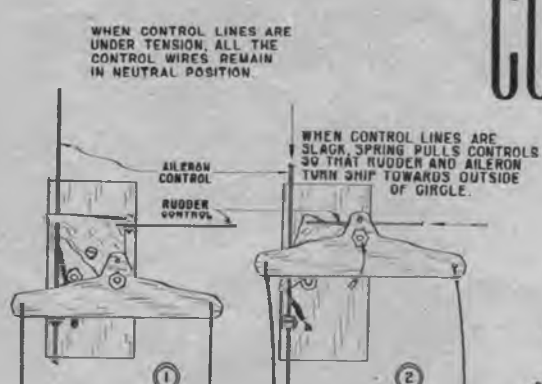
SEATTLE GUIDELINERS

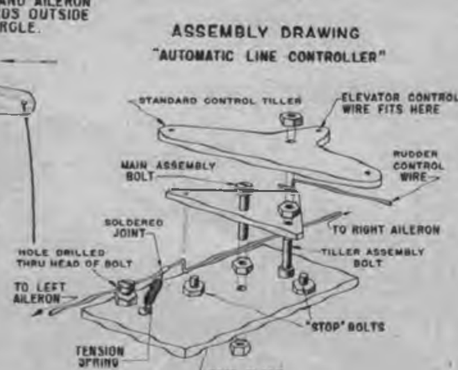
NOPE, these are not models built by clients of a loony bin; they're shots of typical designs built by the Seattle Guideliners who'll try anything to squeeze a few more miles an hour from their "spin-dizzies." Lack of space curtails our printing all their unusual models, but they've done everything from scale jobs of modern military planes to the six-inch Atom-powered job shown at the left. Records are: Class A, 49 m. p. h.; Class B, 59 m. p. h.; Class C, 78 m. p. h. Secretary Ellis Sigmon suggests that neighbor modelers who want to join a progressive club write him at 311 W. Smith Street, Seattle, Washington.

CONTROL LINE NEWS

Here's the new "Hollywood Flying Tigers" with a few of their "spin-dizzies." Average 70 m. p. h.

AUTOMATIC CONTROLLINER





WHAT control-line flier hasn't been perplexed at the problem of keeping his lines taut! Although it is customary to warp the wing and turn the rudder of a ship to counteract slackness, it creates a lot of undesired drag on a fast-flying ship. The average speedster needs only enough pull on the lines for good control and no more; excess pull inevitably creates drag and slows the model down.

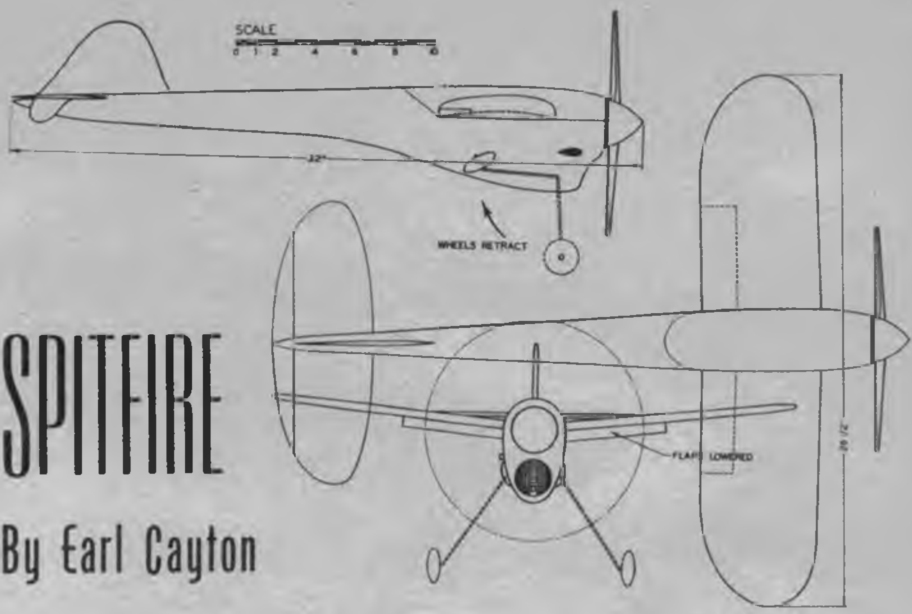
This device eliminates the excess drag, takes up the slack and gives just the right amount of pull at all times by controlling both the ailerons and rudder. If there is too much pull on the lines, the ship banks toward the operator until it is again in normal flying position.

The line controller is made entirely of 1/8" plywood. The tiller is also of plywood, but fiber or metal can be used. The tiller is mounted on the corner of a plywood triangle which pivots (see drawing) and not on the fuselage; it can thus move sideways freely on the fuselage to control the ailerons and rudder as well as tilt horizontally for elevator control. Should the operator pull on one line, it works as does an ordinary tiller; but if both lines are pulled at once, it moves toward you, pulling with it the rudder and aileron wires. While the ship is flying, this action would move the ailerons and rudder to a neutral position; once the lines slacken, the spring returns the tiller to its original position. The ailerons *(Turn to page 66)*

By William B. Schwab

SPITFIRE

By Earl Cayton



CONTROL LINE NEWS

THE Spitfire was designed and built exclusively for participation in tethered-speed events. Efficient streamlining, correct proportions and a few uncommon gadgets make it a threat in any controlled-flight contest.

Since wind-tunnel tests on models prove that pod and boom fuselage designs offer least drag, this principle was used for better streamlining. A large spinner faired into the pod reduces frontal drag. The pod is designed just large enough to cowl completely the motor and its accessories, the control-line system, the retractable landing gear, and the throttle, switch and flap mechanisms; it is then faired neatly into the boom.

Inefficient speed and incorrect proportions are common causes of failure to win events. The Spitfire's lifting and control surfaces are designed only large enough to retain stability. The exhausts are made large enough to let the hot air from the motor out of the cowling efficiently.

Guide liners have long needed a method by which to land "hot" control models safely. A tethered model has such a high wing loading that, when the motor cuts, the craft loses flying speed and practically falls to the ground. Some modelers whirl the lines of their ships; a few use timers, a difficult technique. To solve the problem, a system was devised by which the "hottest" speed racer may be easily landed. With a third line, the motor is throttled just enough to keep up flying speed. A fourth line is used to bring the flaps and landing gear down and cut the motor; the model then settles safely to the ground.

TRY GEARS FOR CONTROL

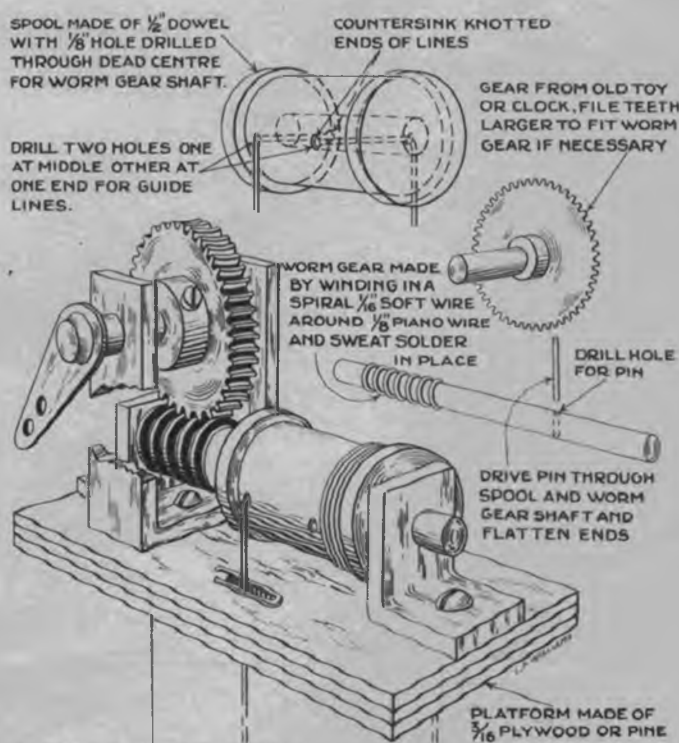
By A. H. Requarth

THE smallness of a model airplane is a determining factor in its speed. Control-line fliers, however, have found that the smaller the plane, the more sensitive are the controls. A model with a 24-inch wingspan, for example, was far from right when it was used with a standard control-line set-up. It is almost impossible to keep a small plane on an even keel for even one circle, and there's always the possibility of a crack-up. Here, after thorough testing and experimentation, is something that will not only give control-line fliers more enjoyment, but will lessen the expense.

The solution lies in a gear-control method which is relatively simple to make. The gears can be bought, but homemade gears have been found better because they weigh less and, not being very wide, eliminate any cross-gear bind. The gear ratio should be about 24 to 1.

First make a worm gear by wrapping some soft 1/16" wire about a straight piece of 1/8" landing-gear wire and sweat-solder it into place. Take a gear about 1 1/2" wide from a clock or a discarded toy and, if necessary, file the teeth larger to fit the worm gear.

Get or make a spool as shown in the diagram; it can be easily made on a wood lathe. Drill a 1/8" hole through the spool, being careful that it is perfectly true to the outside of the spool. Secure the spool to the worm-gear (Turn to page 40)



MEGOW'S NEWEST "Jap-

WAR, with its tremendous development in aviation, has also brought important changes in design and construction of model airplanes. This new Megow "Jap-Slapper" Gas Model is in every way a product of *today*. Entirely new in design, it features Megow's new "Victory Construction," with interlocking plywood formers and fully gusseted joints . . . a construction of great strength, yet light as balsawood, and using regular model cement.

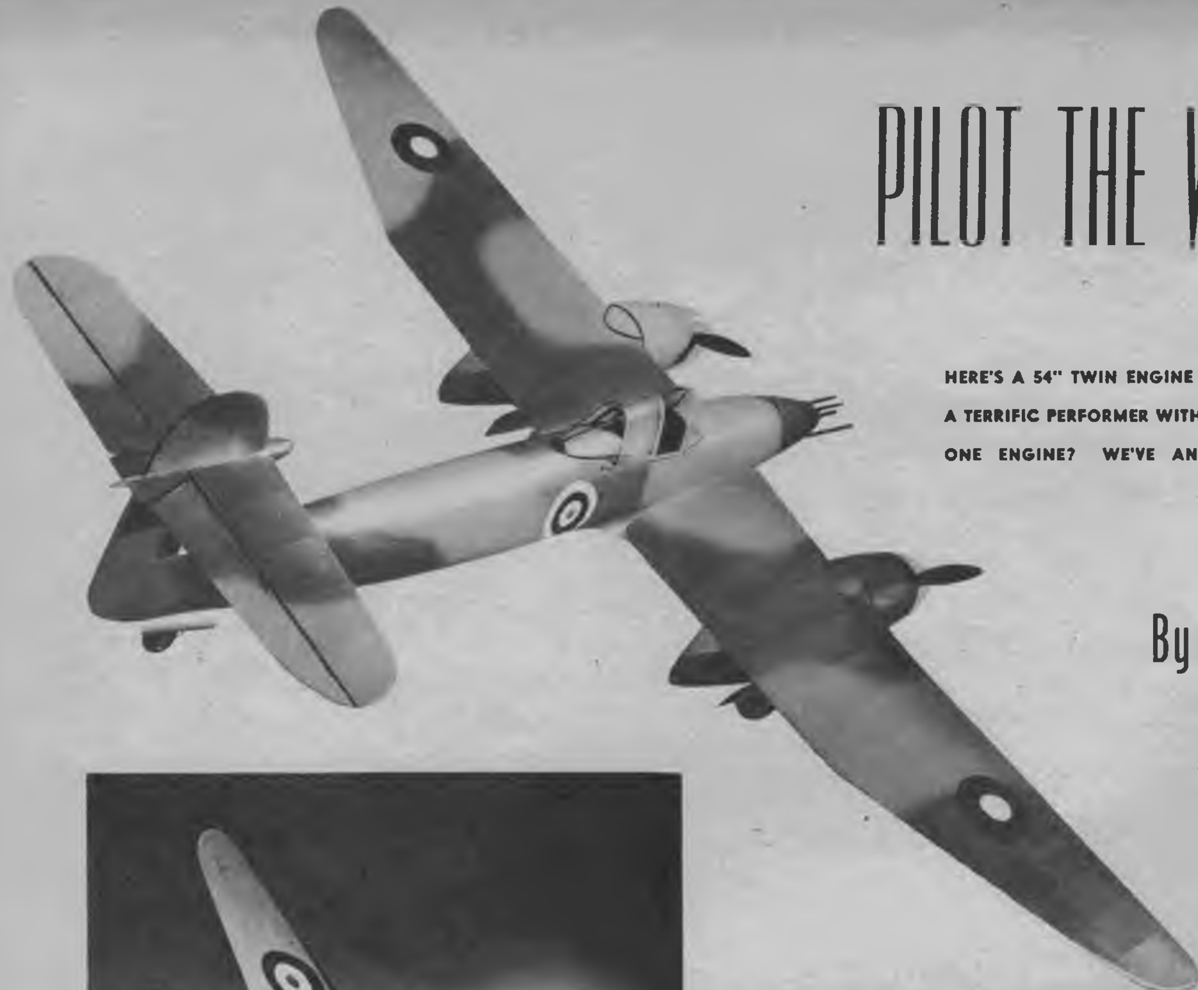
Megow's "Jap-Slapper" embodies revolutionary ideas in model building, gained from real aircraft construction. It is specially designed for contest work, and not only meets all the problems of the model builder today, but gives him every opportunity to establish sensational new records. The wingspan is 42 inches, wing area 300 square inches, and wing loading capacity 9½ ounces per square foot. Overall length, 32 inches. It is a class B model, made for motors of .20 to .29 displacement, and with a ready-to-fly weight of only 20 ounces.

See your dealer, or order direct if he cannot supply you.

$2.00
BY MAIL
Postage, 15c Extra

GAS MODEL
"Slapper"
As a leader in the field, a large part of the Megow plant is now engaged in war production, but the production of regular lines is continuing. If an occasional delay occurs, we feel sure our dealers and customers will understand that war demands must come first.
Megow
PHILADELPHIA, PENNA.

PILOT THE WESTLAND



HERE'S A 54" TWIN ENGINE CONTROL LINER THAT'S A TERRIFIC PERFORMER WITH EITHER PINE OR BALSA. ONE ENGINE? WE'VE ANTICIPATED THAT, TOO.

By Paul Plecan

Under view shows realistic detail of nacelles and landing gear.

This photograph will give you a good idea of immense size of the job.

UNIQUE because of its slimness and high-mounted stabilizer, the Westland Whirlwind is the answer to many a model-maker's dream. Unusual performance is offered by this twin-engined model, plus an appearance that will win most any "beauty" event. A line is connected to switches in both ignition circuits to "cut" both engines if one starts sputtering.

