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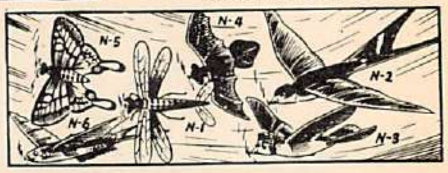

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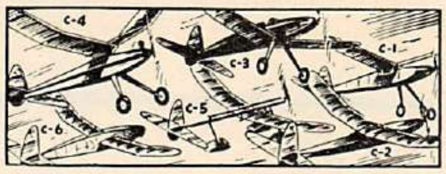

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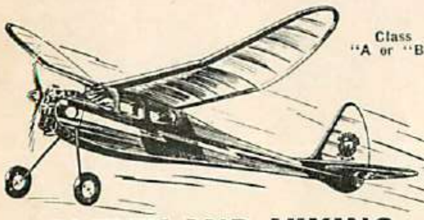

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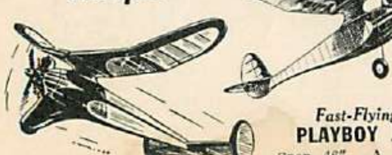

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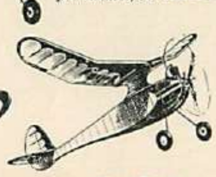

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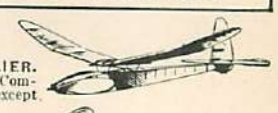

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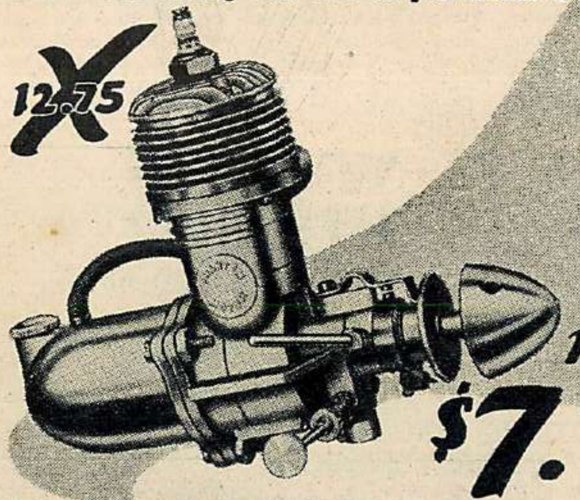

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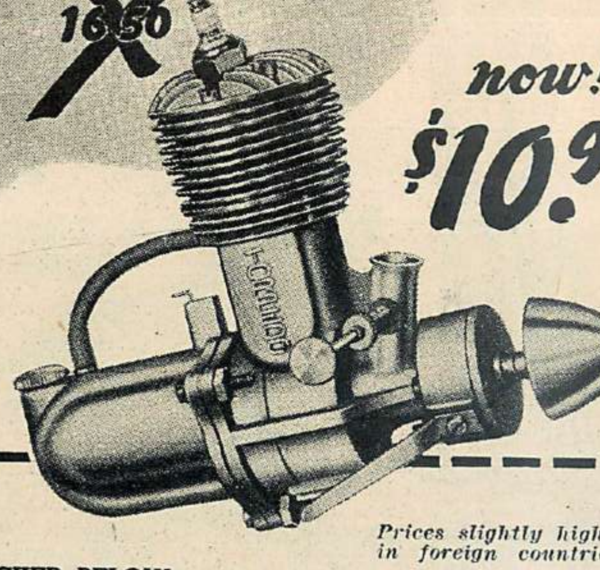

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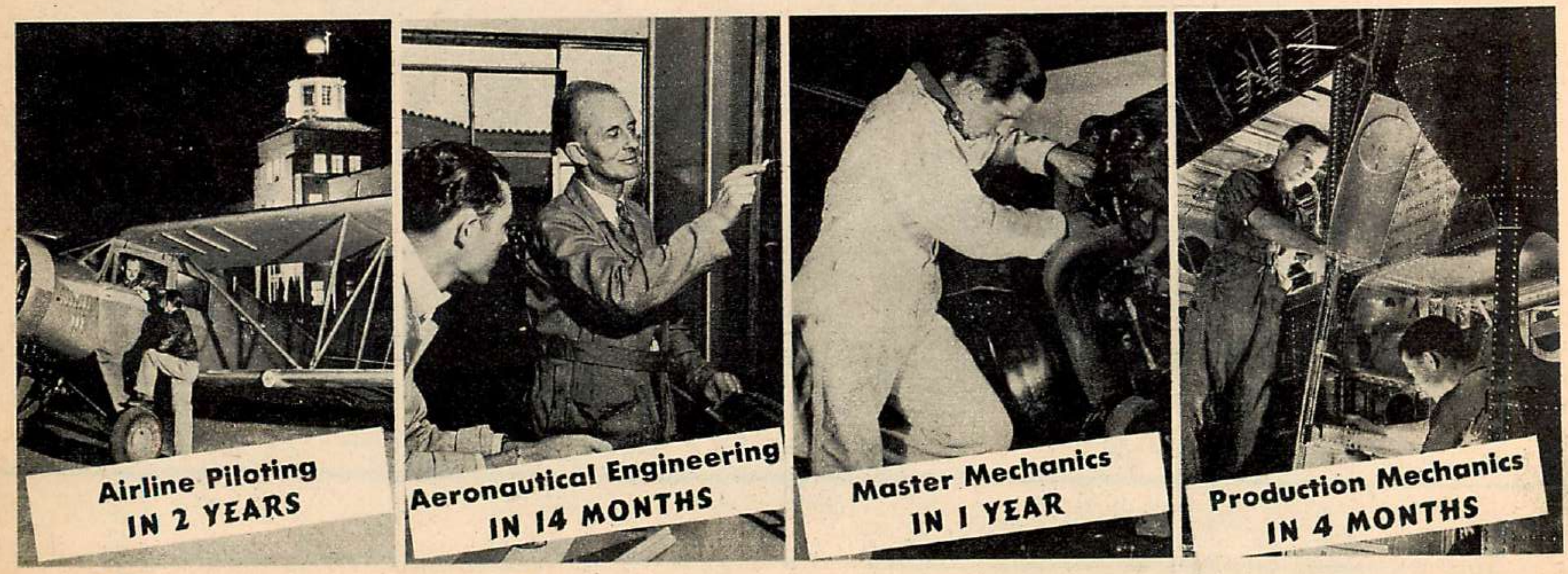

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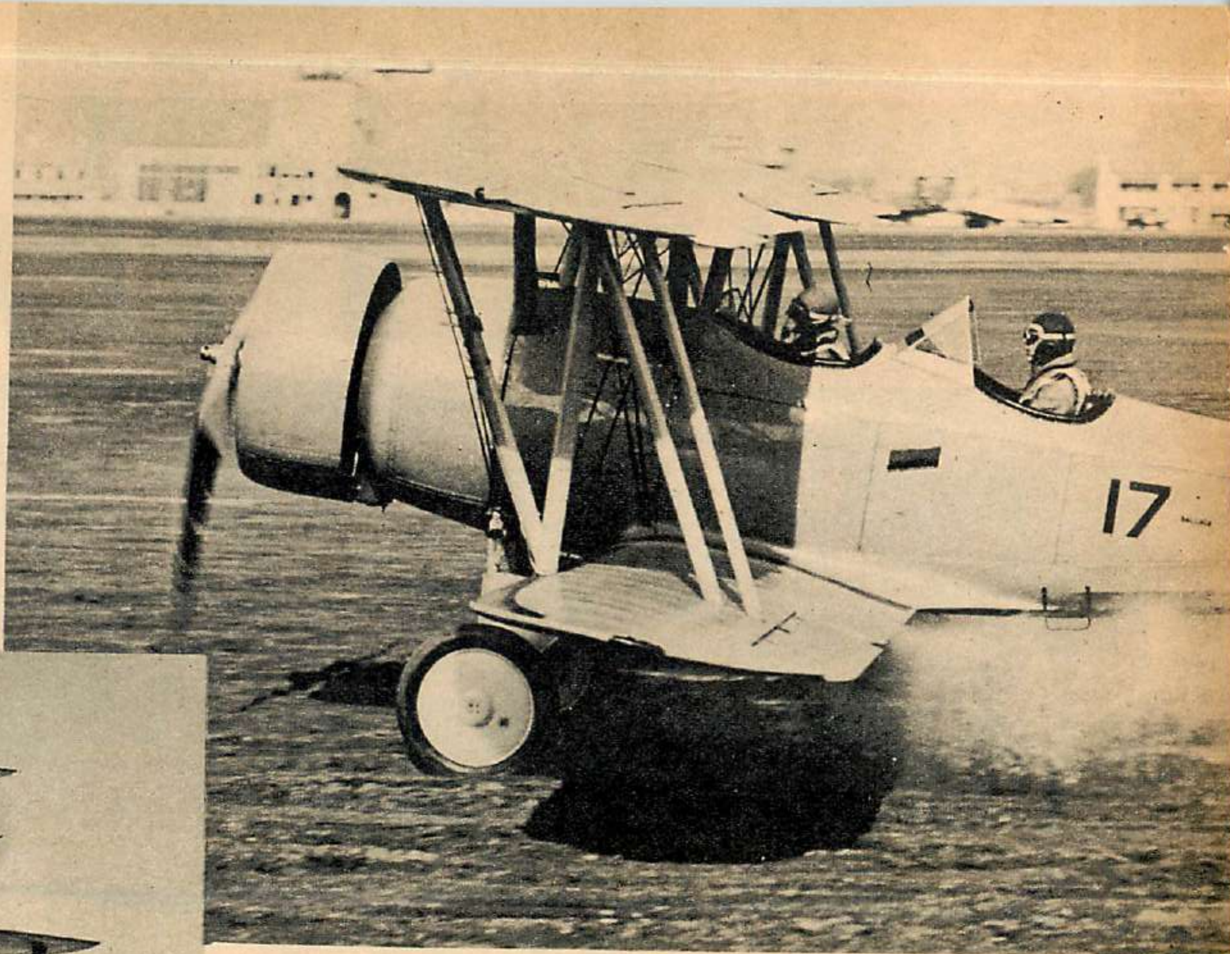
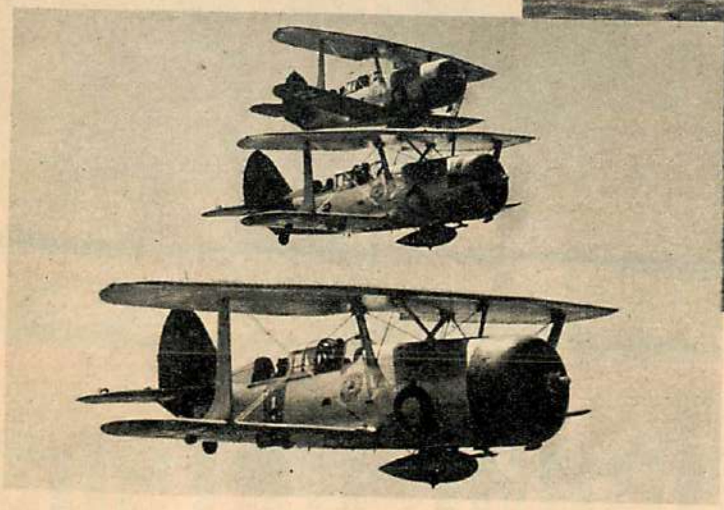
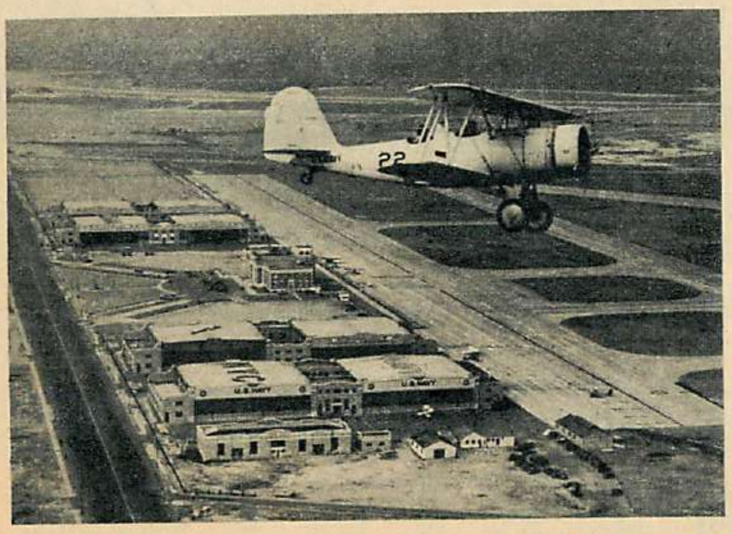


Big moment! The reserve pilot takes off in standard trainer, the reliable N3N-1.

Below—From N3N-1 to SBC-4s is a long jump, but they're goal of all cadets.



Author's home port. Three instructors at the Grosse Ile, Mich., Naval Reserve Aviation Base fly formation for edification of student group.



In the East the U. S. Naval Reserve Base at Floyd Bennett Field is important as a "pilot mill." Below in foreground are Reserve hangars.

NAVY PILOT

Our naval reserve bases will "grind out" 1600 pilots per month. Here's a start-to-finish picture of the training Mr. Civilian will get.

FANTASTIC, absurd—that's how it struck anyone familiar with existing training facilities. "Navy to Train 1,600 Pilots a Month," the headlines screamed when Secretary of the Navy Knox warned that we are confronted with "the most grave crisis we have ever faced in our history." To meet this crisis three new naval reserve aviation bases were planned. The nation had finally awakened to the cruel realization that it needed pilots—thousands of them—not tomorrow, but immediately. Where were those additional pilots to come from?

Few of us knew that during the four years from 1936 to 1939 the navy's aviation cadet program had turned out only 775 pilots. How could the navy hope to turn out 1,600 pilots in one month, when it had gained less than that number in four years? Where were the planes, instructors, fields, mechanics, hangars, overhaul shops and station keepers to be found?

Very fortunately, there had come from the navy in 1919 a number of reserve aviators who had clung grimly to the idea that the naval reserve would be of value in some future emergency. Through the lean and barren years of the depression, they had squeezed small appropriations from Congress to maintain the thirteen naval reserve aviation bases that Congress had set up by the Act of 1925, located near major centers such as Boston, Philadelphia, New York, Washington, Miami, Detroit, Chicago, St. Louis, Kansas City, Minneapolis, Los Angeles, San Francisco and Seattle.