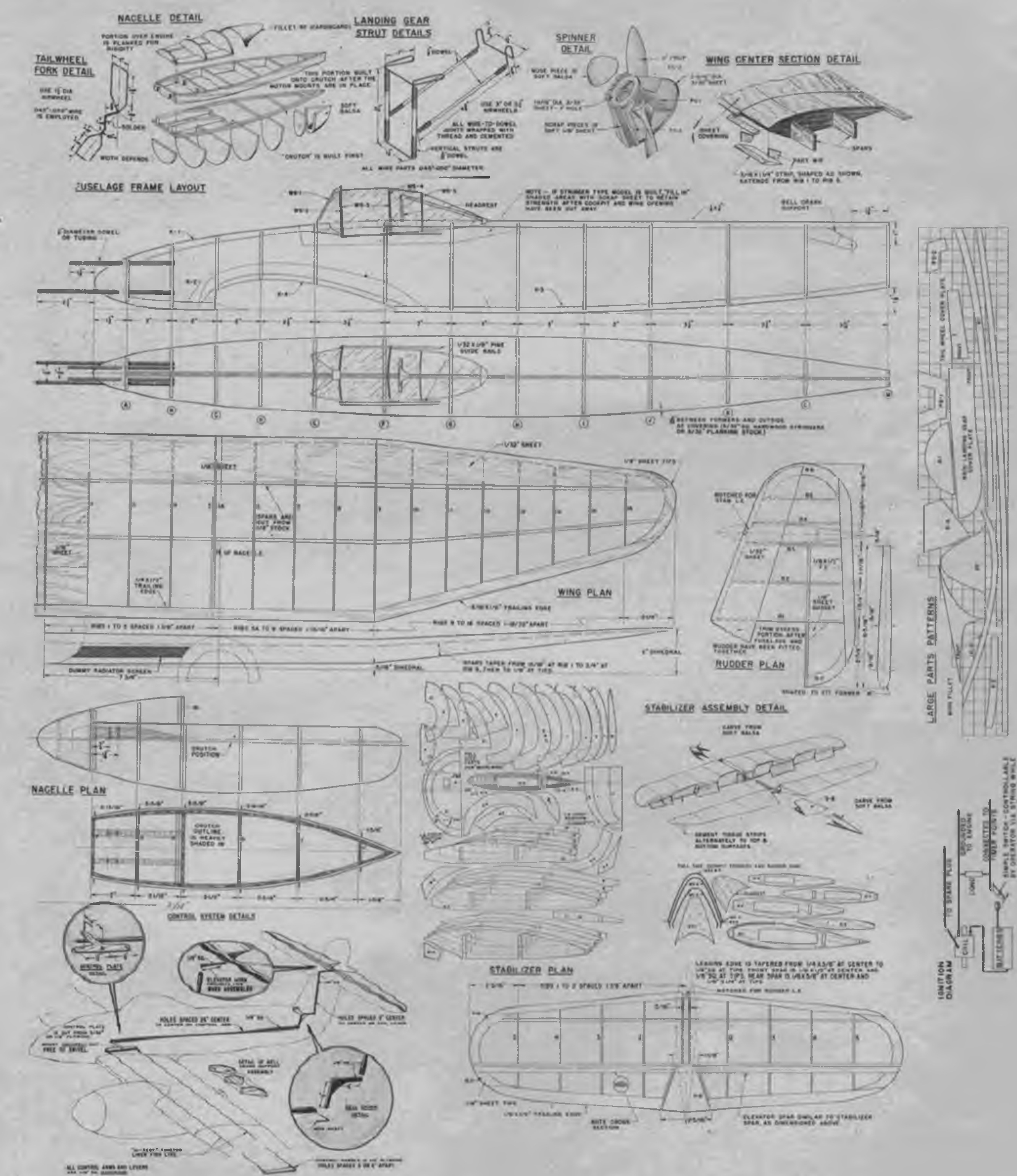
If you are not the fortunate owner of two motors, you can still fly the Whirlwind by installing a Class C engine in one nacelle and using a dummy free-wheeling prop on the other. Of course, the coil, condenser and batteries should be placed in the dummy nacelle to balance the model. In this case the model should be flown in a clockwise circle and the engine mounted in the outside wing nacelle; that is, looking at the model directly from the front, the engine should be mounted on the right side.

Although either balsa or hardwood construction can be employed, a half-and-half combination is advised. Curved parts (formers and ribs) should be of balsa, but straight parts (stringers and spars) should be hardwood. To start fuselage construction, cut out the master keel stringers K-1, 2, 3 and 4 from $\frac{1}{8}$" sheet. Pin them down to your workbench as shown in the fuselage-frame layout. Cut two each of all formers (A to M), mark stringer positions on them in ink, and assemble one set of the keel strips. Following the stringer marks, $^{3}/_{32}$" square stringers are cemented in place. Remove half fuselage from bench, add remaining formers and finish. Before applying *all* stringers, fill in the proper areas and assemble the bell crank support at the top of former "L."

Wing spars are cut out according to dimensions given. "Hot" landings will make hardwood imperative here. Ribs are now cemented in place. Note that the radiator extends from rib #1 to #5. The leading-edge covering is applied in sections, as the cross section changes abruptly at ribs #5-5A. The center section is covered with $^{1}/_{16}$" sheet; the tips with $^{1}/_{32}$" sheet. Also cover all the space between ribs #1 and #2 with $^{1}/_{16}$" sheet.

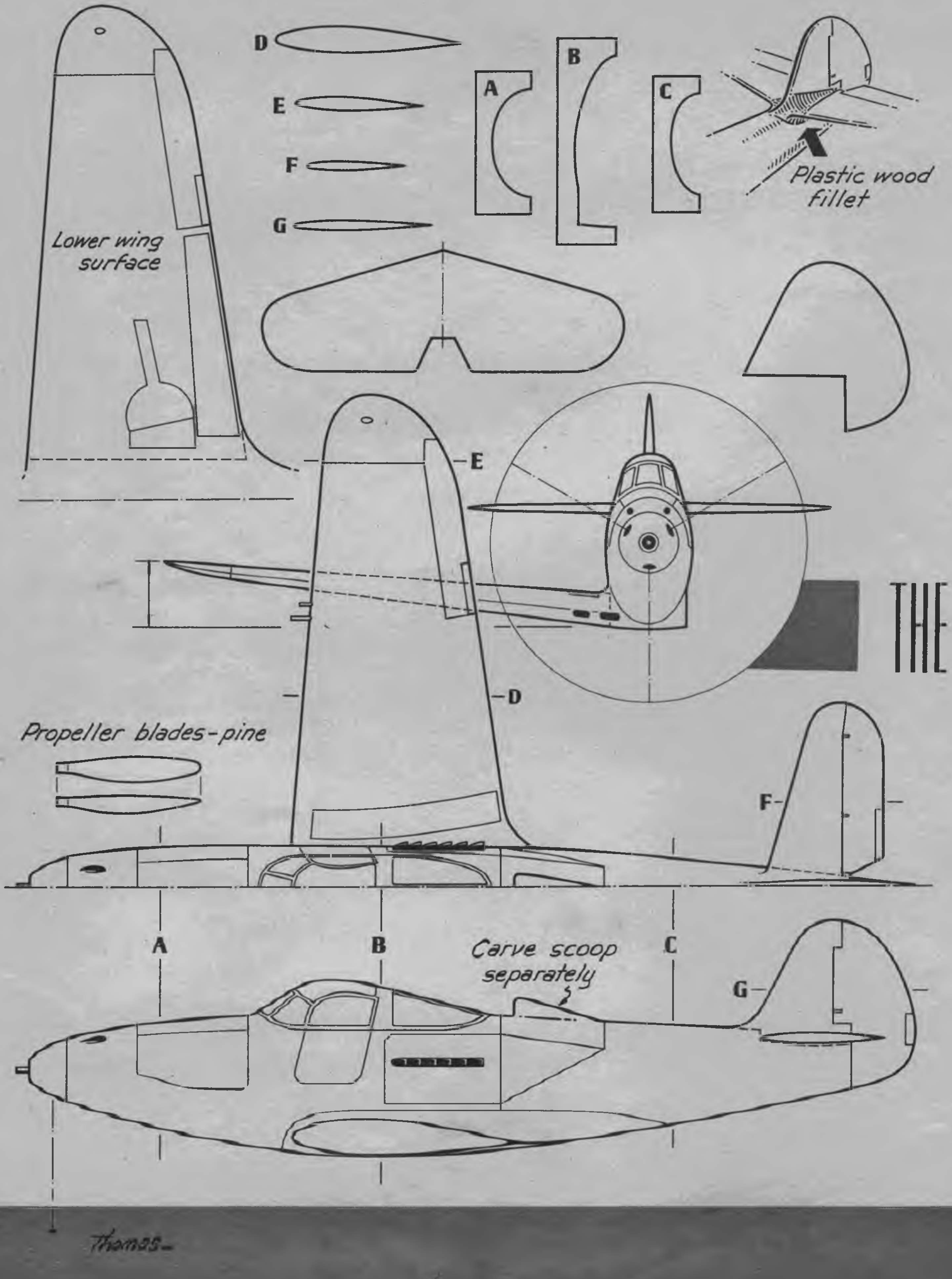
Rudder assembly is simple, as full-size outlines are given. Space off as indicated and cement leading and trailing *(Turn to page 66)*

WHIRLWIND



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**

THE



D
E
F
G
A
B
C
Plastic wood fillet
Lower wing surface
E
D
Propeller blades-pine
F
A
B
Carve scoop separately
C
G
Thomas

THE LAST PART OF OUR SERIES REMOVES THE HOCUS-POCUS FROM AERODYNAMICS. YOUR SUGGESTIONS FOR FUTURE TOPICS WILL BE APPRECIATED.

STABILITY - PART 2

By George H. Tweney

ACTING DIRECTOR DEPT. OF AERONAUTICS, UNIV. OF DETROIT

WE saw last month how longitudinal stability is dependent on three factors: position of the center of gravity; movement of the center of pressure on the main wing; and the area of the horizontal tail and the angle at which it is set.

The action of the first two factors is fairly obvious. The farther forward the center of gravity, the longer will be the length of the tail moment arm, and the better will be the longitudinal stability. Likewise, any movement of the center of pressure on the wings tends toward instability of the airplane, and we all know how this movement is minimized in the case of airfoils having a convex lower surface, and in most cases, with airfoils having a reflexed trailing edge. There remains, then, the area of the horizontal tail, and the angle at which it is set.

The angle must be such that the force obtained on the horizontal tail is in such a direction, either up or down as is necessary, in order to counteract the movement of the center of pressure on the wing. This can be obtained by setting the horizontal tail at an angle less than that of the main wing, the angle between the chord of the horizontal tail and the chord of the main wing being known as the "longitudinal dihedral." This is clearly illustrated in Figure 1.

It is really the angle of attack, the actual angle at which the tail strikes the airflow, which matters therefore we must not forget the downwash from the main wing. This downwash will cause the angle of attack to be actually less than the angle at which the horizontal tail is set. For this reason, even if the tail is set at the same angle as the wing, there will be *(Turn to page 54)*

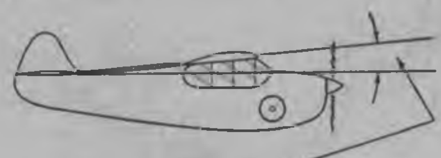


FIG. I LONGITUDINAL DIHEDRAL

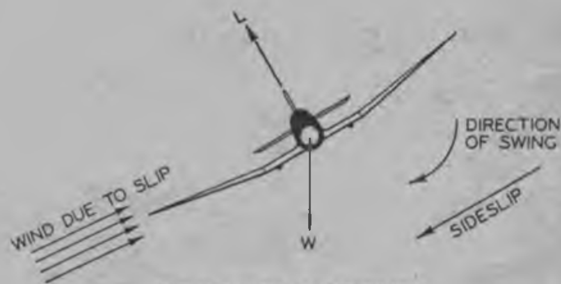


FIG. 2 PENDULUM STABILITY

BELL AIRACOBRA

GRAB THE SCALPEL, BOYS, AND WHITTLE YOURSELF A MODEL OF AMERICA'S FAMOUS FIGHTER FROM SCRAP PINE.

By H. A. Thomas

THE military experts claim that the Bell Airacobra is the most aerodynamically perfect airplane yet produced in this war. While actual performance figures have not been released, rumor has it that its speed is well over 350 m. p. h. which, when combined with a 37-mm. cannon and two machine guns, produces an airplane ranking high among the world's best fighters.

Your scale-model collection won't be complete without this job, so study the plans and let's get going on the construction.

From balsa or soft pine, carve fuselage to the proper side and top shapes, checking contour with cross-section patterns as you go along. Wing halves are tapered to thickness indicated on front-view drawing. Before shaping, however, carefully bevel inner wing edges for proper dihedral where they fit the fuselage. Wing tips are tapered mostly from the under side, giving an upturned appearance. Check the final wing-section shape against cross-section patterns. Tail surfaces are carved in a similar manner. Sand all parts lightly, then dope several times. Assemble model by blocking parts to proper alignment while the cement *(Turn to page 54)*

VOUGHT-SIKORSKY CORSAIR

IN THE BETTER-THAN-400-MILE-AN-HOUR CL

Kodachrome by Rudy Arnold

ASS THIS LATEST NAVY FIGHTER, DESIGNATED F4U-2, FEATURES INVERTED GULL WING.

THE EUROPEAN WAY

By Paul Plecan

SUBSTITUTE MATERIALS REQUIRE MORE ATTENTION TO STRUCTURAL DESIGN. LET'S EXAMINE SOME TYPICAL EUROPEAN IDEAS.

BECAUSE of the scarcity of balsa abroad, the Germans and Russians have made remarkable strides in developing flying models constructed entirely of hardwood. Since German models built for contest work must be made of materials readily available within the country, an overabundance of six-foot hardwood gliders has resulted. Even metal models have been flown in Germany. And models made entirely of Elektron (magnesium alloy) covered with silk have been flown successfully.

Ersatz materials have made their appearance also. When Frank Zaic returned from a European trip in 1937, he brought back a cream-colored, marshmallowlike material which, because it had no grain, could be cut easily and formed with the fingers. If used for fillets and other unstressed parts, it needed but a few coats of dope or enamel to retain any desired shape. But ersatz materials have their disadvantages. German rubber, being less elastic than ours and thus possessing less energy, is a hindrance in flying rubber-powered models. Russian substitutes for balsa, of which the shortage is acute, bring similar problems. This demand for substitutes has brought different uses of materials. For example, two-ply plywood 1-mm. thick ($^1/_{25}$") now replaces parts usually made of $^3/_{32}$" sheet balsa, increasing strength without increasing weight.

The difference in material tends to influence the models physically. Foreign models are ungainly proportioned, according to the American view. Boxlike fuselages are the rule, for only the expert has the patience or ability to make a former *(Turn to page 60)*

European designers certainly do not lack originality. Note unique rudder shape used on this German glider.