In the last few years, the naval reserve base (NRAB) has become what business men call a "going concern," set up, operating, and actually doing business. That fact alone is what may save the time that is now so precious, the fact that the NRAB is already operating and merely has to be expanded. Where ten students a

Watchful waiting. These U. S. N. R. cadets patiently await their turn at the N3N-I trainers. Note their deflated rubber life vests.

MILL

BY JOHN R. HOYT

month went through, one hundred will be trained; where four or five instructors toiled, twenty-five will sweat. Where only thirty or forty applicants met the examining doctor to have eyes, heart, lungs and general fitness tested, several hundred each month must apply!

In other words, each NRAB will become a veritable pilot mill, grinding out one hundred fliers or so each month. When the three new NRAB's are built, there will be a total of sixteen bases and at any one of them you may apply for navy training—with something like the following questions to start you off:

"How old are you?" (Between twenty and twenty-seven is acceptable.)

"Are you single?" (The answer must be yes.)

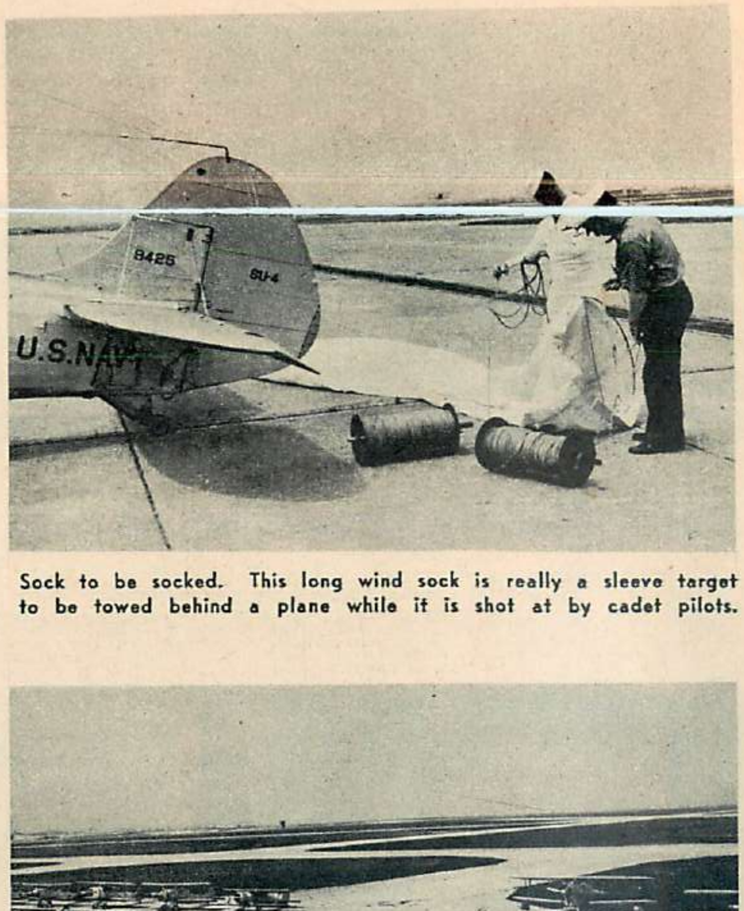
"Do you have a college degree?" (If you have only two years of college, you must have had certain subjects in mathematics.)

"Are you physically fit?" (Your answer doesn't mean much—the doctor will take care of that for you!)

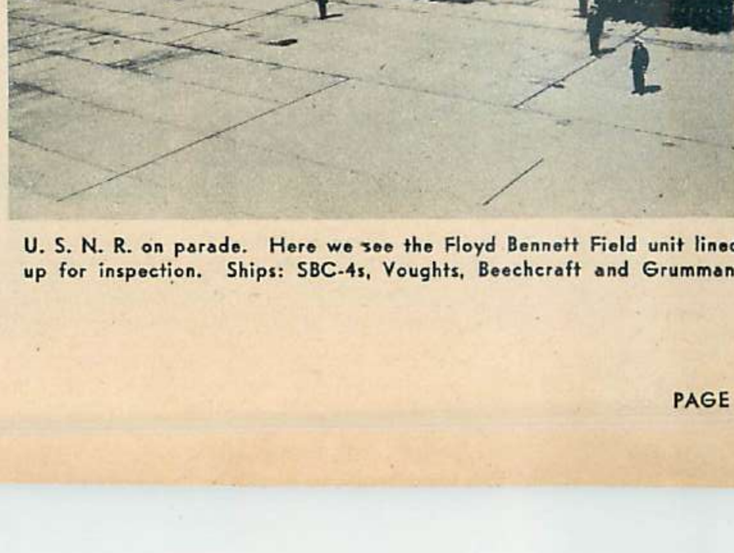
You must furnish a transcript of your college work, a birth certificate and letters of recommendation. If all goes well you'll be interviewed by a board of officers, who will select the applicants on the basis of qualifications, appearance and personality—so carefully that the percentage of students eliminated at NRAB's has been estimated at less than fifteen percent. Let us suppose that you make the grade.

On a day set by the navy department you will report to a NRAB—we will presume that you go to the base at Detroit, located on the tip of a small island called Grosse Ile (pronounced grose eel) just south of the city. This base is an integral unit, independent of all others, operated for and by reserve officers and commanded by an officer from the regular navy.

Here you will train for thirty days. Here you will receive ten hours of primary dual-control instruction. And here, if you meet the requirements, you will be given an appointment as an aviation cadet and sent to Pensacola, Florida, for advanced training. (According to the secretary of the navy, there will be additional advanced training centers, because there are limits beyond which Pensacola cannot be expanded.) *(Turn to page 56)*



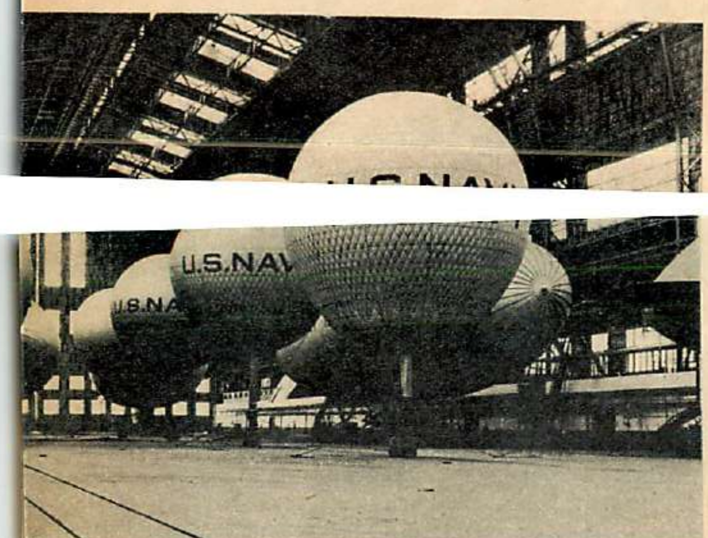
Sock to be socked. This long wind sock is really a sleeve target to be towed behind a plane while it is shot at by cadet pilots.



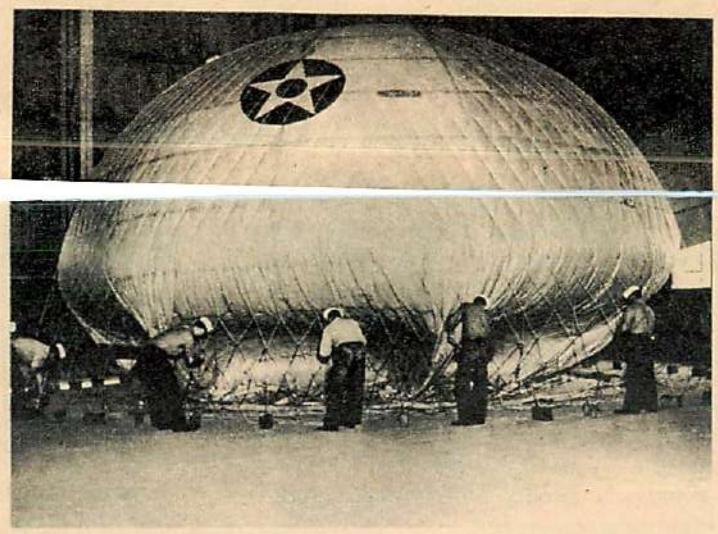
U. S. N. R. on parade. Here we see the Floyd Bennett Field unit lined up for inspection. Ships: SBC-4s, Voughts, Beechcraft and Grumman.

DESTINATION UNKNOWN

Naval air corps cadets learning about lighter-than-air craft receive their preliminary training in these "free" balloons. Up you go—to wherever the wind decides!

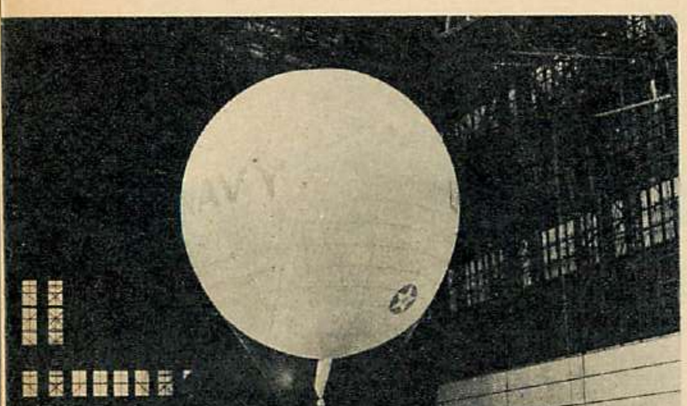


Full house. Here in the Lakehurst hangar we see four of these training balloons ready for flight.

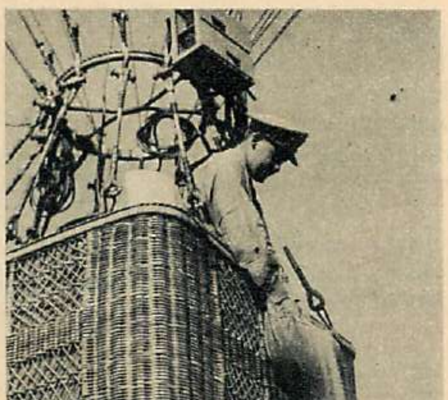


Inflation in the navy. Before take-off each balloon is carefully inspected and inflated. Lead weights hold the bag and net to floor.

Last stages of inflation. Sandbags hold bag steady while basket is attached.

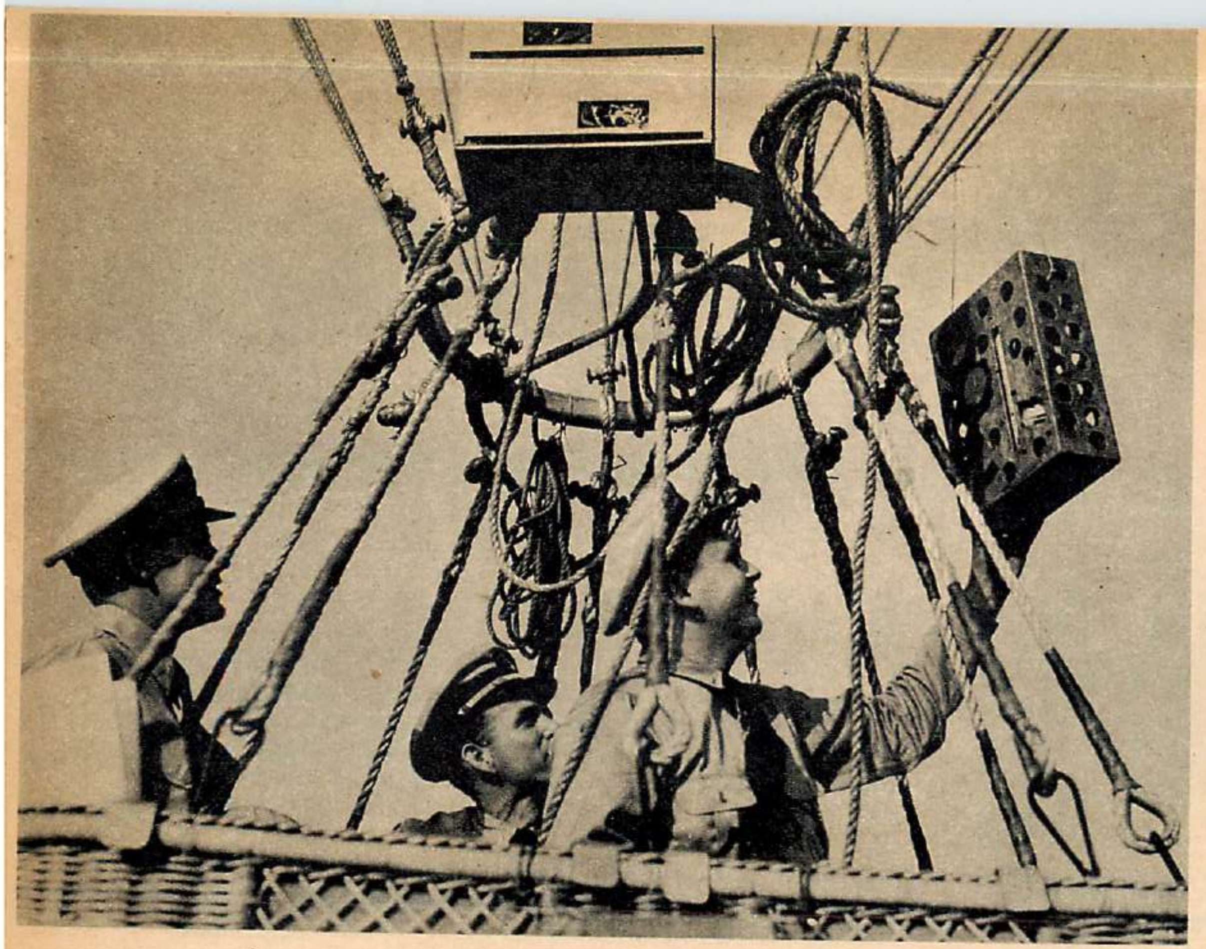


Walking it out into the open. Crew, ballast and all instruments are aboard as ship leaves dock.

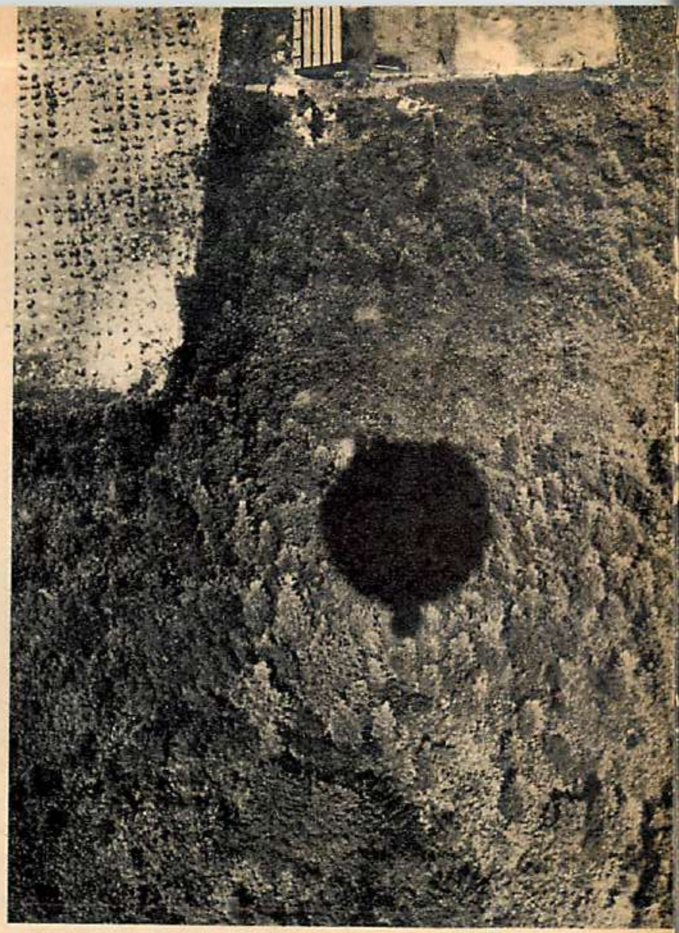


Take-off. A handful of sand falls and up goes the ship. Note pigeons in their box.

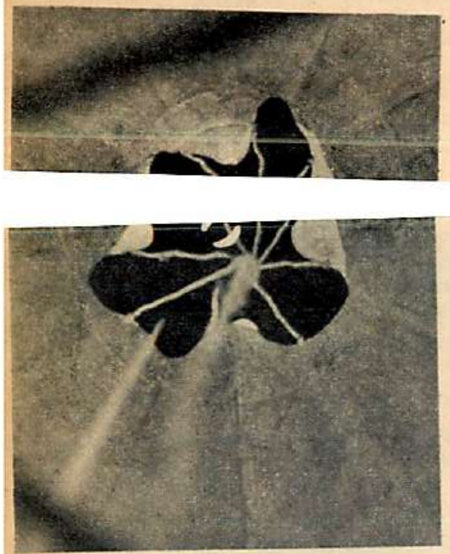
Destination unknown. Up into the sky sails the balloon to drift with wind currents until it lands. Note coiled drag-rope brake.



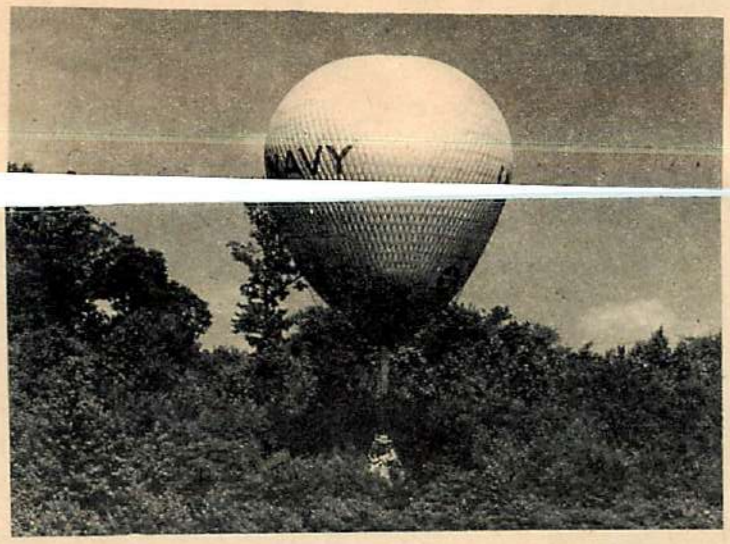
Well, how're we doing? An officer checks box containing altimeter, thermometer, and variometer. Direction of flight may be changed only by entering air layers flowing in different directions. Radio tells where they are.



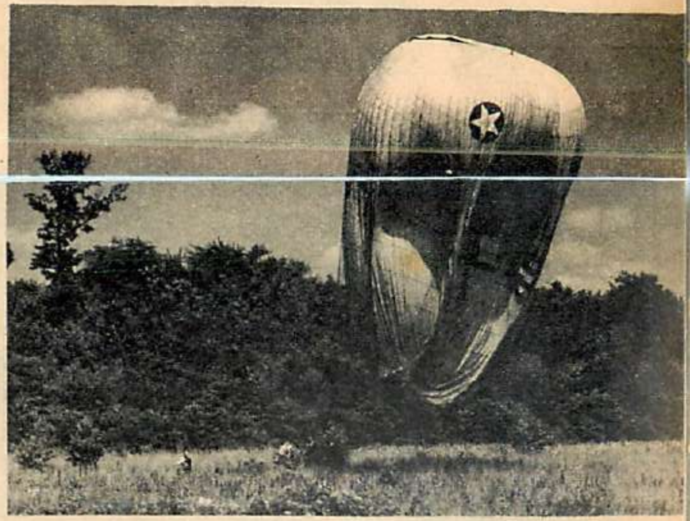
Coming events cast their shadows. Gradually losing altitude, the balloon crew plans to land.



Valving helium through top vent as seen through the balloon's appendix.



Coming in for one-point landing. Hanging onto the rigging, crew waits as the basket plows through shrubs toward the landing spot.



Down and out. Open rip panel at top empties bag of helium the moment basket reaches ground.

Grab her, boys! Sailors who have followed flight of balloon via truck arrive to assist in packing and retrieving the basket.

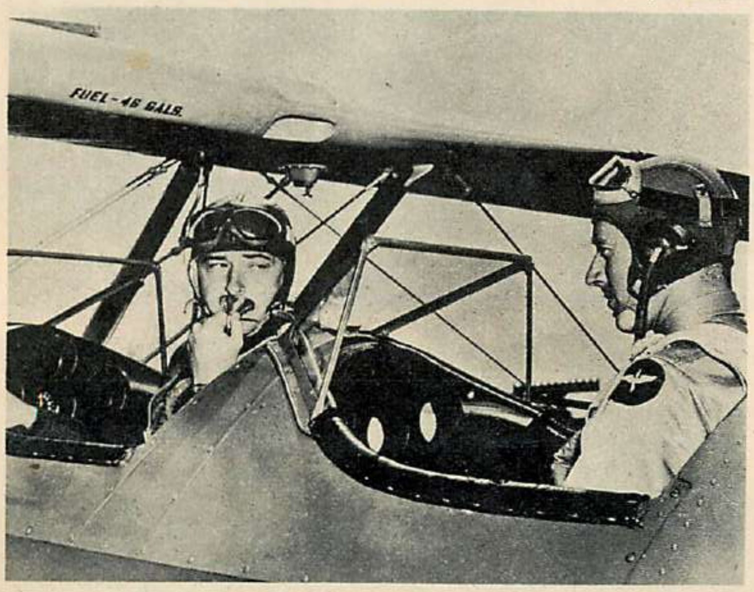
Messages to Lakehurst. Carrying messages of crew and destination, these two carrier pigeons start winging toward the home base.

Now for home. All is packed. Let's get going.

AIR CORPS

Questions on entrance requirements are easy —but form only a fragment of those asked. Come sit beside the information officer in one corps area as he does a day's work.

The goal of every applicant: the back seat of a regular army trainer. Here the instructor in the front seat demonstrates use of Gosport tube.



QUESTION: *What is a flying cadet?*

Answer: A flying cadet is a student flier who has the unique advantage of being paid to learn while learning. Congress created this grade in the army in 1919. The training he receives cannot be equaled in any school in the land. Successful candidates have jobs waiting for them upón completion of the course. While learning they are paid $75 per month plus $1 a day for food.

Question: What is the difference between a flying cadet and an enlisted man in the regular army air corps?

Answer: A man in the regular army cannot become a commissioned officer under normal circumstances as he is not trained with that goal in view. Flying cadets are trained with the purpose of giving successful candidates a commission as a second lieutenant, air corps reserve. They go on active duty upon being commissioned. Then, too, a flying cadet is paid $75, while the pay of a regular army soldier is only $30 per month.

Question: Is C.A.A. or private flying instruction of much value?

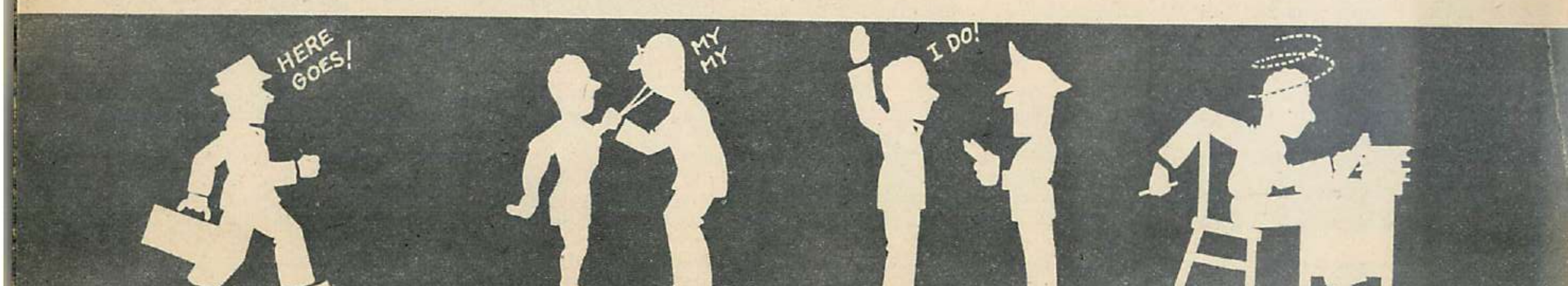
Answer: Yes, but not to the degree that it would pay a candidate to forgo appointment until such time as he has received some training.

Question: What are the age limits?

Answer: Between the ages of 20 and 27. To be eligible for a commission as a second lieutenant, candidates must have reached their 21st birthday at time of appointment. For this reason men under 20 years of age are not acceptable since it is the policy of the war department to appoint successful candidates as second lieutenants upon completion of the eight months' course. Men under 21 years of age must have the written consent of their parents. When an applicant has reached his 27th birthday, his name is taken off the eligible list, and, as it normally takes between two and three months to examine and appoint a flying cadet, men with less than three months to go before their 27th birthday, have very little chance to be appointed.

Question: What are the education requirements?

Answer: Applicants must have two years of college to be accepted without a mental exam. Two years of college means half the credits required for a degree. Nothing short of this



QUESTIONNAIRE

is acceptable. Experience is not considered the equivalent. Those lacking the educational requirements are required to take a mental exam. This exam is given after the applicant has successfully passed the physical exam. The test itself is given four times a year, in February, May, August and November, and in the following subjects: United States history, general history, grammar and composition, geography, arithmetic, higher algebra, geometry, trigonometry and elementary physics. Failure to pass the mental exam does not permanently disqualify flying cadet candidates. They may take the exam again after waiting six months.

Question: You say candidates with half the credits toward a degree are exempt from the mental exam despite the fact that they may have taken a purely academic course with no mathematics or engineering subjects?

Answer: Yes, it is assumed that before entering college they will have had the required mathematics and physics. The very fact that a man has completed half the credits required for a degree demonstrates his ability to study and to learn, which after all is what is wanted.

Question: How is the physical examination?

Answer: The exam is difficult in that it covers just about everything imaginable. It is hard for anyone except a flight surgeon to make a definite statement concerning this exam. A flight surgeon, by the way, is a surgeon who is also a flier. He has a detailed knowledge of the requirements for a flier, both through his own broad experience and through countless examinations of fliers.

About the weight—overweight is a definite cause for rejection, so all you applicants who never made the varsity because of your lack of weight, take heart. As the minimum weight is rather low, the average fellow can pass that requirement. The maximum height and weight are 6 feet 2 inches, not more than 180 pounds. The minimum height and weight are 5 feet 4 inches, not less than 115 pounds.

All men who fail the physical are rejected permanently unless the defect is such that it can be corrected. When the defect is corrected the applicant must apply to the Chief of Air Corps, Washington, D. C., for the authority to be re-examined.

Detailed information about physical requirements will be found in answer to later questions.

Question: Applicants enlist for three years as flying cadets. How soon are they discharged, (a) after the course has been successfully completed, or (b) when they are "washed out"?

Answer: Candidates who successfully complete the course of instruction are discharged immediately upon completion of the eight-month period of training and commissioned second lieutenants in the air corps reserves and placed on active duty for a period of two years. Those (b) who are washed out are discharged immediately. They are not held for further service under present conditions.

Question: What other requirements must be met by prospective applicants?

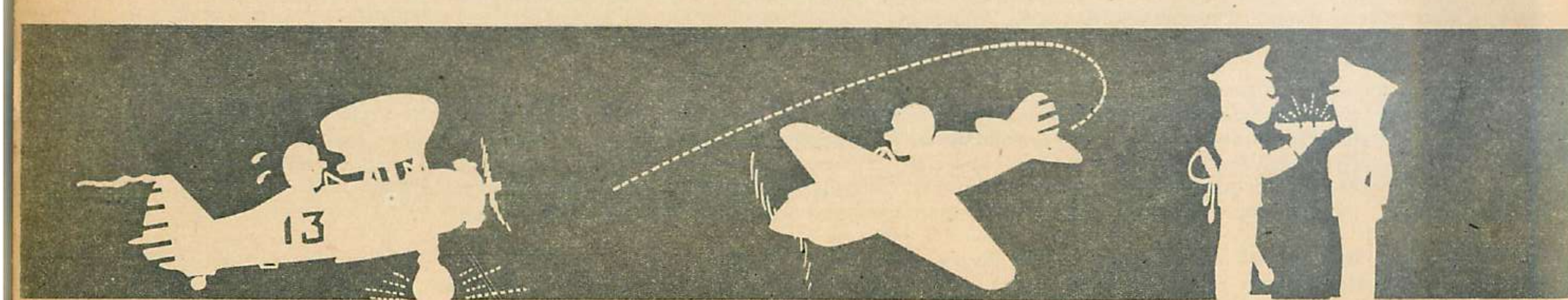
Answer: Men with people depending upon them for support, either in full or in part, should not apply as their application will not be favorably considered. This may be modified slightly in the near future.

Men without a complete high-school education should not apply as the educational exam is even tougher than it appears. The fact that one failure is disqualifying helps make it so. Finally, a man normally leaves high school through lack of interest rather than necessity.