Fig. 1

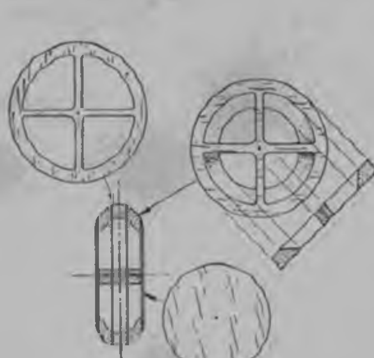


Fig. 2

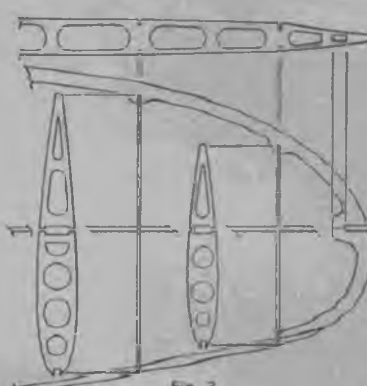


Fig. 3

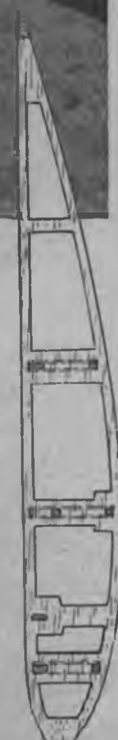
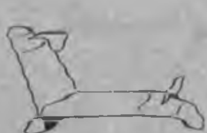


Fig. 4



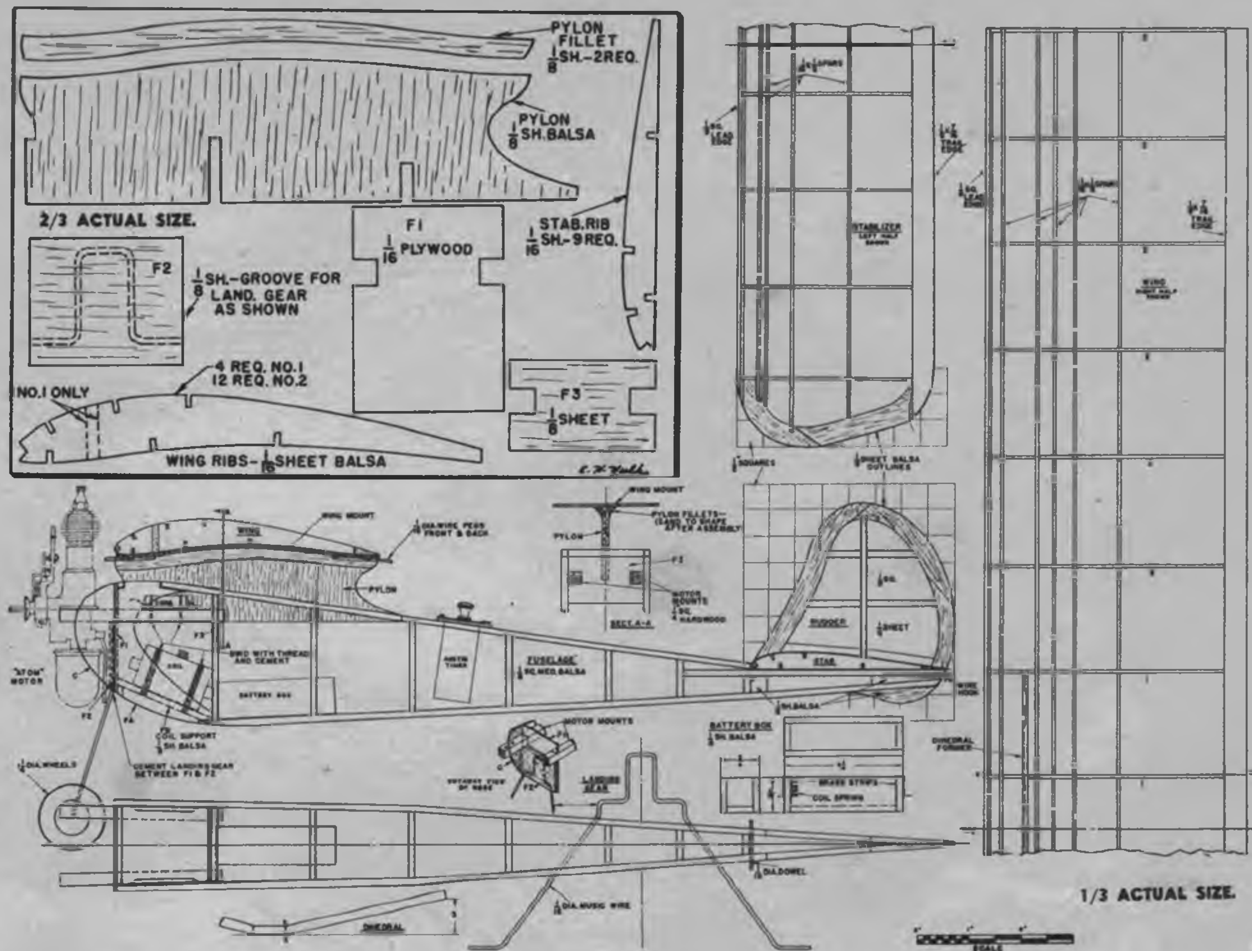
Unique flying wing of '38 with "drooped" tips.

German-built rocket-powered glider shows clean design.

Beginner's glider developed for schools.

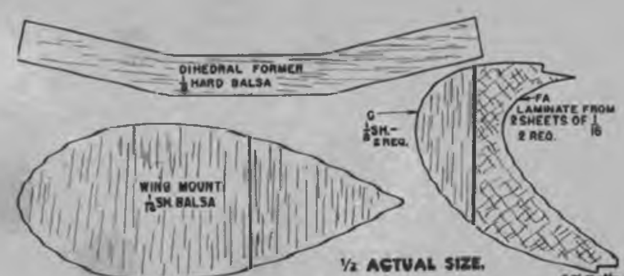
German 6' record holder for 1937. Time: 37 min. 41 sec.

Successful German ornithopter that consistently turned in 35-second flights.



THE LOCUST

By Art Nussbaum



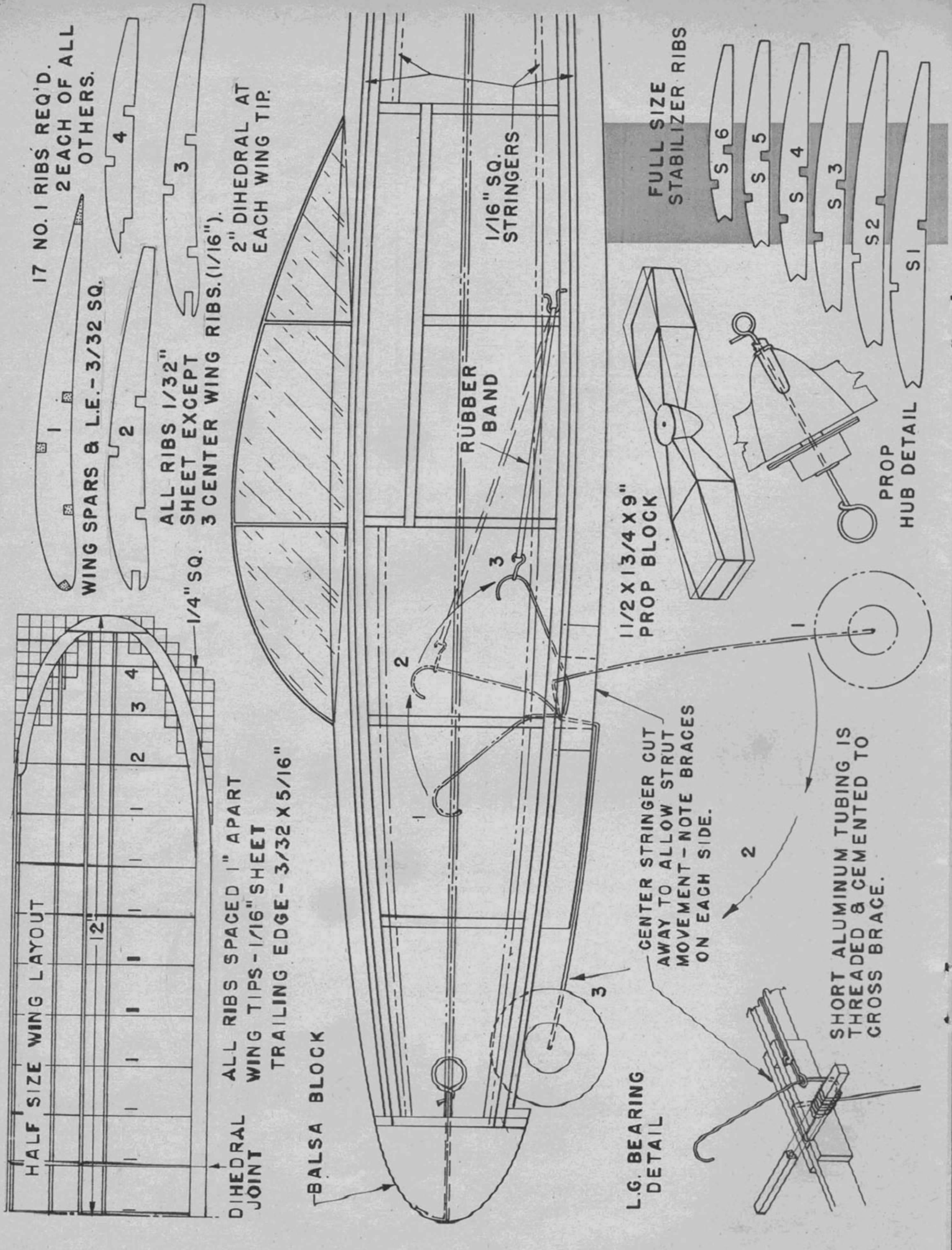
YOU'LL WANT TO BUILD THIS VEST POCKET CLASS A FOR SPRING CONTEST FLYING. P. S.: SHE REQUIRES VERY LITTLE MATERIAL.

ADMITTEDLY she is an ugly duckling, but after you've built her and gotten off a few test flights, you'll have to agree that beauty is but skin deep when it comes to performance. After all, an average flight of two and a half minutes with a fifteen-second motor run is pretty good performance. As for glide, chum, we'll match this job against anything short of a seagull.

How come? Well, first of all, most Class A jobs are tremendously overweight. AMA rules limit Atom jobs to 7.76 ounces minimum, but most ships come off the board at about fifteen ounces, and the owners wonder why they have the glide of a dead duck. Of course, it's pretty nearly impossible to get an Atom down to the minimum weight, as the total engine unit weighs about six ounces, but it is possible to keep the Locust down to about nine ounces.

To obtain this weight, it's necessary to eliminate all fancy trimmings, such as prettily shaped wing tips and neatly curved fuselages, always bearing in mind that the model is *(Turn to page 60)*

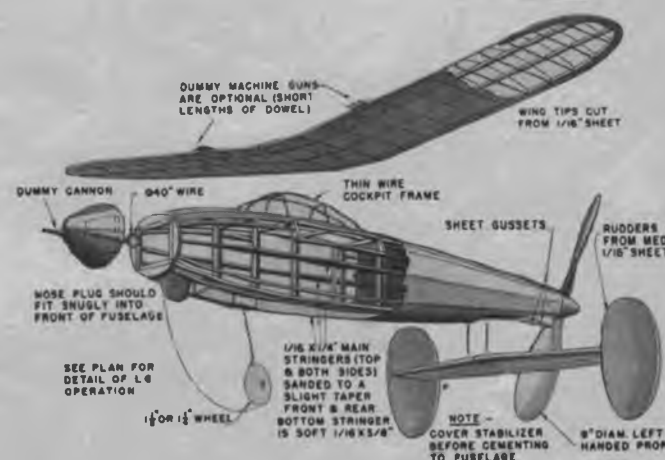
Designer Nussbaum claims fancy wing tips, curves don't improve Class A models.


17 NO. 1 RIBS REQ'D.
2 EACH OF ALL OTHERS.
WING SPARS & L.E. - 3/32 SQ.
ALL RIBS 1/32" SHEET EXCEPT 3 CENTER WING RIBS.(1/16").
2" DIHEDRAL AT EACH WING TIP.
1/16" SQ. STRINGERS
RUBBER BAND
FULL SIZE STABILIZER RIBS
S 6
S 5
S 4
S 3
S2
S1
1/4" SQ.
11/2 X 13/4 X 9" PROP BLOCK
PROP HUB DETAIL
HALF SIZE WING LAYOUT
12"
DIHEDRAL JOINT
ALL RIBS SPACED 1" APART
WING TIPS - 1/16" SHEET
TRAILING EDGE - 3/32 X 5/16"
BALSA BLOCK
CENTER STRINGER CUT AWAY TO ALLOW STRUT MOVEMENT - NOTE BRACES ON EACH SIDE.
SHORT ALUMINUM TUBING IS THREADED & CEMENTED TO CROSS BRACE.
L.G. BEARING DETAIL

PUSHER FIGHTER

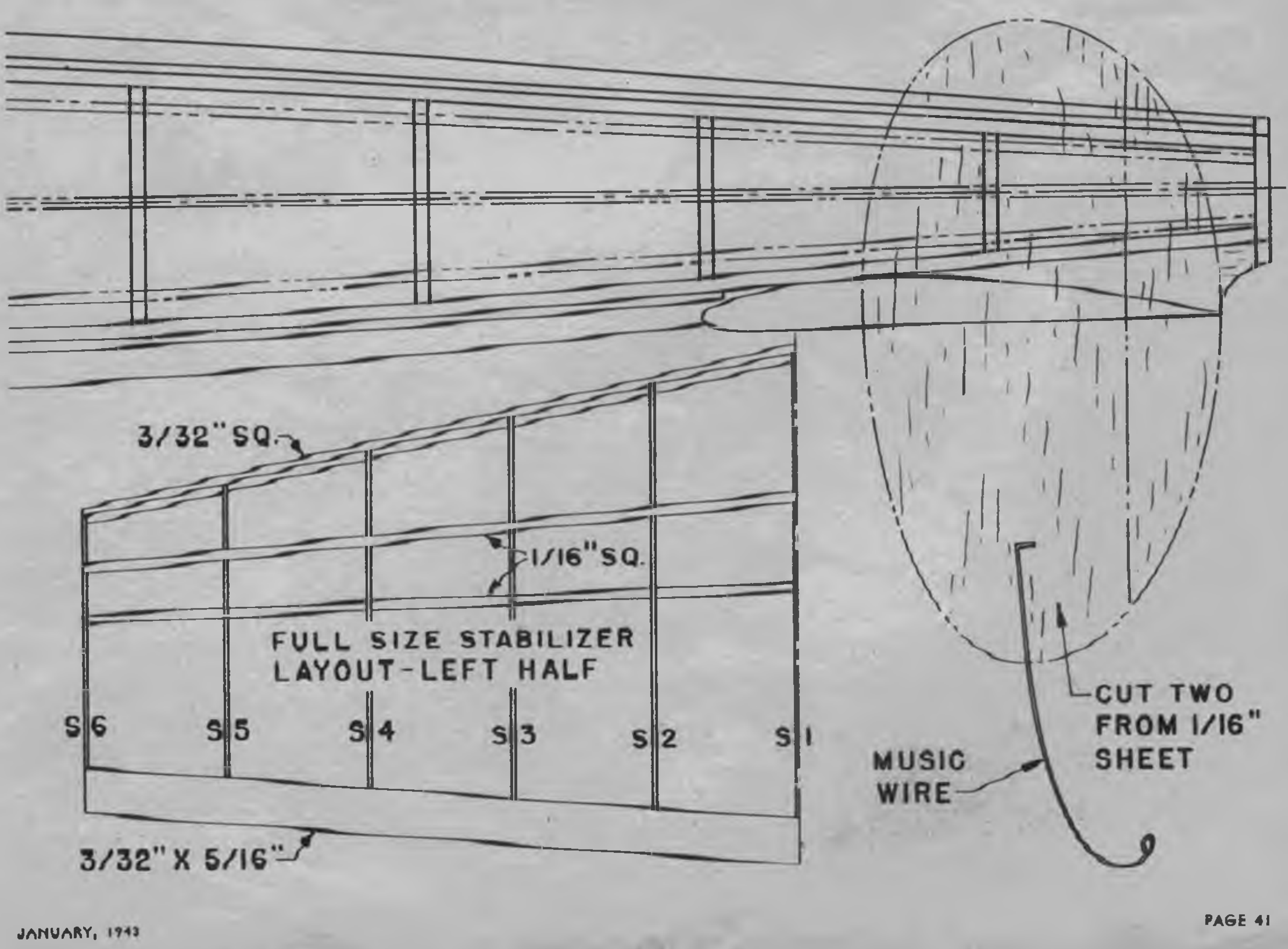
By Gil Shurman

YOUR GUESS IS AS GOOD AS OURS—COULD BE TOMORROW'S FIGHTER, BUT WE'RE CALLING OUR SHOTS WHEN WE SAY SHE'S A GOOD FLYER.