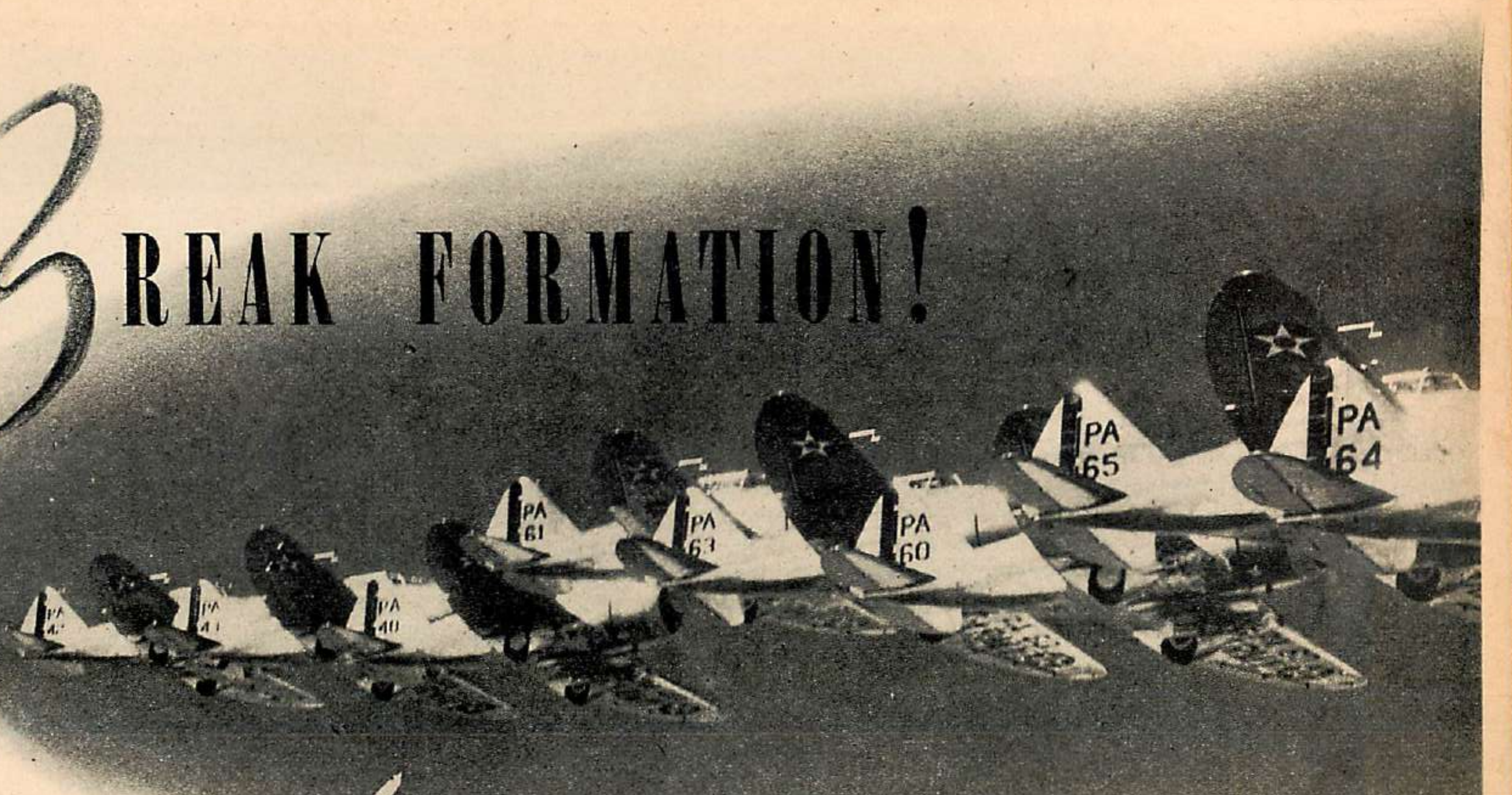
Applicants who are in the regular army, national guard or reserve officers' training corps are required to forward their applications through channels. This does not hold the application up any appreciable length of time. Men in the services mentioned above are given a preference over applicants from civil life regardless of the qualifications of the civilian applicants. Those civilians having previous military training, but who are no longer connected with the military service, are not given any preference over civilians without this training.

Question: Upon passing everything, and after having been notified of my eligibility, when do I get sworn in and when does my pay begin? Who sends me to the air field?

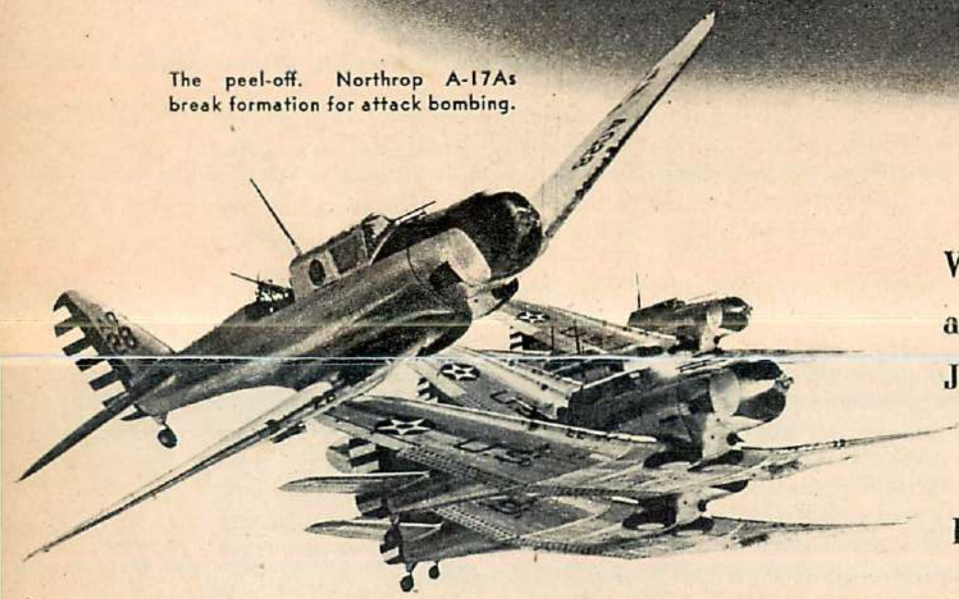
Answer: When an applicant is notified by the war department as to his eligibility, the letter will state the class for which he is qualified. Sometime before the class starts the applicant is notified to report to the nearest recruiting office at his own expense to be sworn in as a flying cadet. Once he is sworn in his pay starts, and continues to and including the date of his discharge. The army sends him to the training center to which he must report for primary instruction. His uniforms are provided him and every effort is made to see that he is quartered in the best accommodations available. *(Turn to page 62)*



BREAK FORMATION!



Dress parade. Republic P-35s in close formation make three-element flight.



The peel-off. Northrop A-17As break formation for attack bombing.

What happens in aerial combat? How does a squadron leader maintain tactical unity? Just why and when is formation broken?

BY JAMES L. H. PECK

THE above questions are typical of the ones being asked nowadays on air-force fighting, and in the answer to each of them "organization" is the keyword.

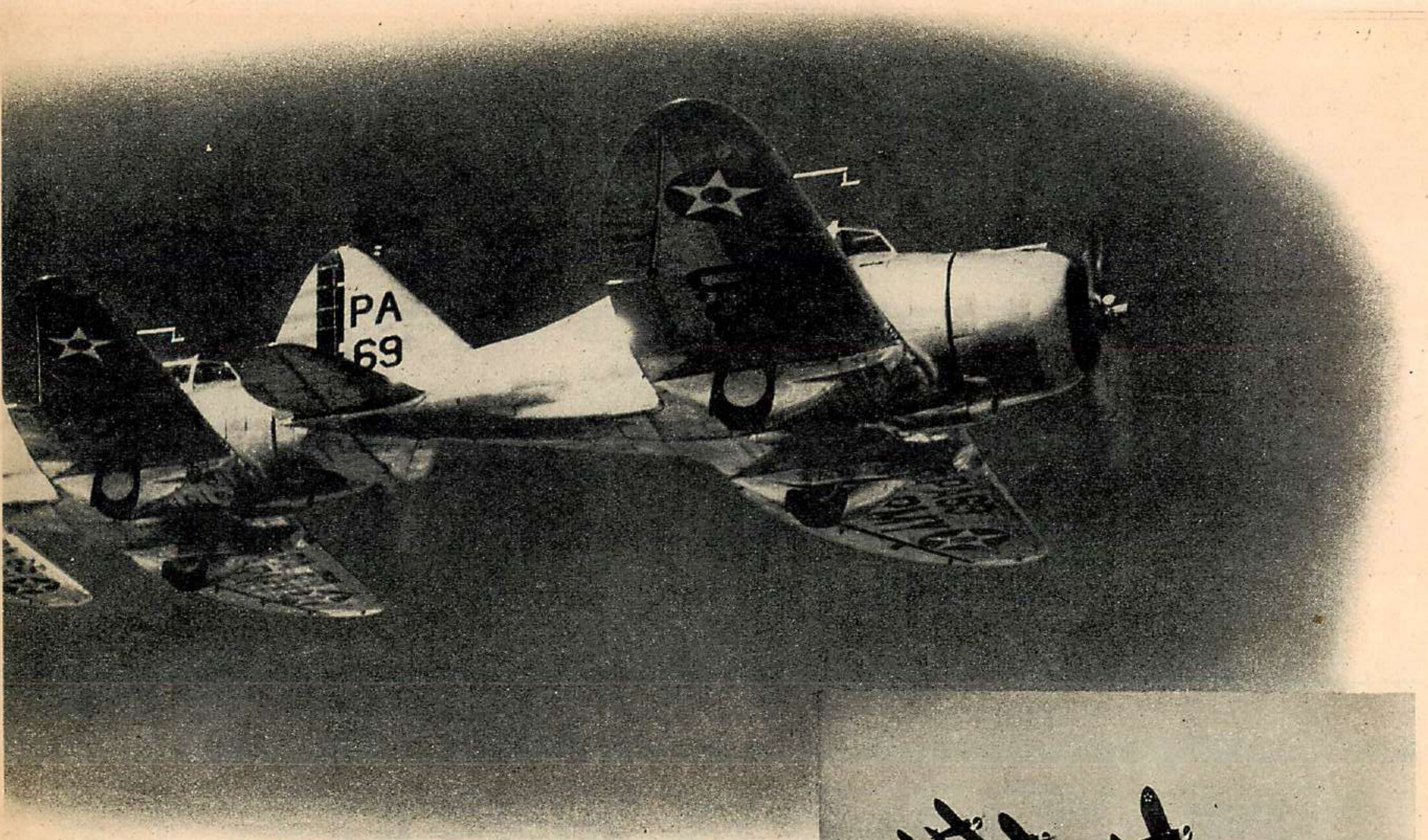
Strange though it may seem, employment of air power this troubled world over follows certain fundamental procedures or patterns; although each nation must, necessarily, strive to outwit the other in the hope of gaining command of the air. One of these basic patterns is the three-plane fighter unit, which is being universally employed. This smallest of tactical units is known as the *element* in the air corps and the *section* in the naval air service, and is headed by the element or section leader. The *flight* is composed of two or three elements, and is headed by a flight commander. Second in charge is the deputy flight commander, who may lead the second element or fly in that of his superior, as circumstances dictate. This unit is known as the *division* in the navy. The squadron—which designation is used by both services—consists of three or more flights. In addition to his flight commanders, the squadron commander, is supplied a staff of officers who relieve him of the minor details of administration and tactics.

The *group* is made up of three or more squadrons, and the group commander is usually an older flier of wide experience. A *wing* comprises two or more groups—a whole lot of airplanes. So many, in fact, that the wing commander is rarely less a personage than a brigadier general who, as such, is directly responsible to the chief of the air corps. The pursuit group is the largest formation of craft that is usually dispatched on a mission—unless the whole enemy air force is running amuck—because it is the biggest tactical unit which normally operates under the control of one individual. The squadron is capable of acting as an independent command and is, therefore, the most commonly employed.

How is it employed? When?

In offensive strategy, against hostile combat patrols of all sorts, against reconnaissance, and even troop concentrations. In defensive strategy, missions attendant on the protection of a city or other vital area, protection of airdromes, lines of communication, and friendly reconnaissance, and in direct "support" of other arms such as attack, bombardment, reconnaissance, or utility (troop transports, staff planes, ambulance craft, or freighters). The part pursuit plays in helping to achieve and maintain command of the air is quite obvious. To carry out these assignments, flight patterns, or formations, are employed to (1)permit a number of ships to be maneuvered under a single command, and (2) obtain the highest possible concentration of fire power. There are *combat* formations and *search* formations. The former may be offensive or defensive, and of these, there are two types: *open* formations, wherein the planes are spaced far enough apart to maneuver but are within supporting distance of one another, and *extended* formations, for comfortable cruising and patrol work. An occasionally used third type known as *close* formations are wing-touching patterns employed only for close-order drill and exhibition work.

"Wait a minute!" hollers a client. "Let's get this straight. First it's elements, then flights, squadrons, groups, and wings. Then



there are combat formations and search formations, and either of these kinds may be flown close, open, or extended." He hesitates a moment, says, "Correction, search formations are always flown extended, so as to cover more area—right?" Right.

The squadron is, of course, under the tactical control of the squadron leader, but this control is exercised through his flight commanders and their deputies by one, or a combination of three methods. "Indoctrination," meaning that pilots have been trained and drilled in the execution of V's, echelons, stagger formations, and variations of these basic patterns; radio command; and visual signals of various sorts. Pilots who have been thoroughly indoctrinated require only preliminary orders concerning disposition of forces, and the command to attack.