THE Pusher Fighter is a semiscale model of what our future pursuit planes probably will look like. As can be seen, the chief difference between our present planes and this model is the arrangement of a pusher propeller.

The most obvious advantages of having a pusher propeller at the rear end of the fuselage are that the smooth, undisturbed air passes over the wing and tail and leaves the entire nose of the ship free for the installation of as many machine guns and cannon as desired, without having to use synchronizing apparatus. Upon further consideration, it can be seen that this design lends itself extremely well to the idea of having the pilot in a *(Turn to page 65)*



RAF ON CANVAS

AVIATION ARTISTS, MANY ON DUTY WITH THE RAF, BRING HOME VIVID MEMORIES TO MAKE THESE STIRRING PAINTINGS OF VARIED AIR COMBATS.

Big bad Wulf meets his match. This dramatic painting shows action between a group of Spitfires and Focke-Wulf 190s over Belgian coast. Spitfires won.

One down, one to go. This painting graphically illustrates the attack by two Heinkel 113s upon a Manchester over enemy territory. Both were shot down

Whirlwinds in action against enemy surface craft. The painting clearly shows this unique twin-engine fighter with four 20-mm. cannon grouped in nose.

The plane known as Old Boomerang is popular with artists of the RAF, for it has featured in many dramatic incidents. It bombs and machine-guns shipping.


B. Stone

Catafighters

(Continued from page 13)

believe it went down thirty-five feet into the water. Luckily I had already opened the roof of the cockpit, but before I could get away the plane had gone under so far that I was in inky darkness. I thought it was all up. However, by doing a dog paddle I managed to come to the surface with my lungs nearly bursting. I gasped a bit, you can guess, and was very glad to see a boat waiting for me. They hauled me out and in an incredibly short time I was having a cup of tea and feeling fine."

The financial side of this encounter is interesting. A Spitfire costs from $20,000 to $30,000, a Focke-Wulf costs a minimum of $250,000, and so the profit is $220,000. That in itself is good, but add to this the fact that the German raider might have sunk two or more freighters with cargoes worth millions of dollars, and one sees that the Catafighter is well worth while. Just how worth while was revealed by the British in a statement that no convoy equipped with a Catafighter has lost a single ship from air attack.

Not all the Catafighters' battles are against a single enemy plane. Recently the Germans have been using HE-115 float seaplanes, and the HE-111 bomber newly converted into a torpedo bomber. Both these planes have ranges of well over 1,500 miles, and flights of them have been active by day and on moonlit nights. One Catafighter pilot zoomed into the sky to attack a formation of six HE-111s and one HE-115, which was carrying a heavy and deadly torpedo. The seven enemy planes could have done enormous damage to the convoy. The RAF pilot maneuvered his plane to a position of advantage with the sun behind him and roared into the enemy's flank. In a few seconds he was in the middle of the formation, and one of the HE-111s was falling in flames. He shot clear, looped and came down again, his guns blazing. This time he got the HE-115. Another maneuver and he found himself on the tail of an HE-111 that had veered away from the others to give its rear gunner a chance to get a clear shot at him. His eight guns toppled that, too. For twenty minutes he fought the remaining Germans. Finally they broke and fled, but not before they had done some damage. A 20-mm. cannon shell which had burst in the cockpit inflicted serious wounds and he was bleeding badly. Coolly he turned the Hurricane on its back and bailed out.

The Catafighter is one use of the airplane to which the Germans have no answer. They cannot armor their big bombers sufficiently to resist the impact of close-range machine-gun fire. To fit the necessary armor would mean the sacrifice of range and speed. They cannot give these aerial ocean cruisers any fighter escort. Neither can they be sure which ship carries a Catafighter. All these are reasons why the German long-range planes are no longer a menace in mid-Atlantic; the use of Catafighters has probably played an important part in our sending supplies to Russia.

Details of the actual launching apparatus are secret. It is probable that the 100 m. p. h. impetus is given to the fighter by means of an explosive charge, although the British for many years have had an excellent spring-propelled launching apparatus. The first Catafighter was a Spitfire, but recently the new Hurricane fitted with four shell-firing cannon has been employed. Since the introduction of the new method of giving fighters ocean bases, the Air Ministry reports that attacks by the Kuriers have been fewer.

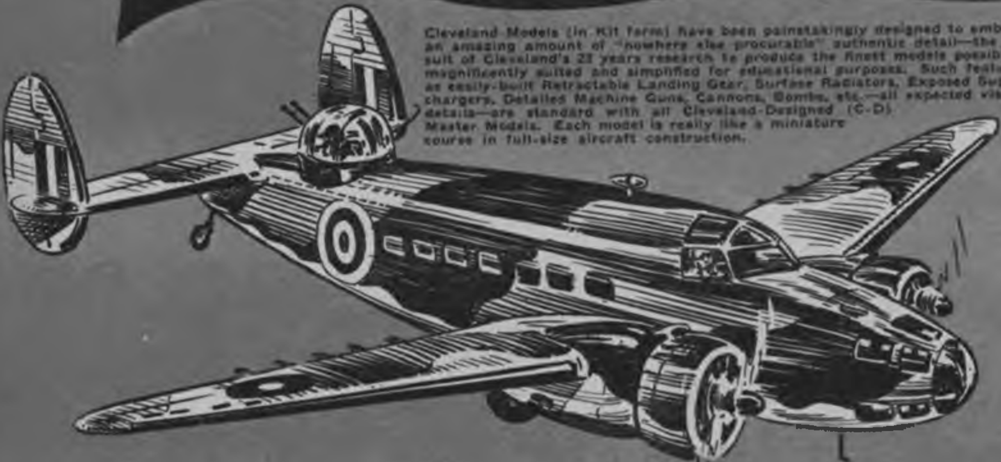
According to reports, the fighter is not always lost, even if the pilot is unable to fly to land. One pilot has the proud distinction of having been able on three separate occasions to place his plane near enough to the parent ship for it to be salvaged. Others have faced the problem of getting down into seas on which it would be impossible to land a heavy flying boat. One pilot was catapulted into the teeth of a 60 m. p. h. gale. He shot down the German plane and then, with his motor failing because of a direct hit in the cooling system, he prepared to bail out. The fury of the wind threw his plane over to the upright position just as he was about to jump, and he found himself half in and half out of the cockpit, with the plane literally being blown out of control. Finally, while the fighter was bucking like a mad horse in what was a miniature typhoon, he got himself clear. Pulling the rip cord as late as he dared, he found, when his parachute opened, that he was being swept along by the gale at a terrific speed. Right in his path was a big ship, bouncing and diving in the heavy sea, its bow throwing up crests of foam. He says that he missed the foremast by a few feet. Just as he thought he was going to be dashed against it, the ship went into a trough of the waves, and he was clear. His wild flight continued for another mile, and finally he hit the top of a wave with such force that he lost consciousness. When he came to he was in the sick bay of a merchantman. The crew had managed to launch a boat and bring him in.

Whose idea it was to use these catapulted fighters is not exactly known. The idea may not be so new as many imagine. During the last war, the British had their famous Q ships, which were innocent-looking freighters until a German U-boat made its appearance, then they would strip for action and reveal themselves as heavily armed warships. At the time, the suggestion was made that these ships should carry a small seaplane which could be used to bomb submarines. The idea was never developed, however.

No matter whose idea, it is a good one. Catafighters are now in use on all long-distance convoys, and these planes with a single sting are beating the long-distance bomber with which Hitler hoped to attack our sea lanes on the vertical flank.

IT'S GOING TO BE A MERRY CHRISTMAS

Cleveland Models (in Kit form) have been painstakingly designed to embody an amazing amount of "nowhere else procurable" authentic detail—the result of Cleveland's 23 years research to produce the finest models possible—magnificently suited and simplified for educational purposes. Such features as easily-built Retractable Landing Gear, Surface Radiators, Exposed Superchargers, Detailed Machine Guns, Cannons, Bombs, etc.—all expected visible details—are standard with all Cleveland-Designed (C-D) Master Models. Each model is really like a miniature course in full-size aircraft construction.



JUNKERS JU87 "STUKA"

Employed with deadly effect by the Nazis in the Battle of England, and other highly terrorizing Nazi "Blitzkriegs." An "ugly duckling" design, but very efficient. Model Span is 34", C-D Master Kit SF-84 .... **$3.50**

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Called "Old Boomerang" by the British, for it always seems to come back. A powerful bomber, also used for reconnaissance and has done some fighting, too. Has seen plenty of action over Europe, Africa and the wide stretches of the Pacific. A "must" model among dyed in the wool modelbuilders. Model Span is 49⅞". C-D Master Kit SF-95

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BREWSTER "BUFFALO"

This U. S. fighter also is very widely employed by both the British and Dutch. Also known as "Peanut Special." It is doing a tremendous amount of work over the Pacific. Both land and carrier-based. Span 26¼". C-D "Master" Kit SF-87 .... **$3.00**

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GRUMMAN F4F "WILDCAT"

This excellent US Navy shipboard fighter, that fought like a Wildcat to hold Wake Island, is also used in good quantities by the English who call it the Martlet (G-36-A). This Cyclone powered mid-wing job is used extensively by the English in North Africa who have used it with considerable success. It may also be fitted for light bombing work. As a fighter, it does 326 m.p.h. This speed and its maneuverability has gained for it an excellent reputation of being "Wildcat" in fighting over the far stretches of the South Pacific with our own forces. Model Span is 28¼". C-D Master Kit SF-88 .... **$3.00**

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Aviation Casting

(Continued from page 10)

To make it easier for the pattern maker, special rules are made for measuring patterns. Known as "shrink rules," a different one is made for each type of metal, and on these all graduations are increased by the proper amount. Thus a twelve-inch shrink rule for cast iron actually measures 12⅛ inches standard measure.

White pine is generally used for the pattern because it is easily worked and fairly durable, but mahogany or maple also may be used if the pattern is to be used frequently. In extreme cases, as for mass production, the patterns are made of hard bronze. In most cases patterns are made in two parts, although if it is a complicated piece, three or more parts may be required. Knowing where and how to "part" a pattern is one of the marks of a good pattern maker, for he must always keep in mind that the pattern has to be drawn out of the sand without breaking or disturbing it. To facilitate drawing the pattern from the mold, the sides are made slightly tapered, usually about seven degrees, and all surfaces are very smoothly finished and well varnished.

Each half of the pattern is now fastened to a steel plate called a pattern plate, with the flat, or "parting face" down, and this plate is fastened to the molding machine. For very large parts, the plate and machine are not used, but for small and medium-size parts, such as are used in Wright Cyclone aircraft engines, the best and fastest results are obtained when these are used. A wooden frame is now placed around the pattern and filled with sand, and the machine then jolts this violently to pack the sand firmly into all the curves and angles. Vigorous pounding with a wooden rammer also helps in packing the sand firmly. When the frame, or "flask" as it is called, is completely filled, the top is smoothed off, and it is then turned upside down. An air-driven vibrator rains thousands of light, sharp blows on the edge of the plate to free the pattern from the grip of the sand, and the pattern plate is carefully raised to draw the pattern clear of the mold and leave a perfect impression in the sand. The upper half of the mold is known as the "cope," and the lower half as the "drag," the two being fitted together to form the complete mold. Before this is done, however, a channel is cut through the cope to provide an opening through which the molten metal can be poured.

The sand used is not ordinary seashore sand; it must be clean, free from lumps and stones, and of a certain degree of fineness. It is mixed with a special oil and a certain amount of water to make it hold to the desired shape, but if it is too wet there will be a violent explosion when the molten metal touches it. Molds used in this moist condition are called "green sand" molds and are the most common type, though not the most suitable for all kinds of work. For parts such as a Cyclone cylinder head which is covered with scores of deep thin ribs or "fins," a different technique must be used, since the inrush of molten metal would easily break the thin sand walls which form the spaces between the fins. In this case a different sand mixture is used, and the flask is removed from the mold, which is then baked for several hours in a special furnace. When properly baked it is very hard and can be handled without any trouble. The fins, however, are so light that even when baked they are easily broken unless properly reinforced. Engineers of the Wright Aeronautical Corp. therefore have devised the following method: Sand is packed tightly into the spaces between the fins of the pattern, then long, thin, headless nails are pushed into the sand at close intervals until the pattern looks like a porcupine. More sand is added, carefully at first so as not to disturb the nails, and then when these are well covered, the flask is filled in the regular manner and well tamped down. A number of heavy wires are also embedded in the body of the mold to strengthen it, in the same manner that steel is used to reinforce concrete.

After the pattern has been removed the mold is placed on a metal tray and carried by means of a conveyor through a long oil-heated oven. This baking process takes about seven hours and results in a mold that is hard enough to stand considerable handling without damage. Such molds are known as "dry sand" molds, or sometimes as "cores."

If the part is to be solid, only the mold will be needed, but in most cases castings are required to be hollow, and therefore cores are used to form the inside surfaces. These cores are made in the same manner as the molds, and are well reinforced with wires. The sand mixture, however, is somewhat different and the cores are baked until very hard. It is, of course, important that the cores be located accurately in the molds to avoid having the finished casting come out with one wall thicker than the other. This is done by forming projections on the core called "prints," and corresponding recesses in the mold, into which these prints will fit. Sometimes, especially in the case of iron castings which do not have to stand much internal pressure, small iron wire supports are used to hold the core away from the sides of the mold. When the molten iron is poured, these remain embedded in it, and while this does no harm for rough iron work, it cannot be used for aluminum aircraft engine parts which must stand great pressures.

After the cores have been placed in position, the two halves of the mold are fitted together, the joints sealed with a mixture of clay and water, and the mold is then ready for the pouring operation.

Aluminum is received from the makers in the form of ingots—bars about five inches square and some fifteen inches long. These are placed into melting furnaces heated by powerful oil burners and holding a ton or

(Turn to page 50)

(Continued from page 48)

more of metal. As the aluminum melts, a close watch is kept on the temperature, because if this goes too high the material will be spoiled. When it reaches 1,600° F. the metal is ready to pour. A ladle, holding a hundred pounds, is placed beneath the spout and the furnace is tilted by means of a large hand wheel. The ladle is usually carried by a hoist on an overhead runway and is handled by two men, one raising or lowering the hoist as required, and the other doing the actual pouring. At the door of the melting room the pourers stop while a third man places a pyrometer (a high-temperature electrical thermometer) into the metal and holds it until the temperature has fallen to exactly the right point. For important aircraft castings this is usually 1,400° F., but if the mold is some distance from the melting room the checker may allow the pot to leave at a few degrees higher so that it will have cooled to just the right temperature by the time it is poured. This pouring temperature is highly important, and an error of only a few degrees will make the difference between a good or bad casting.

Arriving at the mold, the pourers tip the ladle and pour the metal as quickly as possible. A funnel made of baked sand is attached to the top of the mold and helps to prevent spilling. Heavy shoes and asbestos leg guards protect the men from splashes, while thick safety-glass goggles take care of their eyes. For some large castings two or three pots may be poured at the same time through separate openings. After the metal has solidified and cooled, the mold is broken open and the casting is removed. This usually takes about half an hour.

Castings removed from the mold cannot be used immediately. First of all the cores must be broken up and removed through some convenient opening, all the core reinforcing wires pulled out, and then the surplus metal must be cut away. This surplus consists of the "sprue" or piece of metal which fills up the pouring opening, the "gates" or narrow strips connecting various parts of the mold so as to insure an even flow to all parts, and the "risers," which are substantial lumps of metal rising from the top of the casting. This surplus metal may amount to as much as, or more than, the weight of the desired casting, but it is necessary to assure perfect parts. As the metal of the casting cools it tends to shrink, while the metal in the risers acts as a reservoir to counteract this and thus avoids empty spots in the mold. Furthermore, certain impurities always exist in the metal, and a certain amount of sand is liable to be carried along. This always rises to the surface and is trapped in the risers; if these were not present, the impurities would remain in the casting and produce a weak or faulty part. The surplus metal is not wasted, however but is melted down, purified, and cast into ingots to be used over again. The last stage of preparation consists of cleaning by means of a sand blast, then the casting is ready to pass to the machine shops.

Navy Trains To Win

(Continued from page 17)

any university or college intramural program. But their purpose at the preflight school is entirely different. The average collegian participating in an intrafraternity swimming meet does so only because he enjoys the sport; it isn't a great tragedy if he doesn't win. The man who beats him is usually a pretty good guy for all of that. But the aviation cadet swimming in the preflight-school tank knows he must be better than good at keeping afloat, for some time in the not-too-distant future he may have to swim for his life whether he likes to swim or not. He knows that the fellow who forces him to swim—the fellow who shoots him down—isn't going to swish by and drop him a life belt.

The navy preflight school directors expect the cadet's participation in the nine sports to accomplish five major objectives: to so co-ordinate mind and body that they will be able to serve under the most difficult flight and combat conditions; guarantee the ability to successfully engage in hand-to-hand combat; provide the ability to swim and keep afloat for prolonged periods; develop the ability to run speedily and over long distances under abnormal as well as normal conditions; and inspire the will to win against all odds.

The only three results of such a program directly beneficial to the future pilot from a professional standpoint are: an improved sense of balance; familiarity with the sensations resulting from long periods in an inverted position, and co-ordination of eye, mind and body through swifter synchronization of the faculties.

To make the sense of balance and ability of body co-ordination hyperacute, special emphasis is placed on proficiency in gymnastics and tumbling. The cadets are required to achieve a high degree of skill in maneuvers which enable them to maintain their orientation in relation to the fixed world about them, regardless of the position or motion of their bodies.

Throughout the drills, exact records are kept of the performance of each cadet. Their innumerable laps about the running track, over the obstacle course—always in competition with another cadet—are timed. Their sprints the length of the swimming pool are recorded. Continually competing against an individual, the cadets are divided into platoons, squadrons and battalions. Individual and group champions are determined for each class.

This mind-and-muscle method of developing good pilot material is an innovation in our military program. Whether it pays dividends remains to be seen, for the first preflight-school graduates will not complete their flight instruction and operational training until 1943.


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Model Aircraft Handbook, 300 pgs., 100 illus. By Wm. Winter (Air Trails); Model Airplane Design, 528 pgs., 205 illus. By C. H. Grant (M.A.N.); Aerodynamics for Model Aircraft, 257 pgs. By Abarum Ziev; Building & Flying Model Planes; Youth in Aviation (Program manual for leaders & Contests); Model Airplane Contests (Official rules, etc.); How To Get A Job In Aviation, 96 pgs. By C. F. Matsen (Curtiss-Wright).

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Finer, cleaner, faster, accurate model-work.

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Carved hard-wood fuselage saves 4 to 6 hours' work! (6) BELL AIRCOBRA (17"), $2.50; CURTISS P-40 (16½"), $2.50; RYAN STM-2 (17"), $2.50, (2) BREWSTER-BERMUDA (17½"), $2.50; GLOSTER GAUNTLET (17½"), $2.50; GRUMMAN F3-F2 (15"), $2.50; HAWKER-HURRICANE (17½"), $2.50; N. A. BT-14 (20"), $2.50; BOULTON PAUL DEFIANT (20"), $2.50; SPITFIRE (18"), $2.50; CURTISS HAWK "75" (16"), $2.50, (3) Messerschmitt ME-109 (16"), $2.50; LOCKHEED HUDSON, (16½"), $2.50; (1) STUKA DIVE BOMBER (22½"), $3.00; (4) LOCKHEED P-38 (20"), $3.50 (includes carved booms and fuselage); WESTLAND-WHIRLWIND (22½"), $3.50 (includes carved motor nacelles and fuselage).

STANDARD KITS

Any of above BURKARD KITS in standard form (cut-to-outline shape fuselage instead of carved) available. Each kit—regardless of price—contains cut-to-outline shape wings, rudder, stabilizers. Leading and trailing edges tapered where necessary. Aluminum cowls, where specified. Cement, dope, insignia, wheels, full size plans, celluloid for cockpit, prop material, metal paper for cockpit detail.

Limitless selection of all standard makes. Unless otherwise indicated, solid kits contain "cut-to-outline-shape" bodies, tail and wing surfaces, decals, insignias, full size plans. ¼" scale—30¢. JAPANESE ZERO, RUSSIAN STORMOVIK, LOCKHEED P-38 (Lightning), GRUMMAN WILDCAT, No. AMER. MUSTANG. Also: B-1 SEAPLANE, CURTISS P-40, STUKA DIVE BOMBER, CURTISS DIVE-BOMBER, GLOSTER GAUNTLET and DOUGLAS ATTACK. ⅛" scale—35¢. BOEING P26-A, HAWKER HURRICANE, HAWKER FURY, HAWKER P6-E, CURTISS P-37, SEVERSKY P-35, NO. AMER. BELL P-39, MESSERSCHMITT, SPITFIRE, HEINKEL, DEFIANT, RYAN PT-20. 4 for $1.50 SOLIDS, NO. AMER. APACHE, CURTISS KITTYHAWK, SPITFIRE, GRUMMAN WILDCAT, JAP ZERO (Individually, by mail, 45¢).

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Moulded fuselage, scale model. Metal covered with no detail missing. Rivet-reproduction included IN SCALE! Kit is complete in every respect, including motors, prop, cockpit covering, wheel pants, etc. (by mail, add 25¢ for packing, postage). **$2.75**

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Complete selection of foremost producers: Joe Ott "Identoplanes," Comet Official Identification Models, Megow's "Spotter" Planes.

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Send 3¢ stamp for illustrated listing of hundreds of JACO decals. U. S., United Nations, Enemy Squadron insignia, numerals, etc. Save as you order from this list.

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Super ATOM

A limited quantity remain. No more "for the duration" when these are gone! Lightest Class "A" engine ever perfected, weighs less than 2 ozs. with plug and condenser. Develops highest power-to-weight ratio! 9,500 RPM. .097 cu. in. displacement. Complete with plug and condenser. **15.50**

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Designed for flight with Atom, by America's foremost modellers!

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Simplified monocoque design. Removable nose unit. 33" span. 165 sq. in., 4 ozs. $1.50.

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Wing ribs, tail parts, fuselage sides and bulk heads die cut. Finished prop.

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Miniature of America's best known sky "flivver" detachable wings.

ITSY-BITSY $1.00

Unique design, brilliant flying. "Parasol" polyhedral wing and wheel gear.

Rogers

R. M. 6.5 .... [illegible]
"20" .... [illegible]
"35" .... [illegible]

Popular 'B' Plane Kits

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For Class "B" or "A" events. Strong, rugged. Semi-monocoque fuselage. 42" span. Weighs 18 ozs. (with Ohlsson).

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1st small ship in gas model history. Originally $4.95, 46" span.

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The sensationally successful Leon Shulman 44" span flyer!

CORONET $2.50

One of the large "B" models, deluxe kit 46" wingspan.

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Sleek, trim high-wing flyer. 50" span, 34½" overall length.

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Super-Quaker—6' 4" span, $4.50; PACER "C" (National Champ), $4.95; FLAGSHIP—78" wingspan, $4.95; (DeLuxe FLAGSHIP), $6.95; MERCURY—72" span, $4.95; Playboy, Senior 80" span, $3.95.

GLIDERS

For those modellers who have turned their interest and attention to interesting glider-model work, we suggest one or more of the following: CONDOR $1.00; EAGLET 50¢; JAVELIN, DART or ARROW 25¢; Bard's Glider 39¢. (By mail, postage should be added.)

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9", 10" and 11"

ZIPROPS

8" to 15" each 25c

[illegible] minimum slip. Perfect "aerodynamical" design and guaranteed absolute uniformity, making replacement, if necessary, a matter of seconds with no readjustments necessary.

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POLKS

AND YOU *Can* GET IT!

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50¢ MOVABLE WHEELS AND WINDSHIELD

The busiest little vehicle in Uncle Sam's "mechanized" army—and the most popularized! Makes up into a handsome, super-detailed replica. Kit includes cut to size parts, all necessary hardware, turned wheels with full-size plans and construction pointers. Nothing omitted, not even transparency for windshield! Scale: ½" to foot! (DOUBLE-SIZE JEEP, $1.25)

$1 4 for 1

MOVABLE TURRET ¼" TO ½" SCALE

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The most practical, most convenient car-kit idea ever perfected! Everything to build a complete "O" gauge unit is right in the kit, right in place. Merely add the trucks for your line, and you're ready to go to it! Special bolster for mounting Lionel Trucks included.

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PASSENGER also BOX or REEFER

All parts cut-to-size; Clip-together wood bodies, die cast end sills, formed steps, painted, scribed, lettered sides (visit or write for types available), scale dummy couplers, ice-hatches, brake-wheel, platform, and staff, grab iron (every unit included exactly as specified in easy-to-follow construction plans).

REEFER or BOX CAR $3.75
(Choice 42 Different Sides)

PASSENGER (EITHER TYPE) $3.95
NOTE: Prices do not include trucks

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Airplane Catalog

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IF IT'S ADVERTISED! IF IT'S GOOD! IF STANDARD MAKE!—POLK'S HAS IT!

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SUBURBAN RESIDENCE (No. 601). 6" x 7½ x 6¼. 85¢; FARM BLDG. UNIT (661) Residence, Barn-silo, garage, hennery, residence, set $2.25; R. R. Passenger Station (No. 620) Super-detailed 8¼ x 12 x 5. $1.15; Interlocking Tower (No. 638) 5½ x 6¼ x 6¾. 85¢; COTTAGE (attached garage) 6¾ x 8½ x 6. 85¢; PLATFORM WAITING ROOM (No. 623). 85¢; BACKGROUNDS (No. 700) Mountain (No. 701) Village (No. 702) Farm (No. 703) City. each $1.15.

WATER TOWER (624) 6¾ x 6¾ x 10¼ high. $1.15; BUNGALOW (689) 6½ x 10⅞ x 4½. 85¢; FREIGHT STATION (incl. upper floor room) 8 x 16 x 7¼. $2.25; TANKTOWN (7 bldgs.). $1.00. A complete village (T-300) consisting of combination passenger and freight station, interlocking tower, water-tower, section house, lumber yard, country store and residence! Easy to put together (all parts cut to size).

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BUY WAR STAMPS—BONDS

Stability

(Continued from page 35)

in effect a longitudinal dihedral angle, and the airplane may be longitudinally stable.

Although the dihedral angle is the best and the most usually adopted method of obtaining lateral stability, other methods have been tried with varying degrees of success. If the wings are placed in a high position and the center of gravity in a correspondingly low position, a type of lateral stability of the "pendulum" type is introduced. See Figure 2. This method is apt to lead to the airplane swinging first to one side and then to the other during recovery. As in the case of dihedral, there is a sideslip in the direction of the lowered wing while recovery is taking place, but the low weight is inclined to swing over too far in the other direction, causing the other wing to drop; then a sideslip follows in that direction, and so on. This method is usually adopted in the high wing or parasol type of airplane.

However, something which we must very definitely consider is the amount of projected side area of the airplane. This side area made up of the vertical tail, fuselage, et cetera, will present areas at right angles to any sideslip, therefore there will be considerable pressure upon them which will tend to restore the airplane to an even keel if they are high enough above the center of gravity. The conception of a "center of lateral area" is sometimes used in connection with this action.

The reader will have noticed that, whatever the method of obtaining lateral stability, once the rolling motion is completed and the airplane is flying with one wing low, correction takes place only after a sideslip occurs toward this low wing.

It is this sideslip which affects the directional stability, and that is why we mentioned in Part I that lateral and directional stability are unavoidably tied up together.

Last month we saw what happens when the airplane is deflected to the side in its forward flight; how the turning effect of the pressure behind the center of gravity had to be greater than the turning effect in front of the center of gravity, in order to return the airplane to its original course.

If, on the other hand, the turning effect in front is greater than that behind, the airplane will tend to turn farther off its course. Notice that it is the turning effect, or the moment that matters, and not the actual pressure. Therefore, it is not merely a question of how much side surface is in front of or behind the center of gravity, but also the distance from the center of gravity. For example, a small fin at the end of a long fuselage may be just as effective in producing directional stability as a large fin at the end of a short fuselage.

Now we are in a position to connect these two forms of stability—the sideslip essential to lateral stability causes air pressure on the side areas of the fuselage and provides for directional stability. As explained above, the effect of this pressure will be to turn the nose of the airplane into the relative wind; that is, toward the direction of the sideslip. The airplane will then turn off its original course and in the direction of the lower wing. Then, the effect of the dihedral angle comes properly into play, and we have a very complicated set of forces doing their best to right the airplane.

Just as a slight roll results in a sideslip and then a yawing motion, so a yawing motion by itself will cause one wing to travel faster than the other, obtain more lift, and thus cause a rolling motion. Thus, a *roll causes a yaw*, and a *yaw causes a roll*, and the study of the two cannot be separated. To complicate this problem still further, a pitching motion may sometimes occur in combination with the roll and the yaw, and then we have all three of the stabilities working simultaneously.

The best place to observe all of the phenomena discussed above is in the flight of our model airplane. In a large airplane we have the pilot to apply corrective forces to right the airplane, but in the model the stability must be inherent. It has often been said that the only way a model builder can become familiar with all the stability problems is to build *and fly* as many designs of his own making as possible. So go to it, and learn all about this bugbear—stability.

Bell Airacobra

(Continued from page 35)

hardens. Model wing and tail fillet with plastic wood, then sand to proper shape. Shape propeller hub to fit the pine propeller blades. Now add details, such as gun barrels, exhaust pipes, et cetera. Finish in army olive drab with gray paint on the under surfaces. Trim detail with black paint, then add army insignia to complete your Airacobra.