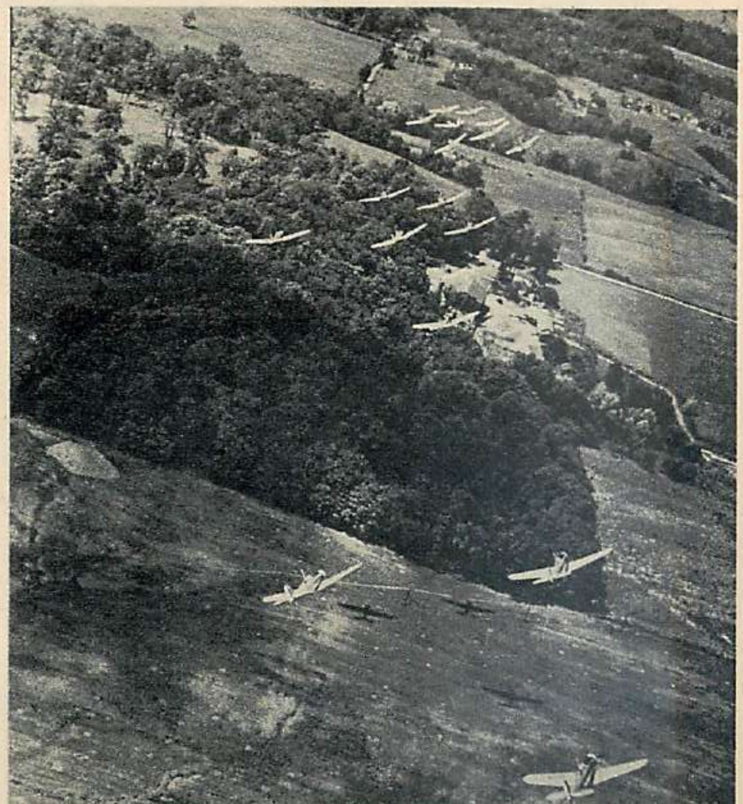
So that the squadron may know the details of the mission, "combat orders" are posted. Information supplied by Intelligence reveals the position, strength, et cetera, of the enemy forces and of friendly elements—ground and aërial. The main provisions include:

The route out (direction from which objective or area is to be approached).

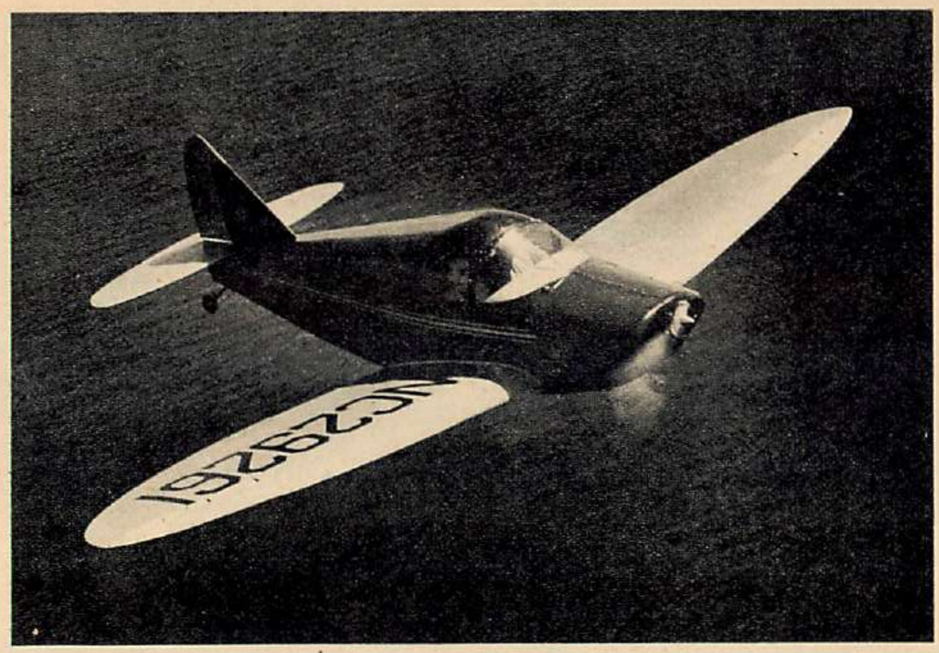
The route back (usually, the most direct line of flight to the home airdrome). *(Turn to page 52)*

"Rat-race" beginning. These training Boeings break formation to chase each other's tails in deadly circle. Each protecting plane ahead.

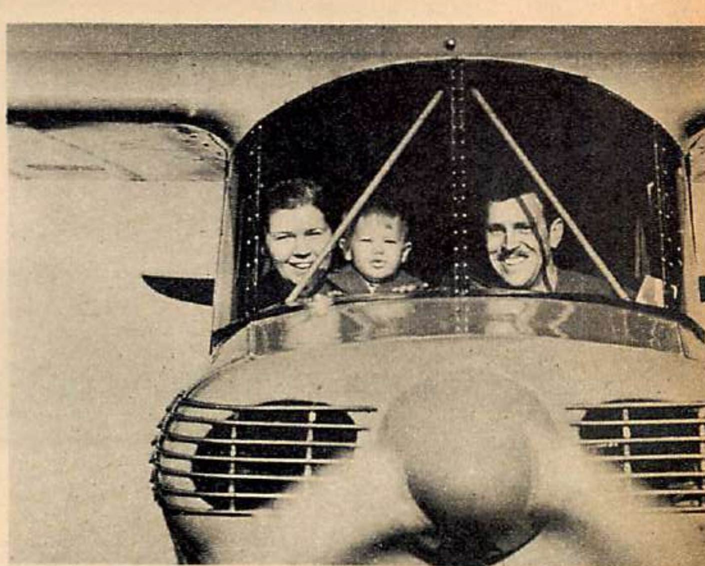
Shadow boxing. This A-17A flight of two three-plane elements flies low over the ocean on tactical mission. Personally, we'd want our wheels safely up.

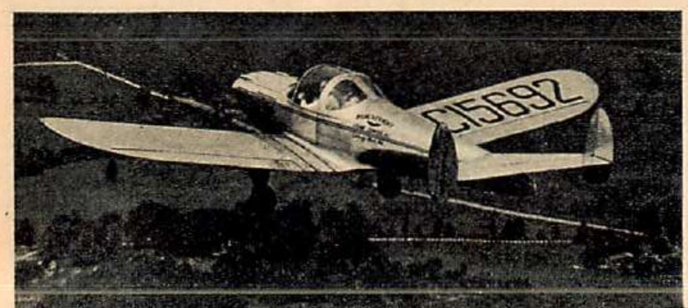


Going to work. This unusual photo shows an eighteen-plane squadron composed of two flights of three elements each in attack maneuver.



Culver Cadet has guarantee of 120 m.p.h. This is the only light plane with completely retractable landing gear.





FINE FEATHERS *make*

The smart appearance of the current light plane hides a multitude of amazing technical improvements.

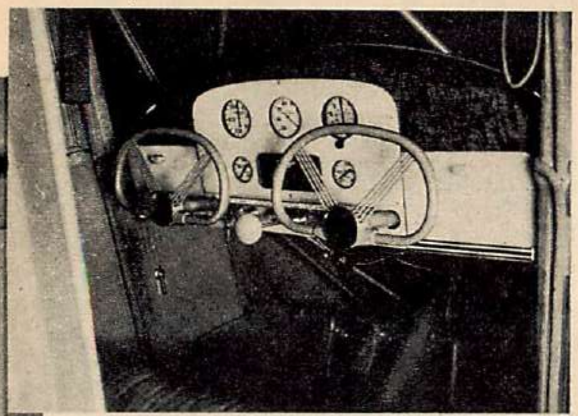
BY HANS GROENHOFF

Ahead of itself. The Ercoupe, clean and sturdy in design, has twin rudders. Great stability and tricycle gear let ship land itself.

Right—Pioneers in all-metal construction for light planes, the Luscombes have made an enviable record for themselves in recent months. This shows the new Silvair.

Al Williams likes 'em fast but he likes the Stinson 105 also for its slots, flaps, hydraulic brakes, good looks.

Taylorcraft's modern version of the light plane has done much to make this branch of flying popular. These economical ships are good-looking and safe.



Light plane luxury. This modern interior and plastic instrument board is but one of reasons for popularity of 1941 Aeronca Super Chief.

Family fun. Excellent visibility of the new Cub is demonstrated by Al Bennett and "company." Note modernized engine cowling and spinner.

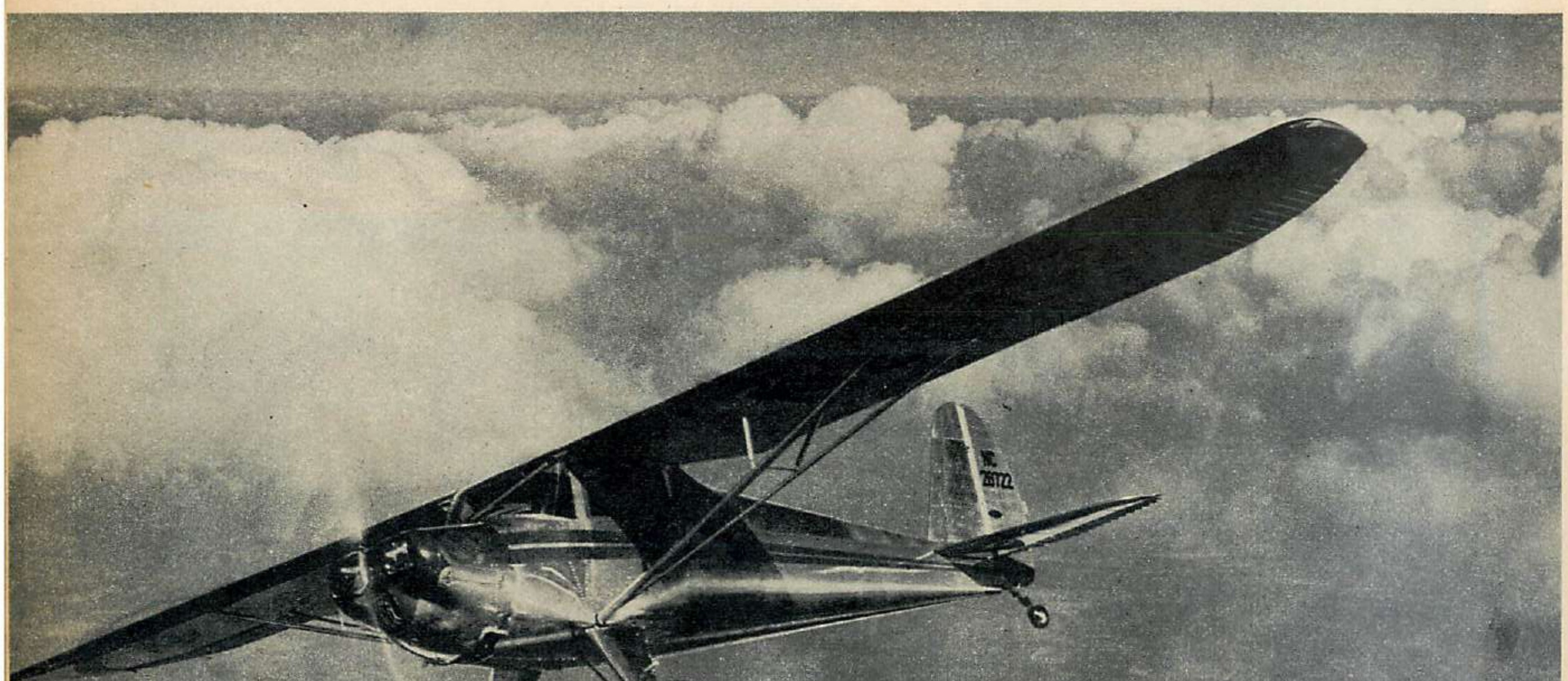
FINE BIRDS

BACK in the year 1932 Joe, a good friend of mine living a half hour's ride from New York in the lowlands of New Jersey, owned a car known as the Model A Ford, a good little car with a reliable four-cylinder engine. It was cheap in price and cheap to run. But its looks were cheap, too, compared with the automobile of today. It had none of the smooth flowing lines of the 1941 models. In the same year Joe also had one of those queer-looking light airplanes which was cheap in price and cheap to own. Its appearance never made much of a hit. It, too, had a reliable little engine, but scarcely enough power, and it was looked at with much suspicion, if not with a sneer, by the old-timers at his airport who flew circles around him in high-powered expensive ships. Joe's flivver of the road was the mass product of an industry many years old. His flivver of the sky was something entirely new.

Today in 1940 Joe again owns a Ford, but it's larger and more powerful. Its body is streamlined, its interior more cheerful and more luxurious. He also owns a brand-new light airplane which is in every respect as well finished, as comfortable and as luxuriously equipped as his car. Its engine is considerably more powerful than the one in his old model. It's equipped with a muffler and it runs like a clock.

The interior is soundproofed, heated and ventilated. Upholstery is colorful and comfortable and the appearance of the instrument panel will stand comparison with that of any modern car. With power and range added, Joe's flivver is constantly being used for cross-country travel. No longer is his flying confined to the four boundaries of the airport, and no longer need he flee to the protective cover of the hangar when a slight breeze blows across the field. Moreover, his pilot friends have ceased poking fun at his little craft, for most of them are now flying similar ships.

What the flivver of the road has accomplished on the highways, the flivver of the air is now repeating in the sky—and in a comparatively shorter time. Even mass production is developing to a point where one manufacturer already is producing 400 complete airplanes a month. Judging from recent developments in the light plane, much of the progress would have seemed incredible only five years ago. (Turn to page 64)



ENGINEERING MADE EASY

While giving you no scholastic credit, experience in model building is a big help when you're ready to go to aeronautical school.

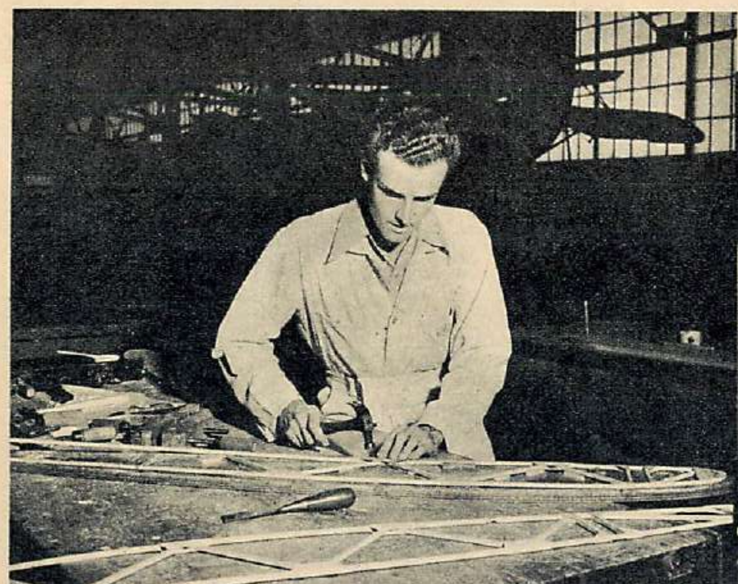
BY PETER BOWERS

Thank Heaven for "slip-sticks"! Pete and his trusty slide rule ponder a weighty equation in the Boeing drafting class.