A U. S. NAVAL BIRDMAN* SAYS:
"I also thought that I would let you know that your models are beyond doubt the finest solid line in existence . . . very realistic and complete . . . the carved fuselage eliminates a lot of mess and makes it possible to make models right in the barracks."
* NAME WITHHELD
The writer (attached to The U. S. Navy Airforce) is on a confidential service mission and governmental regulations prohibit publication of name, station, etc.
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there's NO gift more welcome than a
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CHOICE OF BURKARD SOLID—BAY RIDGE GAS
MOVABLE CONTROLS
Any BURKARD solid can be converted into an extra-interesting 'movable control' demonstrator by hinging rudder & 'flaps' at hinge line!
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RYAN STM2
17" span
Reg. $1.50 DeLuxe $2.50
(Carved Floats $1 add'l.)
BREWSTER BERMUDA
17¼" span
Reg. $1.50 DeLuxe $2.50
GLOSTER GAUNTLET
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GRUMMAN F3F2
15" span
Reg. $1.50 DeLuxe $2.50
HAWKER HURRICANE
17½" span
Reg. $1.50 DeLuxe $2.50
N. A. BT-14
20" span
Reg. $1.50 DeLuxe $2.50
BOULTON PAUL DEFIANT
20" span
Reg. $1.50 DeLuxe $2.50
SPITFIRE
18" span
Reg. $1.50 DeLuxe $2.50
CURTISS HAWK 75
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Reg. $1.50 DeLuxe $2.50
MESSERSCHMITT ME 109
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UP TO 23" WING SPANS
FULL SIZE PLANS
The 'gift-deluxe' that flatters a modeller! Burkard solids are in a class all their own! Reduced to scale size from original plans of the original planes! True in detail, true in silhouette! Regular (standard) kits include 'Cut-to-outline' shape fuselage, wing and tail surfaces (tapered leading and trailing edges) turned wheels, aluminum cowls and nacelles (where specified) insignias, numerals, tail striping, celluloid for pilot's cockpit, foil paper for detail, blanked props, large bottle of cement, base paint, etc.
FULLY CARVED FUSELAGE in DELUXE KITS
FOR LIFETIME MODELS
ONLY Sanding REQUIRED
SAVES 4 to 6 HOURS WORK
The DeLuxe Kits feature a beautifully carved and turned fuselage, eliminating all of the tedious work! Speeds your progress on the project AND assures a handsome finished model! The fuselage is completely carved, planed and trimmed down to shape, including cockpit. Saves you from 4 to 6 hours! DeLuxe kits contain every other item regularly included in standard kits—nothing omitted, nothing changed!
If you plan to camouflage or metallize your model, do it with this popular
CAMOUFLAGE KIT 1.00
The original camouflage unit available to modelers! This complete outfit consists of foil paper (for achieving metal-covered effect) brush, insignia, colors, cement, sandpaper, instructions AND AN INGENIOUS STYLUS FOR RE-CREATING FINISHED RIVET DETAIL. (By mail: Add 15c for packing, postage, etc.)
FIRST GAS MODEL
MIKE
When first introduced, 'MIKE' Kit retailed at $4.95!
A unique, heavy-duty Class 'A' job that has hit 'tops' with fliers from coast to coast. Features a 42" span with plenty of 'thermability'! Easy construction makes it ideal for the beginner! It's a contest-winner!
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In the famous 'GENEROUSLY-FILLED' KIT (less wheels only)
XCLUSIVE FOR THE "Duration!"
Distributors for ALL-GENUINE FACTORY REPLACEMENT PARTS
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The reigning Class 'C' Champion—won it 'the hard way' at the Chicago Nationals! Sal Taibi's greatest achievement! Built in adjustments. Sharp right turn under power, slow left circle in glide! Rides every 'riser', 60" span, 45" long, 4 sq. ft. area, $4.95. Pacer 'B' (the original design) delivers the same championship-calibre flight! 53" span, 37½" length, 492 sq. in. area, $3.95. (Either can be flown with 'B' or 'C' motors.)
(MODELS NOT ILLUSTRATED)
DIAMOND DEMON—For 'A' or 'B' motors. 44" span, 18 oz. flying weight. (postpaid) $1.49
TOPPER 'A'—skyscraper wings, climbs like a rocket! Ideal for larger 'A' or 'B' motors. Includes Streamlite wheels, $3.50
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CONSOLIDATED MODEL ENGINEERING CO.
A Merger of BURKARD - BAY RIDGE - JACKSON'S
DEPT. AT-1
3079 3rd AVE. NEW YORK, N. Y.

Junior CAP

(Continued from page 22)

ing and cadet activities will be centered around the airports so the young recruits will quickly get the feel of aviation. Since the present membership of the senior Patrol has passed the 60,000 mark, it is to be expected that the cadet membership will come in fast and furiously.

The announcement of the CAPC comes right after the formation of the high-school Victory Corps with its Air Service Division, so the immediate question raised in many quarters is, "Where does the CAPC fit into the scheme of things, and will it conflict with the ASD (Air Service Division) of the Victory Corps?"

The distinction between the CAP Cadets and the Air Service Division of the Victory Corps is that the CAPC program is centered around the "airplane," whereas the Victory Corps program is centered around the "boys." In the Victory Corps, except in maintenance work, students will not come in physical contact with full-sized planes, but in the CAPC they will, definitely. Cadets will learn navigation, meteorology, and other aviation subjects at CAP ground schools carried on in conjunction with CAP airports and activities. In addition to the standard ground-school subjects, emphasis will be placed also on military drill, courtesy, and discipline, together with such timely subjects as first aid, gas protection, and code signaling. CAP officials point out that the cadet who goes directly into the armed forces after this training will have a head start in any branch of the service to which he may be assigned.

To better understand the reason behind the CAPC, let us go back to the period when OCD was directed by Mayor Fiorello H. LaGuardia. The idea for an aerial home guard was proposed, and Mayor LaGuardia assigned Thomas H. Beck, president of the Crowell-Collier Publishing Co.; Guy P. Gannett, Portland (Maine) newspaper publisher, and Major Gill Robb Wilson, president of the NAA, to the task of formulating plans.

This trio of aviation leaders recommended that an organization similar to the present CAP be set up; the title "Civil Air Defense Service" was suggested. Whether objections to the name resulted from the abbreviation "CADS," or because it did not meet with the approval of some assistant to the assistant to the assistant administrator is not quite clear. But the idea behind the CADS was the creation of a civil air defense *service*, the term "service" indicating recruiting of pilots for military service, training of personnel, indoctrination of youthful enthusiasts, and so on.

As a matter of fact, this is exactly what the CAP has been doing, and now it is expanding its scope to cover the training of youth in aviation through the Civil Air Patrol Cadets.

So to the Victory Corps and the other junior aviation programs comes the newest—the CAP Cadets, which is one of the most significant and beneficial organizations yet inaugurated.

Air Power Is Important, But—

(Continued from page 19)

have been confirmed or are being confirmed."

The critical approach to Douhet's teachings has certainly been no bar to the USSR's pioneering in air power. It introduced paratroops and glider trains, was ridiculed for it by German military journals, and a few years later was flattered by the Nazi high command's aping of its various unprecedented techniques. Almost a generation ago, combat without aviation became as unthinkable to the Russians as combat without artillery. It was Stalin himself who first defined the bomber plane as a sort of super-range artillery.

Red army experts did not swallow Douhet *in toto* because he preached isolation of the air force from the land and sea weapons and denied the latter's usefulness in modern warfare. Major General Zhuravlev of the Red air force declared in the *Krasnaya Zvezda (Red Star)* of October 11, 1942:

"The basic force in war is the land army. The air force itself is organized in such a manner that it can accomplish its tasks not independently of the land forces, but in co-ordination with them. When Douhet evolved his doctrine, he could not draw upon the experience of war, but arrived at his conclusions only by logical deduction. The experience of the present war has proven in a sufficiently convincing manner that the outcome of campaigns and even of wars depends upon the correct application of all the armed forces and not of any one arm."

And the authoritative General Khripin maintains that victory through air power alone is impossible in global war: for Douhet, dealing with an isolated duel between two hypothetical States, did not realize a situation such as that in which the world finds itself. Khripin cites the Italo-Ethiopian War as an example. Mussolini's air armadas ruled the skies and, in general, had to contend with backward natives sans actual technological defense. Yet it was by no means a lightning campaign.

One-sided mechanistic theories are eventually doomed, despite any period of popularity, remarked Khripin in reference to the ideas propagated in England by General Fuller and Liddell Hart to the effect that small mechanized armies were to take the place of mass armies in future wars. Russian military writers used to refer to such theories as "garage strategy."

One principle emerges clearly from the Soviet treatment of various air-power and other ultra-modern proposals. The ever-progressive and alert strategy of Moscow has steadfastly refused to adopt a gambler's strategic boycott of obvious current realities for the sake of a problematic future. Russia's views hinge on no fanciful military doctrine, but rather on the sage idea that military science must adapt itself to existing weapons, conditions, and opportunities, even while searching for better ones.

One can imagine the pragmatic Russians' asking how, in the midst of world war, can they or the United States or any nation be expected to build its strategy about weapons proposed by super airpower prophets, weapons that are not only unbuilt, but not as yet even designed! There is a world war being fought, and the enemy is effectively wielding land, sea and air weapons of today. Can we afford to dispense with these weapons for the sake of a program which may bring victory in 1950 *if* we survive in the interim? Some years ago a Soviet commentator, A. Lapchinsky, said:

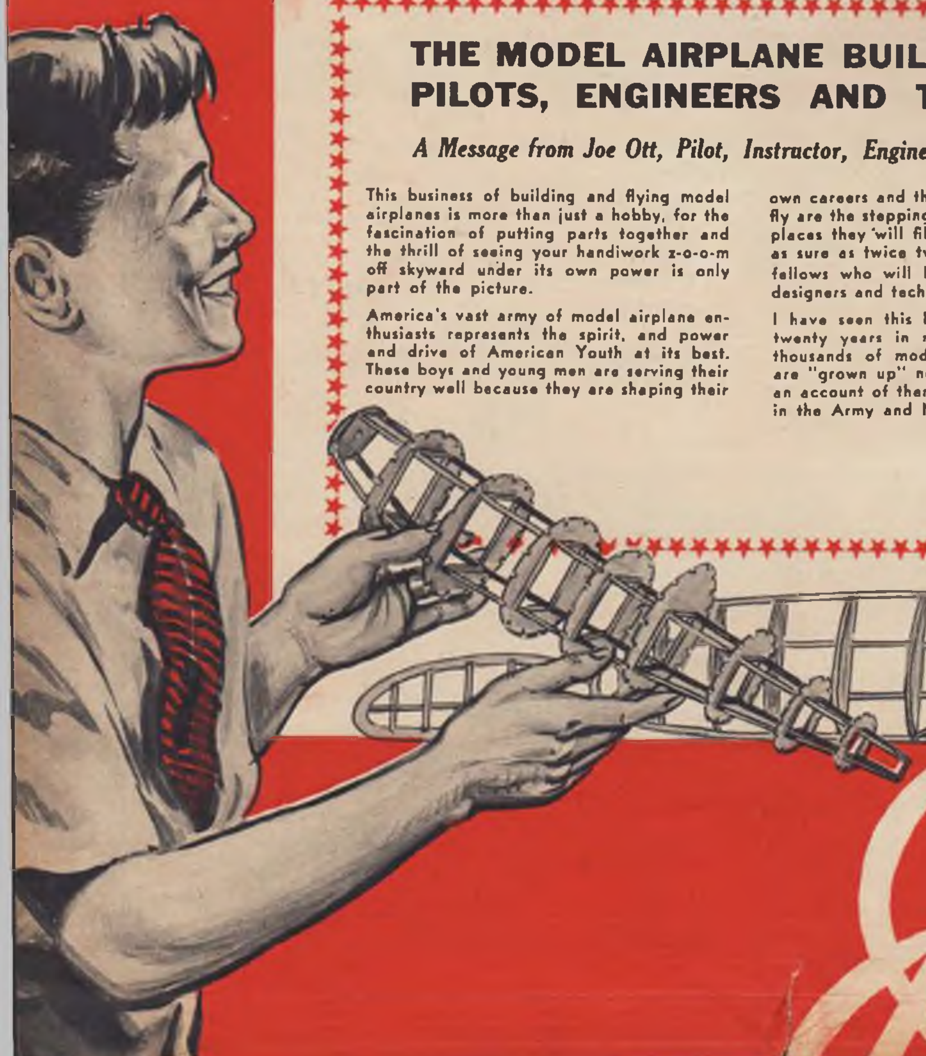
"A decisive moment for us is not the moment of our future conflicts in the air, but the one we are living through now. If the errors are committed precisely at the present moment, they will be as hard to remedy as the errors of the opening period of the war itself. Underestimation of the air forces would be as harmful as unbridled fantasy."

No one can accuse the Soviets of underestimating air power, neither have they closed their eyes to the limitations of aviation. Elementary aeronautics books in Russia inform the student at the beginning that the airplane, though operating in the air, is none the less earthbound. Its landing fields, fuel supplies and servicing crews are on the ground. Furthermore, the combat plane is dangerous only while in the air, being virtually defenseless on the ground. Effectiveness of aviation is directly related to the weather: the take-off itself at times is prevented by mud, and aerial observation, by lack of visibility.

Limited in duration of flight, in range and load capacity, air power by its very nature cannot fulfill the outstanding aim of land warfare—that of possessing and retaining positions—or sea power's mission of maintaining consistent mastery of sea communications. Willy-nilly, the natural home of the human being is on the earth; the law of gravity is inexorable.

Red army leaders never intended to renounce aviation or any other modern weapon. Precisely because they ignored the limitations of any arm, their policy has been to amass the greatest number of all weapons. Such a policy aims to heighten the potentialities of each weapon, both alone and in co-ordination with others. Recently, General Zhuravlev declared:

"The experience of recent battles has also proved that with skillful and stubborn resistance in the air and on land, a numerically superior enemy air force cannot decide the outcome even of separate engagements. Stalingrad is proof of this. In order to break the resistance of the defenders of Stalingrad, the Germans hurled enormous aerial forces against the city. On some days the number of flights of the German air force reached 2,000. The city underwent bombardments which in the aggregate equaled not only the raid of 3,000 planes of which Douhet spoke, but three times 3,000 planes. Yet, this failed to break *(Turn to page 64)*



MODEL

The European Way

(*Continued from page 38*)

and stringer model. Since casein glue takes time to set, the average model builder, anxious to get his model in the air, chooses the simple type of construction. Cross-section rules being different ($1^2/200$), most models are slim and resemble gliders. Dihedral and tail areas are small, as the models are adjusted for straight flight, duration and distance both being considered in determining winners. Noticeably different, too, is the tendency of the European model builder to devise unorthodox types. Flying-wing designs are already old in Germany, and ornithopters, helicopters and rocket models have been flown so successfully that full-size projects have been undertaken. During a pre-1930 visit to Russia, the author witnessed a small contest where he first saw models flown. Cabin models were most in evidence and flew best although, naturally, the flights were crude compared with today's standards.

While retaining our original designs, we can build hardwood models that will fly as well as all-balsa models, although they must be constructed in a slightly different manner. Sheet parts, such as ribs and formers, have to be lightened by cutting away as much as possible without weakening the parts. Longerons and cross braces can be spaced exactly as with balsa, but the cross section should be one quarter the area of the balsa part. For instance, a gas model using ¼" square medium balsa longerons can be duplicated with ⅛" square spruce. For small gussets $1/_{32}$" plywood could be used at every joint possible. The model will be as strong as one of balsa, and it will be more able to withstand shocks due to the inherent flexibility of hardwood.

Only a few major tools are required. A small plane of a good make is necessary for dressing down oversized strips; a jig saw is used for parts cut out of sheet plywood; and a stout knife is needed for carving parts. Waterproof glue is an easily gotten requisite; the author has used a brand named Weldwood, and Casco has, certainly, one similar. Beam scales normally used for weighing parts of indoor models are handy to have.

To obtain satisfactory strength while maintaining low weight, note the hints in the accompanying sketches. By using hollowed-out laminations, lightness can be achieved in the nose block (Figure 1). Note how wooden wheels can be lightened (Figure 2) by using thin side plates and internal spokes. Tail spars are hollowed for lightness and notched to obtain exact rib placement (Figure 3). The ribs can be made in two parts and glued to the spar. Shrinking the covering material will help to keep the assembly rigid. Wing ribs are, naturally, hollowed out (Figure 4). To prevent undue warping, internal spars should be used. Filling the space between spars with bond paper will make the wing more resistant to warping. One good point about most hardwood glues is the lack of shrinkage; if propped and well braced while the glue is setting, a wing will not warp.