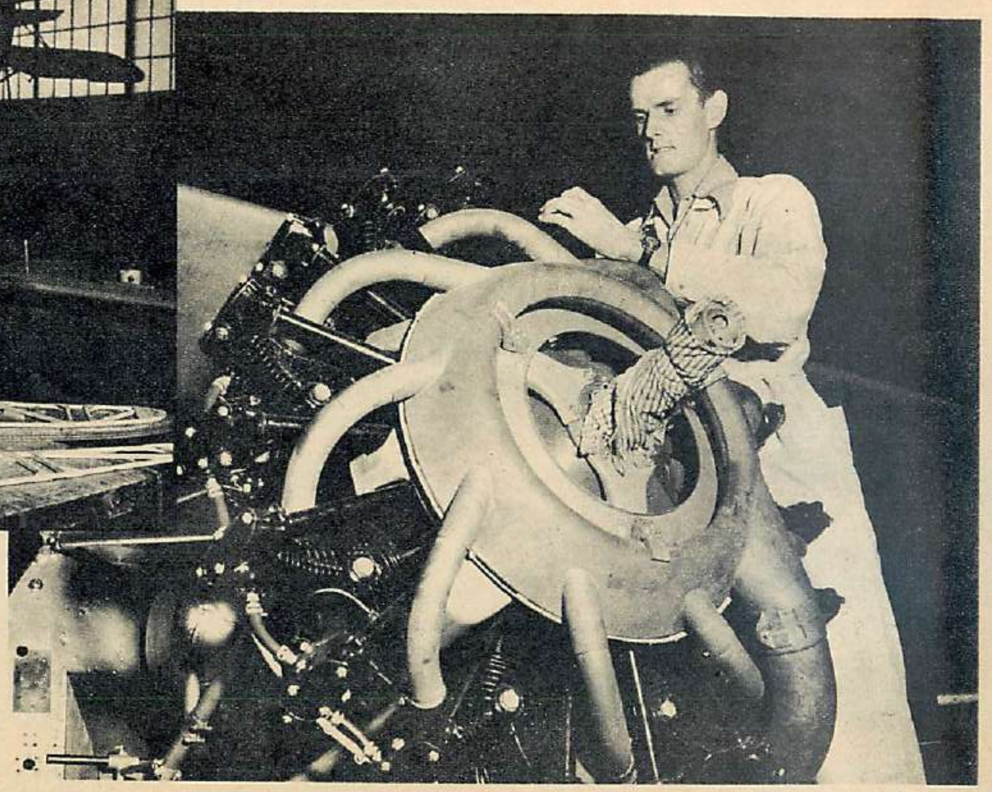
DURING the course of a long model-building career, I have often been asked just what I got out of model airplanes besides a lot of exercise and a flat pocketbook. I always managed to defend the hobby in some way; by saying that I was developing good craftsmanship, or that I was learning how an airplane flew. I wasn't aware at the time just how much I really was getting from it. I didn't know then that the boy who builds model airplanes closely parallels the course of the engineer who builds the real thing. Both accomplish the same thing, the boy turning out a model by trial-and-error methods, the engineer producing a real plane by scientific means.

My model-building program has been a very intensive one, embracing just about every known type of model, from the most elementary glider to the most streamlined gas model, so I can safely say that I have built as many models as has anyone my own age. I may have carried it too far in some places, as my teachers and parents lost no time in pointing out, but at the same time, I was laying a sound foundation upon which to build a career.

Not until I entered the Boeing School of Aëronautics did I begin to appreciate what models had done for me. It was then that I found the difference between a model builder and an engineer to be one of degree only. Where the model maker proceeds by rule of thumb with his crude tools, the engineer constructs with scientific knowledge built on an understanding of mathematics and physics, using delicate precision tools to help him. From the very start, the experience gained in ten years of designing and building models proved its worth. The vocabulary of aëronautical terms built up by reading aviation magazines, visiting airports and talking to people connected with aviation made the study of aircraft nomenclature a pleasure rather than a task. When the instructor would ask for the definition of the term "power loading," for example, the students without previous acquaintance with the words could write the definition as given by the book, while any model builder, having had to figure power loading for contest models, could write the term from first-hand knowledge. In aërodynamics classes, the lift and drag formulas that help to produce a well-designed model provide a practice in their *(Turn to page 46)*



Rib assembly comes easy to anyone who has wrestled with the tricks of gas-model construction.



Even full-size engines are easier for one who has tinkered with gas jobs. Principles are the same.

WHAT'S YOUR QUESTION

This department will attempt to answer any questions concerning aviation. Those of general interest will appear on this page; others will be answered by mail. Inclose a three-cent stamp to insure a reply. ★ All inquiries regarding appointments for U. S. army air corps flight training should be addressed to the Adjutant General of the Army, Washington, D. C. Those concerning application for naval aviation training should be addressed to U. S. Navy Bureau of Navigation, Washington, D. C. ★ Persons interested in applying for air corps ground training, such as that for airplane and engine mechanics, riggers, instrument and radio men, as well as aerial photography and parachute work, should address the Commandant, Aircraft Technical School, Rantoul, Ill.

QUESTION: Is the Ranger-powered Fairchild 24 equipped with dual stick or wheel control? Where can I get kits or plans for models of the SB2U-1, P-36, SBC-4, A17-A and the Grumman JF-2? M. L., Fargo, N. D.

Answer: The Fairchild 24 is equipped with dual stick controls. Regarding the models of the above ships, suggest that you write to some of the model manufacturers who advertise in the magazine.

Question: I would like to know where I could get plans for a simple training glider. Would the plans cost anything? How much would it cost to build? F. C., Boissevain, Me.

Answer: Stone Aircraft Co., Box 57, Detroit, Mich., sells plans and kits for a simple primary training glider. The plans cost $8. It would cost about $150 to build.

Question: I'm planning to build a glider or sailplane. Please tell me where I can obtain information or plans to build either one. Is a license required to fly a glider? C. D., Takoma Park, Md.

Answering: Write to the Soaring Society of America, Box 71, Elmira, N. Y. You must have a glider pilot's license to fly these ships.

Question: What colleges have aëronautical engineering courses? What languages should I take in my last two years of high school? E. H., Chicago, Ill.

Answer: Regarding names and addresses of colleges offering aëronautical engineering courses, write to the Civil Aëronautics Board, Washington, D. C. In regard to languages, would suggest Spanish and Latin.

Question: Could a pilot in a closed-cockpit ship traveling at a speed of 9 G's or over bail out? Could he bail out if the wings had folded up? R. E., Boston, Mass.

Answer: You are using the term "G" wrongly. It is not the speed at which the ship travels; it's used to measure acceleration during change of attitude such as a pull-out from a dive. While subjected to a 9G acceleration the pilot would not be able to get out of a plane. If the wings folded up the pilot could bail out, provided the wings have not folded around the cockpit.

Question: Do you know of any firm which sells gliders or sailplanes in either kit form or as a finished product? B. P. W., Oakland, Cal.

Answer: Yes, the Bowlus Sailplanes, Inc., San Fernando, Cal., and the Briegleb Aircraft Co., 16005 Bassett St., Van Nuys, Cal., sell ships both in kit form and ready built.

Question: What is the price of a 1940 Taylorcraft? Can I enter naval flight training without college education? H. N., Middletown, Conn.

Answer: The prices of Taylorcraft range from $1,685 to $1,835. You must have a minimum of two years of college education to enter the naval air service for training.

Question: I would like to know where I can buy a good aëronautical dictionary or encyclopedia. P. W., Dallas, Tex.

Answer: Write to the Aviation Press, 580 Market St., San Francisco, Cal.

Question: Please give me the formula for finding area chord and maximum span of an elliptic wing. Also, what is a good airfoil for an outdoor fuselage model? S. W., Chicago, Ill.

Answer: $(\text{Span})^2 = \text{aspect ratio} \times \text{area}$; maximum chord $= \dfrac{\text{area}}{.7854 \times \text{span}}$; area=span $\times$ chord $\times$ .7854 (chord measured at center of wing). It is hard to say what is the best airfoil to use, as a number of model makers design their own.

Question: Where can I find pictures of modern European military planes? Do you keep back copies of Air Trails and how much do they cost? R. W., Belmont, Mass.

Answer: You can find pictures of European military planes in most aviation magazines. Photographs are obtained from photo news services. We have some back issues of Air Trails; they cost 15 cents each.

Question: Could you tell me where I can buy plans to build a small plane? About how much would a designer charge to design a small ship to my specifications? H. E. O., Schofield Barracks, T. H.

Answer: The Heath Airplane Co., Benton Harbor, Mich., used to sell plans and kits for a small single-place monoplane. Write to them about it. A designer will charge a great deal of money to do it for you. It may run into a couple of thousand dollars.

Question: Would you please give me details of the new light plane made of plastic which is being built by Howard Hughes? F. K., Salt Lick, Ky.

Answer: Sorry, we have no information concerning this ship.

Question: I would like to know the markings and identifications on pursuit planes belonging to the GHQ air force. I would like to be acquainted with all their characteristics. B. R., Great Neck, N. Y.

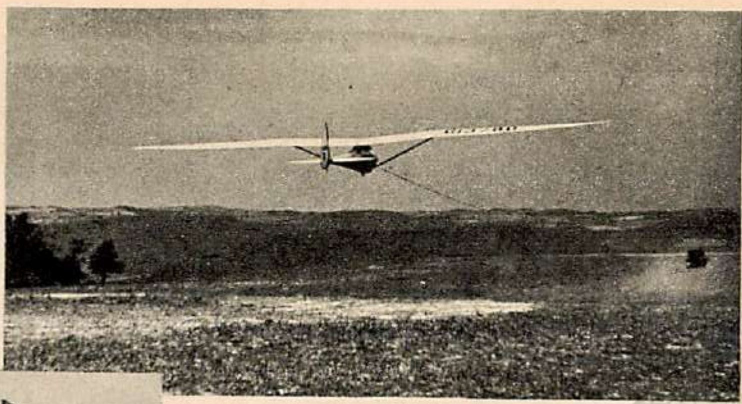
Answer: In our November 1939 issue we published an article by Roger F. Parkhill, "Identification of Army Aircraft," which answers all your questions. Send 15 cents to Mr. Clifford of our circulation department for a copy of this issue.

Question: I'm anxious to know if there are any clubs in New York where a girl of 16 can join. M. M. M., New York City.

Answer: We do not know offhand of any clubs in the vicinity of New York City. Suggest that you write to the managers of either the Flushing Airport, Flushing, L. I., or Floyd Bennett Field, Brooklyn. We understand that several clubs operate from these airports.

Question: What are the requirements for appointment in coast guard aviation? Where may I obtain solid model plans of the Northrop A17-A and the Curtiss P-36? G. F. P., New York City.

Answer: Regarding appointment in the coast guard, write to the U. S. coast guard, Floyd Bennett Field, Brooklyn. You might be able to obtain plans for the above ships from Cleveland Model & Supply Co., 4508D1 Lorrain Ave., Cleveland, O.

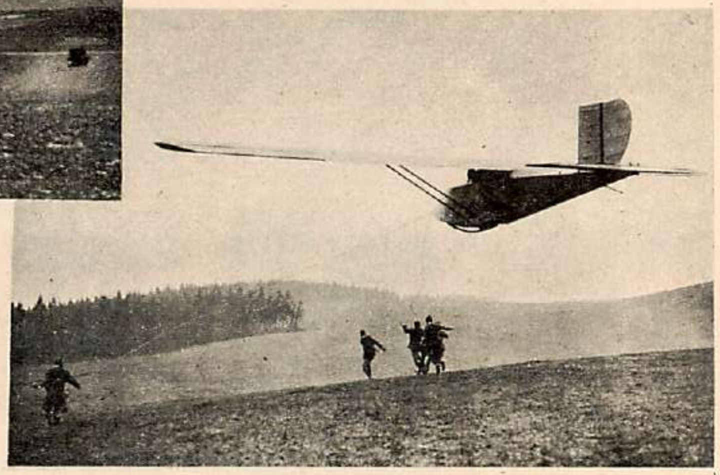


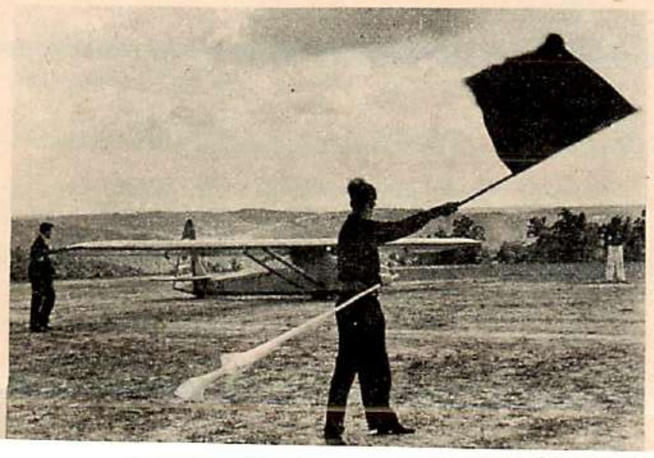
For training, auto towing is ideal. Speed is controlled by car driver; therefore, flight of student is under his direction.

If terrain does not permit other methods of launching, shock cord is used. This drops off as glider passes crew.

Although more expensive, launching winches are by far most efficient method.

Traffic flagman. Down goes the green flag and glider starts down runway.