All in all, the strength of a hardwood model depends on the modeler's ability to whittle down a part for lightness while retaining a maximum surface area for glue. This is the primary reason for hardwood gussets.

Try Gears For Control

(*Continued from page 30*)

shaft by running a small pin through the spool and shaft and battering flush on both sides. Now drill one very small hole on one end of the spool and another in the middle. The holes should be no larger than the lines to be used. The best line is nylon fishing line; two pieces each three feet long are enough.

Now make a chassis for this assembly, always remembering that smallness makes for less weight. It is made of half-inch strips of any $1/_{16}$" sheet metal, bent and drilled to fit the worm gear and pinion. Mount the chassis on a thick $3/_{16}$" piece of plywood or pine. After the worm gear is mounted, make two oval holes where the lines pass through. To be sure that the lines will not rub, make the holes large enough.

The entire unit should be mounted in the plane so that the back side of the platform is flush with the outside of the fuselage. Make certain that the unit is mounted slightly forward of the center of balance and directly on or a bit below—never above—the center line of gravity. Six or seven pulls of the line around the spool should give about eight inches of pull on each line.

With this unit it isn't necessary to have what is now called "a sensitive touch." After it is installed, regardless of how small a ship, overcontrol will not occur, and the smaller model will be no more sensitive than a five- or six-foot model with a larger control arm.

The Locust

(*Continued from page 39*)

designed for performance and not to be the winner of a beauty contest. Anyhow, no one has conclusively demonstrated that streamlining these models is particularly effective at their present flying speeds. Several of the NACA boys have successfully used square wing tips, so if it's good enough for engineers—well, the plans are self-explanatory, so get busy and try her yourself and you'll agree with us.

Towliners Are In

(Continued from page 26)

dor soarer and 48" Eaglet; and Best-by-Test's practical 44" Super Soarer. If you are partial to designing your own, the procedure is much the same as designing a rubber job. I found that sailplanes with short moment arms are easier to adjust into the tighter spirals, which catch even the smallest of thermals.

When you run out of rubber for your rubber jobs they may be quickly and easily converted into high-flying soarers by simply removing the landing gear and installing a tow hook and a nose block to which clay may be added for balance.

On windy days, unsuitable for free flying, fasten the towline onto the hook and the ship may be flown like a kite. One breezy day we had a 50" Cub scale job flying on a line for several hours. With a free-wheeling propeller for realism, it was almost impossible to tell that it wasn't flying.

Even gas jobs may be converted into towliners. With the ignition and motor removed, an extension for the fuselage may be built onto the fire-wall.

Flying adjustments should be carefully done to secure the last possible inch of altitude. The pullout after the line is dropped should be especially watched. With a bit of practice to get used to the flying characteristics of your ship, it isn't difficult to get it to bank off the line at the very top and float away without any recovery dive. Tight spirals are desired in the glide, since this type of flight will pick up even the smallest risers for a bit of hitchhiking.

Most towliner addicts use about a No. 8 thread for a line, but we have found that good stout kite string does just as well and is certainly easier on the nerves when it comes to disentangling it from the weeds.

All ships should carry a dethermalizer of some sort to prevent loss. Our favorite is the bobbin-of-thread type dreamed up by the Cleveland boys for gas jobs. A small-sized Austin timer is arranged so that its retreating plunger pulls a pin holding in a bobbin of thread, the end of which has been tied to a wing tip. The bobbin drops, unreels, and its weight hanging beneath the wing tip (50 feet of thread is sufficient for a glider) throws the ship into a spin that is guaranteed to bring it out of any thermal—well, almost any. When the bobbin hits the ground the drag is removed from the wing tip and the ship pulls out and lands.

Towliners have been neglected too long in this country, and official AMA records are very low. Contest directors will find towliners the only type of ships flying in a short time, and it would be to their advantage to boost them a little now.

Our gang used to laugh at pictures of Hans and Fritzy German chasing their hardwood sailplanes, but we have long since eaten large portions of humble pie. So pull up a chair, dust off the workbench and get to work—because, brother, towliners are *in!*

What's Your Question?

W. S., Chicago, Ill.—The Koolhoven FK-55 had a wing span of 31 ft. 6 in.; the length of fuselage was 30 ft. 5 in.; gross weight, 5,026 lbs. It was powered by a Loraine Sterna, driving two coaxial propellers. The maximum speed of the ship was 317 m. p. h. The Fokker D-23 had a span of 37 ft. 9 in.; weight, loaded, 6,600 lbs.; the power was supplied in a later model by two Isotta-Fraschini Delta V-12 engines of 750 h. p. each. The D-23 had a top speed of 341 m. p. h. at operational altitude. The Nieuport 161 had a wing span of 36 ft.; length, 31 ft. 4 in.; weighed 5,012 lbs. fully loaded. Powered by a Hispano-Suiza 12 crs. engine, it had a top speed of 247 m. p. h. Sorry, we have no information regarding the Fokker C. X. Previous to German occupation, Denmark's army air force consisted of: two single-seater fighter flights, three squadrons of reconnaissance planes, and one balloon group. The naval air force strength was: one squadron of fighters, one squadron reconnaissance seaplanes and one flight of torpedo bombers. Airplanes used by the Danish air arm were mostly: Bristol Bulldogs, Gloster Gauntlets, Hawker Dantorp torpedo bombers; Dutch Fokker D-21 fighters and C-V reconnaissance ships; German Heinkel He-8 seaplanes, and FM-1 (Dornier Wal flying boats). The Belgian air force consisted of: four army co-operation groups, three fighter groups, one night group, one balloon company, and four schools of military aeronautics, consisting of two primary training groups and two advanced. Aircraft used by the Belgian air force were: fighters—Fairey Firefly and Fox, Gloster Gladiator, and Hawker Hurricane; army co-operation—Fairey Fox, Breguet XIX and Renard R-31; bombardment—Fokker F VII and Fairey Battle; training and communications—Morane 230 h. p. Salmson engine, Avro 504N and Stampe-Vertangen RSV.

B. S., Detroit, Mich.—The Airacobra's engine is located in the rear, immediately behind the pilot's cockpit. The white streams which issue from an airplane flying at high altitude are caused by condensation, due to the rapid expansion of the air created by the speedy passage of a plane through it. The condensed air becomes visible in the form of a trail of fog or vapor. The largest plane ever built is the Douglas B-19, which has a wing span of 212 feet and weighs over 80 tons fully loaded.

H. R., San Francisco, Cal.—The Vought-Sikorsky Corsair F4U-1 is in active service with the navy. Sorry, but even we are confused as to what fighter or bomber is the fastest, with all the recent polemics on the relative performance of military aircraft, we are not going to stick our necks out.

P. G., Chicago, Ill.—Sorry, but all information on performance of first-line military aircraft is restricted. Carrier aircraft coming in for a deck landing do not cut their engines until they have landed. For information regarding joining the navy, inquire at your local recruiting station.

R. S., Pontiac, Mich.—The word "liaison" as applied to the light planes in the army means: link or co-ordination. The duties of liaison service are to co-ordinate between land forces by carrying messages, spotting, transporting personnel from one point to another, and to serve wherever operation of larger and faster aircraft would not be feasible.

J. O., Southington, Conn.—Sorry, we do not know where you can get plans for a hang-glider. Try writing to the Soaring Society of America, 949 East 29th St., Brooklyn, N. Y.

L. S., New York, N. Y.—The red band on the fuselage of the A20-A and B-25 is a warning to prevent the crew from inadvertently stepping into the rotating propeller blades. The P-40F is armed with six machine guns.

G. S., Fort Mead, Md.—In order to join our Solo Club, you must present proof of having flown solo either a power plane or glider.

G. B., Chicago, Ill.—We are afraid that you are mistaken. The latest Vought-Sikorsky Corsair is the model F4U-2 and not SB2U-1. The old Corsair was a scout bomber and observation biplane. The new F4U-2 was named in its honor.

C. L. B., Chicago, Ill.—What is meant by the bombardier taking over during a bombing run is that he directs the pilot by intercommunicating phone how to make the run, whether to steer a little more to the right or left, et cetera. The bombardier himself does not fly the plane. Heinkel is pronounced with a broad I. The ship circled in your clipping is an old Curtiss Hawk navy fighter.

J. M., Roach, Mo.—The Monocoupe 90-A has a one-piece side-by-side seat, stick control, the doors are on both sides, the baggage compartment is in the rear behind the seat and is accessible only from the cabin. The engine is a radial five cylinder air-cooled Lambert; fuselage and tail surfaces are of welded tubing construction; wing is of wood. The whole ship is fabric covered. Gas capacity is 98 gallons. Sorry, we do not know where you can get drawings of the engine. For plans of the ship, try writing to Aircraft Plans, 307 Fifth Ave., New York City.

What's Wrong With The Rules

(Continued from page 25)

Interference with aircraft spotting, wartime shortages of material and lack of new motors have spread around the feeling that there's something better in life than catching a thermal and losing a precious engine. That's not enough. We'd like to see models hang around a little longer. Give us more of a chance to appreciate its flight before it dashes off into the sky where only 20-10 eyes can pick it up.

Contest rules show no more imagination than the type of model they breed. They reached a sad state in 1942 when hand launching was legalized and the minimum cross-section rule was discarded for gas models. Who bothered any longer with the ability to take off on a landing gear of sound design? Into the ash can went one of the basic requirements for any type of airplane. Landing gears were meant for purposes other than looking pretty. Design has been pitiful enough without having shaved off the integral design requirement of the ability to take off and land. It's true that rule-making bodies have, in the past, included evangelists who shouted "Hallelujah, brother!" when deletion of landing gears was suggested. AMA conventions have been plagued with those who should have known better when they objected to landing gears because take-offs were difficult against the wind or because the weeds in the Eighty-ninth Street baseball lot snagged the wheels. One would, of course, never expect some contest directors to think of turning a runway into the wind or perhaps cutting the weeds.

Eliminating the minimum cross-section rule was encouraged by the naive expectation that the boys would plunge gayly into the development of the flying wing and other original designs that were so sadly missing. So instead of new talent we have the same old stuff dished up with a "broomstick" fuselage. What model builder will spend time engineering a fuselage if he can fasten wings and an engine on a stick and walk away with first prize? Figuring cross-section areas was too much for the contest management to cope with. At every weighing-in table, unimaginative processors practically came to blows with contestants about where the fuselage ended and the pylon began. Raoul Hoffman devised a beauty of a method for the last Nationals. All contestants traced their required cross-section templates on a cardboard with known weight per square inch. Then Hoffman's men simply weighed the cross sections! Of course, contest directors at Bailey's Turnpike (pop. 2,401) won't have elaborate equipment. Still, we've heard of a little thing called ingenuity.

Encouraged by a catapult hand-launching with no fuselage to hinder it, the model has an even better chance of flying away. Such liberties of design are allowed in rules supposed to prohibit long flights. The next part of this rat race is to make dethermalizers compulsory, shorten the engine run and lower the limit on flight time. Carefully avoided is any rule which might cut into the reservoir of excess horsepower that is directly responsible for the model's flying away.

Why do we grumble? Because contest designs have always been what chiefly attracted us. In the early '30s we had something; but the last few years, as we looked on as an interested spectator, we've been convinced that contest rules are going nowhere with rapidity. The average builder thinks so, too. Perhaps he may never fly in a contest; but he's still a victim of our misguided contest designs. Most manufacturers usually select winning models for their kits; worse yet, they employ the designers themselves. Out flows a stream of routine kits; hardly anything else is for sale. Mr. Average Builder is up a decayed tree.

We remember when Al Lewis used to remind the experts, as they stirred their devils' brew of left-handed rules, that such-and-such a proposal would stifle progress. What happened last year we can't explain. The rule-makers evidently thought that we had to do something about the war; that's certainly all right with us. But, while flight-time limitations to discourage a daredevil modeler from flying his gas job to Africa are good, the cross-section and hand-launch business is a bitter pill to swallow. Along with the scarcity of sugar and coffee, we are fostering a scarcity of models by stepping up their performance instead of cutting it down with *all* the means at our disposal. Less power and a cross-section rule would start a trend toward realistic designs that would be less likely to lose themselves and would certainly avoid the present appalling frequency of smash-ups. Progress *is* being stifled. It does require a mental effort, some understanding of aerodynamics and personal ingenuity to build a model with an honest-to-gosh fuselage and a semiscale appearance. Such models serve a practical purpose and they're educational. Beginners can build them just as easily when they are in kits. But, brother, if the experts had their way, you would see kits with a pole for the body and a prop for a landing gear.

This isn't a campaign for flying scale models. They are an interesting and worth-while phase of the hobby. But even better is the model which ties together the qualities of the scale and contest type. Let's have more realism. Design them like airplanes, build and fly them like airplanes.

This magazine has never lobbied for specific rules; we feel that the contestant suffers when any magazine uses its power to champion an imperfect rule. But, having been contestants ourselves, we're adding our voice to the howl against the new rules on cross sections and hand launching. If you don't like them either, write the Gas Model Committee, Academy of Model Aeronautics, 1025 Connecticut Ave., N. W., Washington, D. C.

Air Youth News

(Continued from page 24)

time America went to war, the information on Jap aircraft was a bit sketchy. Plenty of Jap ships have been shot down or captured by Americans since then and the data have been completed.

The navy is continuing to award honorary ratings to participants in the program who turn out a certain number of specified models. Many schools and model clubs have established miniature production lines similar to the Minneapolis-St. Paul workshops, which were set up by Academy of Model Aeronautics officials. These production centers were operated night and day by twin-city modelers who turned out hundreds of Grade A models.

One of the biggest contests in the vicinity of the nation's capital was held recently under the sponsorship of the Women's Auxiliary of Air Youth and the (D. C.) Association of Model Airplane Clubs. The meet was a triple-threat affair from start to finish, climaxed by a national broadcast.

Top-place man in the competition was Dick Everett of Langley Field, Va., and the NACA research labs. Everybody was on hand to witness the proceedings, including such notables as Federal Security Administrator and Mrs. Paul V. McNutt; Senators Radcliffe (of Maryland), Pepper (of Florida), and Connally (of Texas); Congresswoman Rogers (of Massachusetts); Merrill Meigs of the WPB aircraft board; Sir Richard Fairey, director-general of the British Air Commission; and scores more.

It certainly was a whiz-bang affair with plenty doing all the time. Not least important was the fact that many government leaders had their first glimpse of aeromodeling. Full credit for organizing the meet goes to Mrs. Clarence Norton Goodwin of Washington, D. C., chairman of the Women's Auxiliary of the NAA Air Youth Division.

The NAA Academy of Model Aeronautics now recognizes control-model flying. Of course, it has been cognizant of it right along, encouraging contest directors to include such events even if they couldn't be sanctioned.

Now, however, the AMA will issue experimental control-model flier licenses to anyone holding a regular gas license for a ten-cent handling and postage fee. Licensed models will be designated by regular AMA decal numbers followed by the letter "C." The decals will be available in 1½, 2½ or 4-inch sizes.

Unique feature about the whole set-up is that each holder of a control-model license will have an opportunity to have his or her say as to what the official control rules will be. In the meantime, to secure an experimental permit, gasoleers must pledge to fly their controlliner in a "safe and sane" manner.

In response to a great many requests, the Academy is now issuing license numbers to holders of its rubber-model flying license. Some of the exclusively rubber-model clubs put the heat on headquarters to do this. The idea has been in the minds of NAA officials for quite some time, so the repeated requests came at just the right time to turn the trick.

Rubber modelers will apply regular AMA license numbers to the wings of their craft, and add the letter "R" to indicate that the model is propelled by other than internal-combustion engine power.

Through the generosity of the Model Industry Association, the AMA is now making available for presentation to winners in sanctioned contests sets of distinctive medals. Each set comprises a first (gold), second (silver), and third (bronze) place medal. The medal bears the insignia of the Academy in relief on a blue background. The designation "M. I. A. Award" is on the back of each medal.

With its colorful ribbon, the MIA medal is something to be treasured by any contest flier. Full information on how to obtain these awards may be secured from AMA headquarters by any official contest director.

Of added interest to meet managers and contestants is the offer of William L. Effinger, Jr., president of Berkeley Models, to present war bonds to winners of Academy-sanctioned meets. Already a number of $25 and $50 war bonds have been given out. Details of the Berkeley gift may also be secured from AMA headquarters, 1025 Connecticut Ave., N. W., Washington, D. C.

Air Power Is Important, But—

(Continued from page 57)

the defense of Stalingrad or to determine the issue of engagements even in so limited a sector of the front.

"It is high time to discard these retrograde theories which have long outlived themselves and have been refuted by the experience of the present war. Victory over the common enemy can be achieved only by powerful blows of all of a nation's armed forces on land, in the air, and on the sea."

The day after the above appeared in the *Krasnaya Zvezda*, our commander-in-chief, in his Columbus Day address, spoke contemptuously of "typewriter strategists.' For, regardless of the word winds which blow hot and cold from books, lecture platforms and newspaper columns, this is a war which will be fought and won by the play of experienced leaders engaged in actual, not theoretical warfare.

Pusher Fighter

(Continued from page 41)

prone position. The pilot can lie down in the entirely transparent nose surrounded by his guns, each within easy reach in case of a jam. If the prone position proves undesirable, the pilot can sit upright in the nose of this ship. Both these positions will do away with the conventional cockpit inclosure with its added parasite, drag.

The greatest problem to overcome in a design of this type is that of the location of the landing gear. Since the propeller is in the rear, the tail has to be supported well above the ground. This situation can be solved by using a strong, thick stabilizer, with the two wheels of a tricycle retractable landing gear pivoted at the ends. The wheels would swing inward to the stabilizer when retracting. The single wheel would take most of the load and would be located at about the leading edge of the wing.

The model itself has been built along conventional lines with the purpose of looking realistic, yet still embodying those qualities that are necessary in a good flyer. It employs a simple but foolproof mechanism that retracts the single wheel easily and positively. By examining the drawings you can see that when the wheel is in the "out" position, the rubber strip has slipped down near the pivot point and therefore has only a small pulling effect. This means that only a very slight weight is required to keep the wheel "out." Upon takeoff, as the wheel swings up, the rubber slides up along the lever arm to the top, where the greatest pulling effect occurs. Thus the wheel is firmly held in the "up" position. (See positions 1-2-3 on plans.)

The actual construction of the model is simple. The fuselage consists of a basic square cross section of $^{3}/_{32}''$ square balsa with $^{1}/_{16} \times ^{1}/_{4}''$ main stringers on top and sides, $^{1}/_{16} \times ^{3}/_{8}''$ on bottom, and with $^{1}/_{16}''$ stringers spaced as shown. The procedure to follow is: First construct the two sides of the rectangle as indicated by shading on the side-view plan. Since the cross section is square, cut all four cross braces at once directly over the side view.

The wing and tail are similar in construction, with $^{1}/_{32}''$ ribs, $^{5}/_{16} \times ^{3}/_{32}''$ trailing edge, and $^{3}/_{32}''$ square leading edges. The wing spars are $^{3}/_{32}''$ square, while the stabilizer spars are $^{1}/_{16}''$ square. The wing tips are cut from $^{1}/_{16}''$ sheet balsa and are carefully made to blend into the leading and trailing edges. The two rudders are made of $^{1}/_{16}''$ sheet balsa, and are first covered with tissue before being glued to the stabilizer.

To assemble the parts, first fasten the landing-gear mechanism to the fuselage as shown. Note the cutaway bottom stringer, braced on both sides. Be sure to install the hook and rubber band for retracting the landing gear before covering the fuselage. The portion of the fuselage where the wing passes through should be filled in with $^{1}/_{32}''$ sheet. While

FATHER OF THE FIGHTER

By KEITH AYLING

see next month's

AIR TRAILS PICTORIAL

these parts are drying, cover the stabilizer with tissue and spray with water. When it is dry, give it one coat of clear dope. Glue the stabilizer in place at the end of the fuselage. Now completely cover the fuselage with tissue, including the $^1/_{32}''$ sheet around the cockpit and wing, and treat tissue in same manner as on stabilizer. A minimum of two inches is required for dihedral in the wing.

Make sure you carve a left-handed propeller with the spinner pointed to the rear. As can be seen on the prop hub detail, a Jasco free-wheeler was used.

Lead ballast added to the nose plug will get the model to balance correctly at the wingtips. When the model is flying fairly smoothly at about fifty winds, the number of turns can be increased gradually until faults are worked out. The best flight obtained on a cold winter day was one minute and fifteen seconds. Better weather should produce better flights.

Whirlwind

(Continued from page 32)

edges in place. Be sure that the ribs have been hollowed out before assembling.

The stabilizer is built in the same manner, with the exception of the movable elevator. Trim the leading edge of the elevator to a "V" so that it can be hinged up and down when up against the rear stabilizer spar. A silk or tissue hinge occupies the span of the entire stabilizer. Before assembling this hinge, be sure that the elevator horn is cemented in place. The tail lever, bell crank, and control arm are connected next.

The nacelles are now assembled as per the sketch and plan. The "crutch" is assembled first, notched for the motor bearers, and the upper portion added. Formers and stringers are next. The portion over the engine is removable for adjustments and repair. Plank it with $1/8''$ sheet for strength, as it will be handled often. Due to slight wing dihedral a $^3/_{32}''$ slat must be inserted between the nacelle and wing on the outboard side, to keep the nacelles level after assembly. Use plenty of cement at the wing-to-nacelle joint. Two-ply bristol board fillet RF, cemented to wing and R-1, simplifies fairing at that point. Assemble landing gear and cement all joints well. Do not simplify the landing gear, as the "elbows" have been incorporated to absorb landing shocks. Both longitudinal and vertical shocks are absorbed.

A pair of spinners are now assembled. Note sketch. Cement disk to rear face of prop, add parts PS-1 and PS-2, and add front disk. Planking is now applied around perimeter of spinner, topped off with a nose piece, sanded to blend with the rest of the spinner. Three or four prop-spinner assemblies will offset breakages on test flights.

The ignition system is soldered up, following the circuit shown. With two Atom engines, the author found that the proper balance was attained by mounting coils and batteries to the front of former R. This was a planked-type model.

A sliding canopy is included in this model's design, and is worth while. Assemble headrest first, then cement WS-4 and WS-5 in place, line up, and cover with sheet celluloid. The sliding canopy is assembled by cementing a rectangular piece of celluloid between two WS-3 formers. A sharp bend is needed in the bottom ends of WS-3 in order to slide correctly over the $^1/_{32}$ x $1/8''$ guide rails. Although hard to do with steel wire, it is easily done if the part is heated over a match and allowed to cool gradually. This softens the metal and allows the small radius bend to be made. To regain the temper, heat again, but dip in water to cool it suddenly. WS-1 is best made of .050" or .063" celluloid so that it remains flat. Neat workmanship will pay dividends.

In order to do the coloring properly a spray gun should be used. To obtain authentic shades, refer to the cover of the October, 1941, Air Trails Pictorial. Remember to mask off the proper areas before spraying, and to thin out the dope enough to obtain a fine spray. The vertical bands on the rudder are $3/4''$ wide and $23/4''$ high. The fuselage insignia is $2^{13}/_{16}''$ diam., including the yellow ring; wing insignia 3" and 4" diam., top and bottom, respectively, $4^3/_8''$ outboard of rib #9. Spinners are white, as is the 2" wide band around the fuselage. Props and cannon are dull black. The letters P7110, $1/2''$ high, may be included on the fuselage in front of the white band.

Automatic Controlliner

(Continued from page 28)

and rudder move so that the ship banks and turns from the operator. By adjusting the spring tension on the triangle, the correct amount of pull can be had even at 100 m. p. h.

For building the controller, select the best grade of plywood possible. Drill the holes so that the bolts fit snugly. Place enough washers between the tiller and triangle and between the triangle and mounting block to get free, unbinding movement of tiller and triangle; they must work smoothly and evenly or the aileron and rudder wires will bind against the mechanism. Instead of tying fishline or cord to the tiller, use piano wire; it eliminates tearing the fuselage apart to inspect fraying line inside.

The entire device can be installed into any of the control-line jobs on the market with very little trouble. The only change necessary would be to build in movable ailerons and rudder.

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Demonstrator

(Continued from page 23)

of alignment when in operation, and the valve stems are made to be a sliding fit in the valve rod guides. The same applies to the push rods and push-rod guides. An adjusting screw and nut is tapped on top of the push rods for clearance adjustment.

The exhaust and inlet cams are tapped for the threaded portion on the 3/8" shaft. The rocker-arm assembly is all steel and requires some hacksaw and file work. Pins are 1/16" round rivets.

The timing gears are the most expensive parts to secure and are specified as follows: crankshaft gear, 2½" pitch diameter, 3/8" hole, one required; camshaft gears, 5" pitch diameter, 3/8" hole, two required. Teeth may be of any size as long as they mesh correctly, and can be cut on a fret saw from a piece of plywood.

As an alternative, sprockets and a chain could be used, but this requires an idler to keep a uniform tension on the chain. In any case, the cam sprockets have twice the number of teeth the crank sprocket has. When all the parts are made, the cylinder section is ready to be fitted to the back and nailed, the piston slid into position and the guides or inserts glued or nailed where shown on plan.

The other parts are assembled and valve seats cut in cylinder head to fit valves. Screw an old spark plug into the insert. Paint main section outside of the 1/16" black enamel line with aluminum paint, and inside the black line a dark-red enamel. Coat piston, cams, valves and connecting rod with aluminum paint.

As an added feature, an indicator card could be tacked on with a revolving arm that is driven off a camshaft at the same speed. (See plan.) A pencell light shows through a hole behind the spark-plug points which flashes at the firing position when the arm makes a contact with the connection at the top of the indicator card.

The timing of the engine after completion can be set by anyone familiar with gasoline engines. The cycle of operation takes two revolutions to complete the four cycles.

When you have completed the engine model, set it up on a table and by working it with the handle from the back, demonstrate the four strokes of the piston necessary to turn the crankshaft of an engine, thereby causing a revolution of the propeller.

February Centerspread

in full color

LOCKHEED LIGHTNING P-38

Three-Views Come To Life

(Continued from page 21)

the picture plane, heights can be measured on its vertical in the same scale as used for the top view. *All* heights, including airfoil thicknesses, *must* be referred to this line. Once point "a" is fixed, the drawing proper can be started. The bottom line "bc" of the rectangle for the fuselage profile is drawn by laying a straightedge in line with point "a" and vanishing point 2. Its length is fixed by where it crosses the verticals from "b" and "c." The height is fixed by the scale at "a" as shown. The rectangle "eedd" which establishes the wing span and tip height is found in the same way by using vanishing point 1.

Once these rectangles have been worked out, other lines may be fixed with less work. For example: a line through wing tip "g" from vanishing point 2 gives "fg." The nearer tip at "d" is similarly found, but the lines are omitted here to avoid crowding. All other points may now be found by continuing in the same way.

Figure 2 shows how the same process works when the eye level is placed below the object. Except for this, all construction is identical, the low eye level giving the effect of seeing the ship from the ground.

With the basic straight lines defined, the next step, shown in Figure 3, is to set the height of each of the fuselage sections and their positions along the center line. When this has been done, the profile of the fuselage—that is, the perspective of the way the fuselage appears in the side view—may be drawn in as shown. Next, rectangles are drawn on the wings at the various positions of the airfoil sections given in the three-view, and the airfoil curves may then be drawn in the same way as the fuselage profile, using these rectangles as guides. Next, another set of rectangles are drawn and used as guides for the vertical sections of the nacelles. Care should be taken that these are in the correct positions. In some types, notably the B-24 of the diagrams, these are set below or above the wing centers, and it is easy to make serious errors. Finally the vertical sections of tailplane and fins are drawn

In Figure 4 the fuselage cross sections are completed by first drawing rectangles having the maximum width of each section, and the heights already worked out in Figure 3. These rectangles make it easy to draw the cross sections accurately. The center wing section may also be drawn at this time if desired.

Next, the "bite" that the wing takes out of the vertical section of the nacelle is worked out. This must be done with care, as it governs the line of intersection of nacelle and wing. The circular joints of the cowling are also drawn at this time.

Finally the vertical and horizontal cross sections of the tailfins are drawn. These are more important than they seem. It is common in drawing airplanes to show the joints of the rudder and the stripes as though they were perfectly straight. While this might look neat, the aircraft wouldn't fly very well.

In Figure 5, the actual outline is drawn like a tight skin over the longitudinal and transverse sections constructed in the previous stages. Using the skeleton already drawn as guide, the windows, bombardier's compartment, pilot's cabin, et cetera, may easily be drawn. It is often helpful to draw in one or two extra cross sections as a guide where these happen to be very tricky. The rudder joints and the stabilizers and ailerons may also be easily worked out, using the same sections as guides. The hub, and the circles showing the propeller swing, should give no trouble to anyone used to ordinary perspective drawing.

The last stage, shown in Figure 6, consists simply of getting rid of the various construction lines of the drawing process. In actual drafting practice, some of these would be left

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MODEL AIRPLANE KITS, MOTORS and SUPPLIES

MISCELLANEOUS

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.

in as guides to internal construction.

In conducting this problem, plenty of time was allowed for its execution, as it was realized that it was far more important for the students to cultivate a habit of care and precision than to finish quickly without attention to structural soundness.

At the same time we had to bear in mind that the making of a *picture* is the art student's primary objective. After each outline drawing was finished, it was used to make an illustration. Complete freedom was given the students in choosing their manner of work. Water color was the favorite medium, sometimes used alone, or combined with tempera and air brush. Since so much work had gone into making the preliminary drawings, the students were careful to give their best work to the finishing, making a real effort to get colorful and interesting background material and to work out sound compositions.

In the department of Industrial Design, the students have, as a normal part of their course, a rigorous training in mechanical drafting under an experienced draftsman and designer. During the past few years he has laid much stress on the growing use of perspective explosion drawings, used to explain the workings of mechanisms to the layman.

The usefulness of these problems and methods of teaching is attested by the fact that we now have graduates, and some undergraduates, working in at least six of the major aircraft companies.

There is an opportunity here for every art school to contribute toward the progress of aircraft production without in any way sacrificing the purpose for which it is organized.

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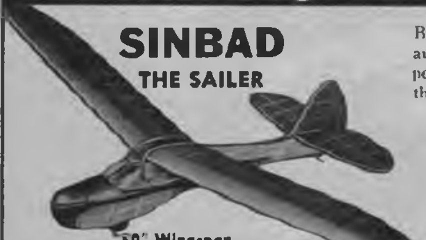

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