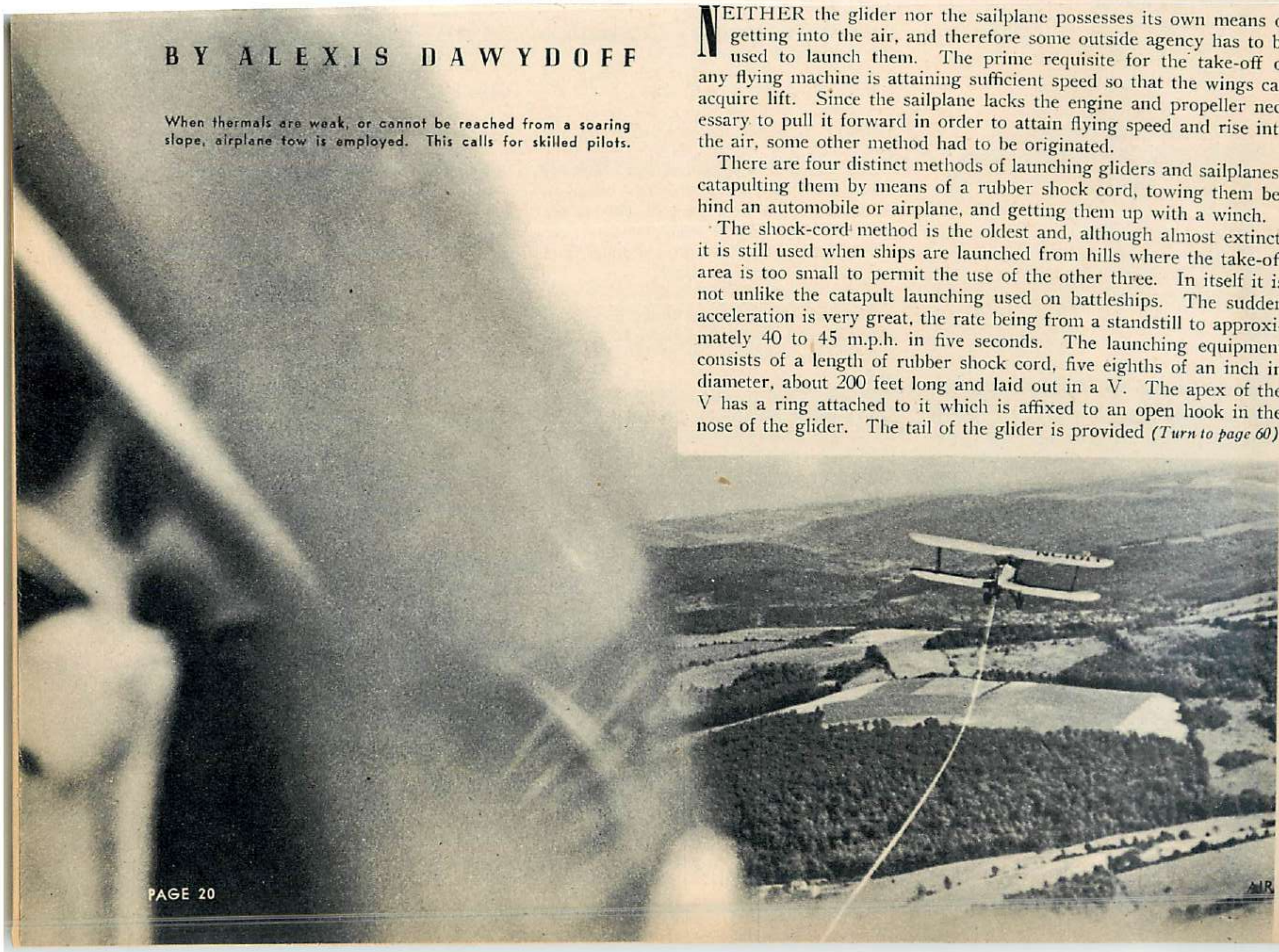




IT TAKES *Pull!*

—to get a glider up. And skill on part of launching crew. Watch 'em handle various problems.

BY ALEXIS DAWYDOFF

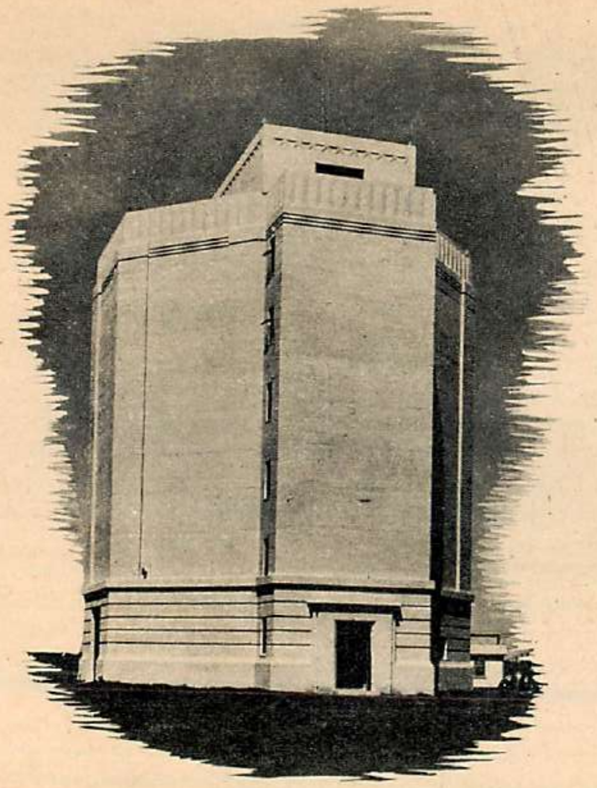


When thermals are weak, or cannot be reached from a soaring slope, airplane tow is employed. This calls for skilled pilots.

NEITHER the glider nor the sailplane possesses its own means of getting into the air, and therefore some outside agency has to be used to launch them. The prime requisite for the take-off of any flying machine is attaining sufficient speed so that the wings can acquire lift. Since the sailplane lacks the engine and propeller necessary to pull it forward in order to attain flying speed and rise into the air, some other method had to be originated.

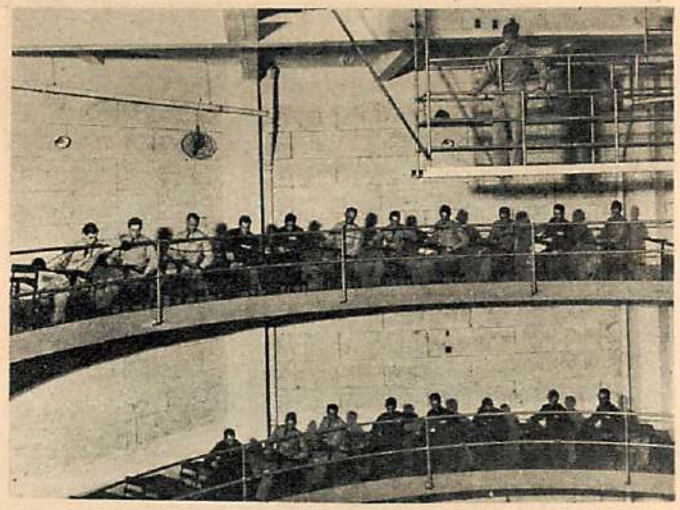
There are four distinct methods of launching gliders and sailplanes: catapulting them by means of a rubber shock cord, towing them behind an automobile or airplane, and getting them up with a winch.

The shock-cord method is the oldest and, although almost extinct, it is still used when ships are launched from hills where the take-off area is too small to permit the use of the other three. In itself it is not unlike the catapult launching used on battleships. The sudden acceleration is very great, the rate being from a standstill to approximately 40 to 45 m.p.h. in five seconds. The launching equipment consists of a length of rubber shock cord, five eighths of an inch in diameter, about 200 feet long and laid out in a V. The apex of the V has a ring attached to it which is affixed to an open hook in the nose of the glider. The tail of the glider is provided *(Turn to page 60)*

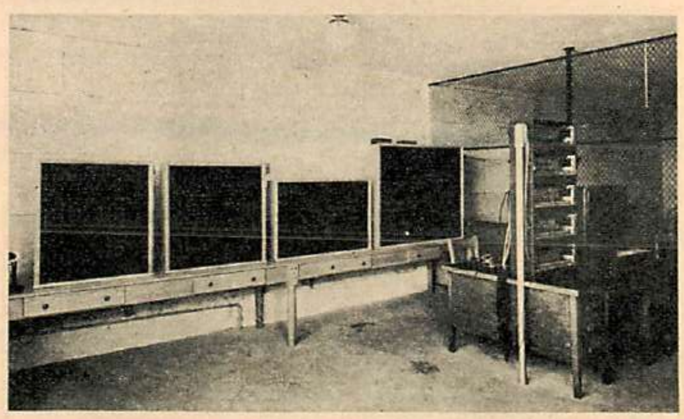


BOMB BOX

In the miniature range building at Kelly Field, Texas, students of the advanced Flying School learn observation on a small scale.

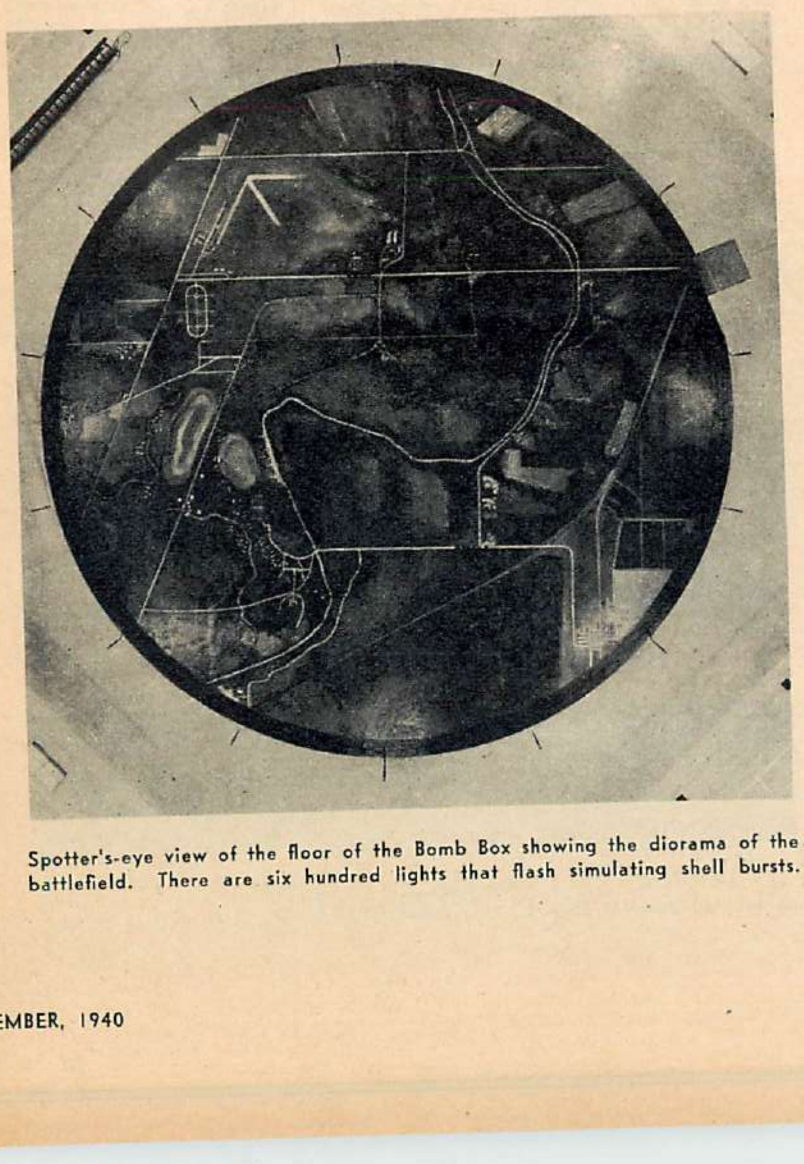


Gunfire below. From the circular galleries about the walls these student observers report the simulated artillery flashes via radio.

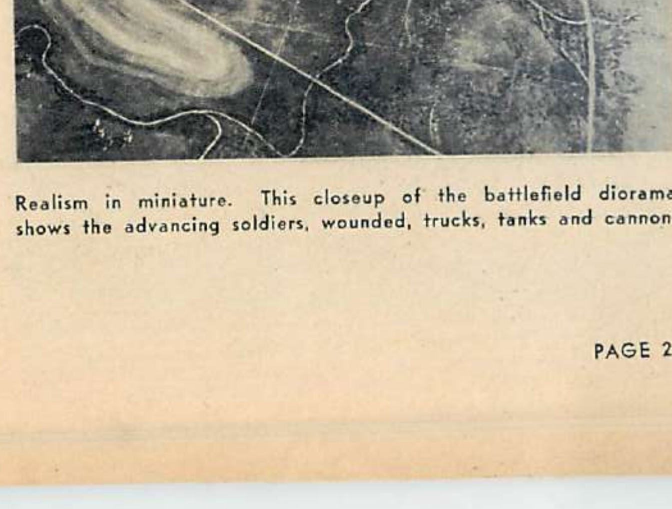


The man behind the "gun" works this control board to produce the tiny flashes that represent widespread artillery or bomb bursts.

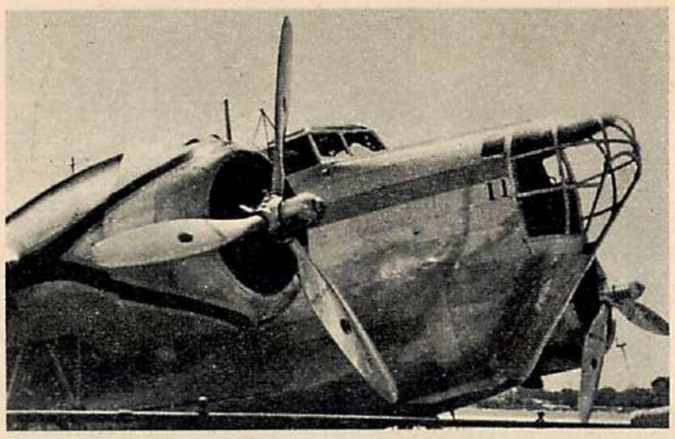
Down to earth. This shows the tower's floor that represents a battlefield. For size of field note the door in upper left corner.



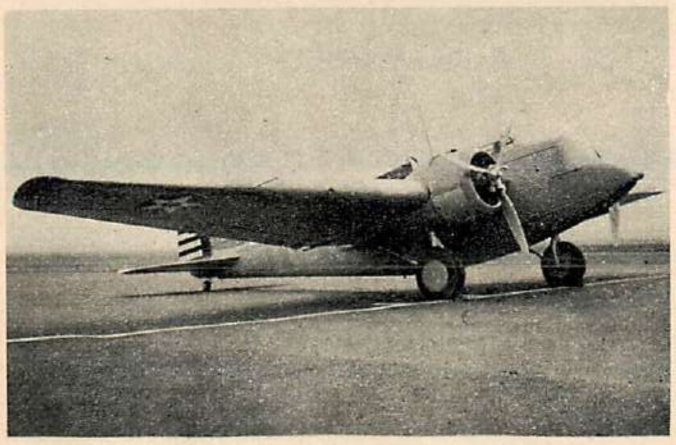
Spotter's-eye view of the floor of the Bomb Box showing the diorama of the battlefield. There are six hundred lights that flash simulating shell bursts.



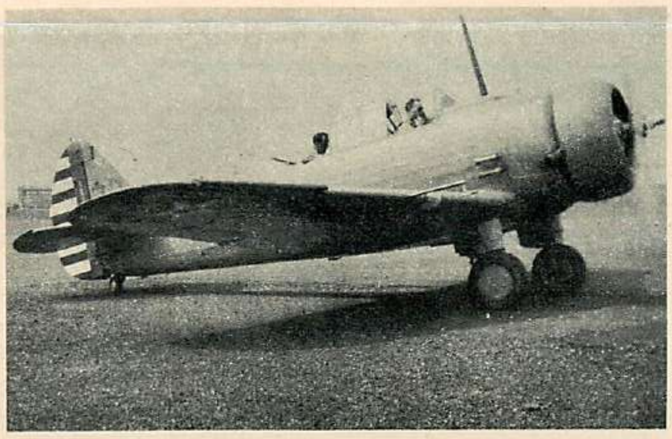
Realism in miniature. This closeup of the battlefield diorama shows the advancing soldiers, wounded, trucks, tanks and cannon.



Unusual Douglas B18-A with machine gun blister under bombardier's post removed and faired over. Taken by Bill Jones, South Gate, Cal.



It's contagious! Here's a Martin B-10 sans nose turret, too. Taken by George Kimball of Kearny, N. J. Note fairing over turret post.



BT-9 warms up. This North American basic trainer was photographed at Newark by the same George Kimball. This is a national guard ship.

Actual size of your Air Adventurers pin.

(MEMBERSHIP COUPON)

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

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

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

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

Address..

....

☐ Check here if interested in model building.

What Do You Think Aviation Owes You?

GREETINGS, Air Adventurers!

One is never quite sure how to approach the subject of "You and Aviation." We get many opportunities to talk to young fellows from all over the country and we are always interested in what they think about this great industry. We try to feel them out and we try to find out what they are thinking.

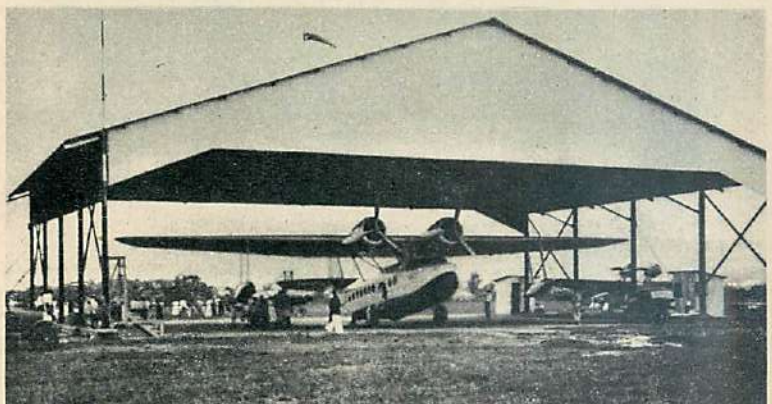
There are many, of course, who like anything about aviation. They don't care what it is as long as it is aviation and they are dabbling in it. They accept commercial or military aviation. They build models or stand on airports and watch the airliners come in. They read about World War aces or about the men in today's control towers—anything, as long as it is aviation. But there is also a group who question everything when it pertains to them or their personal interest. If they are model builders, they are model builders to the limit and they see nothing else. If they are commercial, military planes are just so much junk, and they consider anyone who shows the slightest interest in military planes as something between a warmonger and a fire-eating fanatic.

All this, of course, is good healthy competition along certain lines. These types make up aviation as we know it. They are all necessary to push the various phases of aviation.

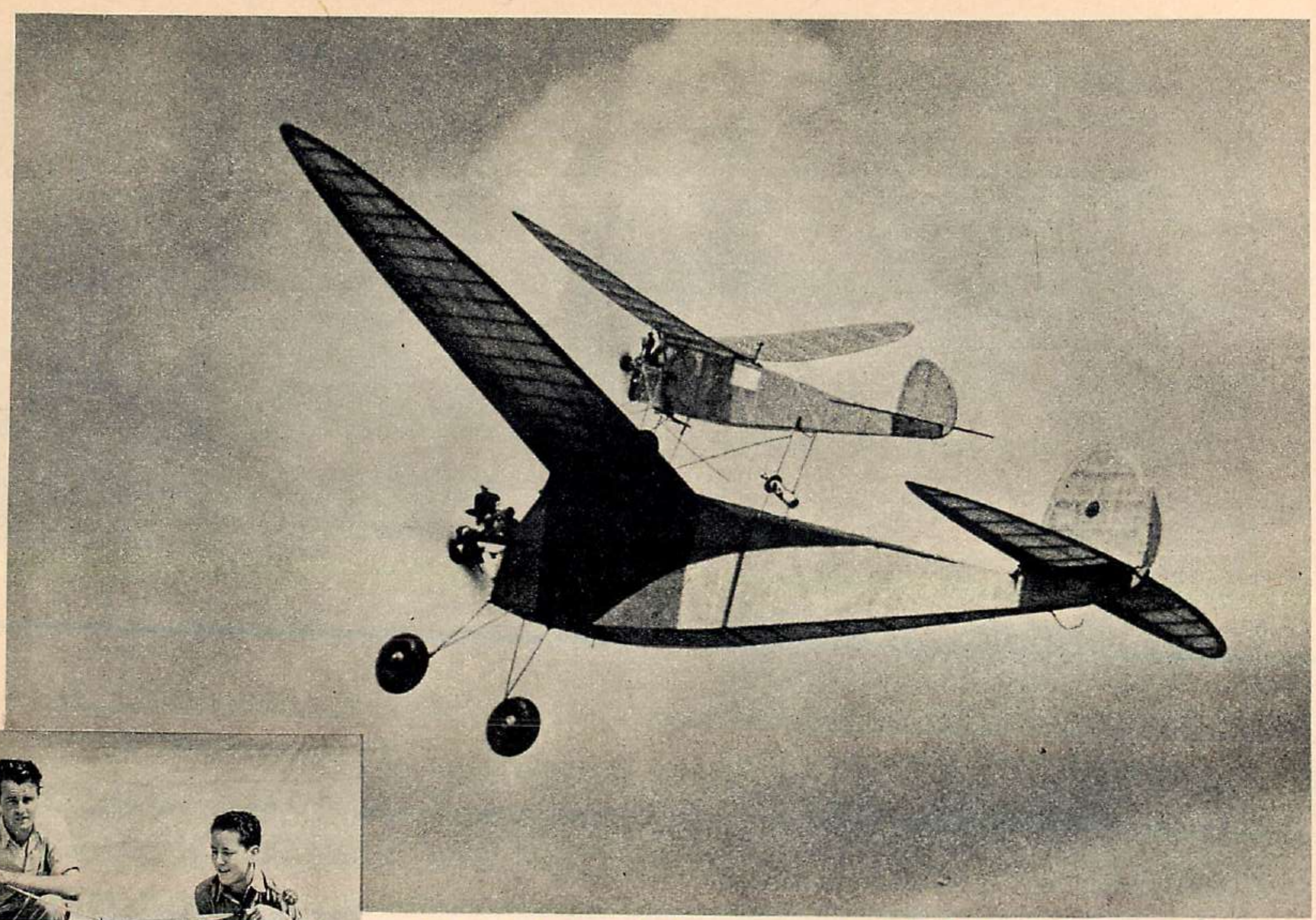
The man we can't figure is the man who argues that there ought to be a place for him in aviation. He argues that because he only has a high-school education, aviation as a profession closes its doors to him. He is sore because he can't step into an air-corps job, with flashing wings, trim uniform and a $40,000 airplane to fly—all by himself. He also argues that since he can draw airplanes well, some manufacturer ought to make a place for him in his engineering department. He wants to fly, too, but because he can't find an "angel" who will teach him while he pays for it in working time, aviation is accused of being a closed shop.

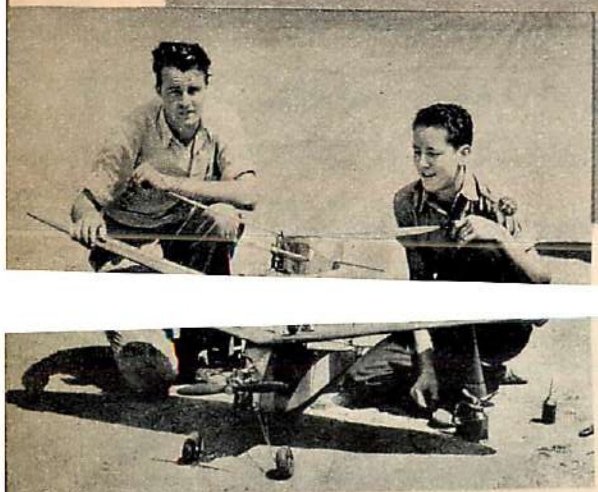
These fellows come under the head of "grousers," to use an old-time war expression. Don't be a grouser. If you want something to happen to you, by all means wish and hope for it, but above all *do* something about it! Any man or woman, any boy or girl can get into aviation, if they really wish it, without a college diploma, or without friends on the board of directors. There's so much work open in the industry today that you can almost take your pick. But you can't get into aviation by grousing about the business.

In the first place, you must believe in aviation. Aviation does not have to believe in you. You must know what *(Turn to page 59)*

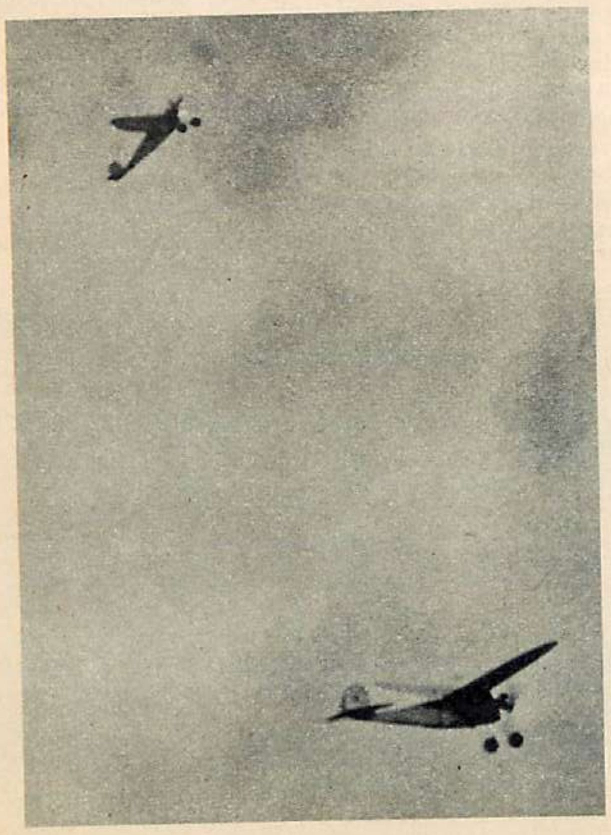


Sikorsky in Hawaii. One of the Inter-Islands ships in open-side hangar being checked and loaded. Photo by Air Adventurer Hideo Murakmi, of Olaa, Hawaii.





Two of a kind. Pickaback Clipper, Atom-powered, is released at any desired altitude by Austin timer. Big brother has an Ohlsson 60. Left—Fred Frazier and Lee Sherman of San Antonio, who worked out the combination, and, below, the two ships just after releasing. The big ship speeds on; little one zooms.



Model matters

The Dope Can by Gordon Light. Contest flashes.

THE DOPE CAN. (By Gordon S. Light.) No. 230 is the room in the Willard Hotel in Washington, D. C., where Al Lewis and Bruno Marchi hold forth in the interest of the Academy of Model Aëronautics. Dropping in one night, we hinted broadly we'd like a cigar or anything else that visitors usually don't have a right to expect. But they saved those things for the cash customers and gave us several hours of model talk.

These two boys have plenty of enthusiasm and are doing a good job in putting the A. M. A. across. Do they have their troubles? Diplomacy is an unknown factor until it's been used in co-ordinating the dozens of model factions, each with a different viewpoint. The problem is to keep old members happy while new members are converted to the A. M. A. viewpoint.

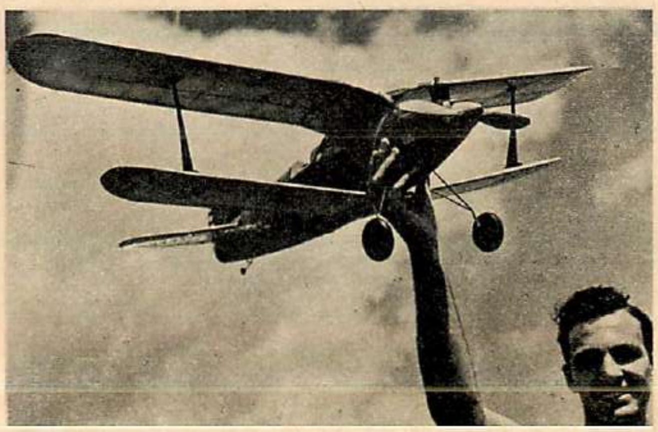
Typical of the troubles is the matter of license numbers. Several members took them to task when they failed to get the same number upon renewing their license. Actually it was the applicant's fault in not writing his name and address clearly. At any rate they took the criticism smiling. Then a short time later Marchi got the ax from a boy who scornfully told him: "I got the same license number again this year. Why couldn't you change it? What's the big idea?" And that's what you're up against when you're in A. M. A. work.

The next time you sit down to write about your pet peeve, remember they probably have a few dozen letters on file calling them names for doing the things

Who said rubber events aren't popular? Look over this collection entered at Paterson, N. J., sponsored by Teaneck Kiwanis and Society of Model Engineers, Ridgefield Park.

MODEL MATTERS

Airacobra has nothing on this for climb. Louis Garami turns loose his latest "Degravitator" for points straight up. Uses new Atom!



Some of us like 'em realistic, so this streamlined Class B biplane with its cockpit is interesting. Joe Hudson, Philadelphia.

August Streuning, Maplewood, N. J., is sold on New Ruler's all-around performance and good looks. Plans from April, May A. T.

you want. Marchi and Lewis can take it and they'd like to hear from you regardless of your frame of mind.

Several puzzling technical terms were cleared up by the last issue of *Prop Wash*, club publication of the Bridgeport Aëronuts:

Rubber motor: Choice pieces of shredded inner tube.
Rubber lube: Never use the stuff myself, but hear that it is a better grade of drained crankcase oil.
Stick model: The hottest thing on wings.
One-bladed propeller: Oh, well, some day I'll carve two blades the same.

If the cold weather hasn't frozen the pond in your meadow, why not whip out and establish a hydro record? It's an easy way to get your name into the list of national records, since many of the outdoor hydro categories are blank (based on the last official release of the A. M. A. contest board, September 1st). An official R. O. W. flight of any length would give you a record in Class C fuselage, Class C and D stick, and Class A and B gas. Helicopter, ornithopter, and Class E fuselage are other fertile stamping grounds for would-be record setters.

Indoors, the list of records is practically filled. An autogiro flight of any length would do the trick. Two R. O. W. listings remain unfilled—open stick Class A and B and Class B fuselage.

The highest official gas model flight in the records is R. O. G. Class B held by Bobby Davis of Atlanta, Ga., a junior, with 21:33.8 (three-flight average). For convenience in setting a record, steer clear of the gas categories. All these flights would take plenty of time to beat, considering only the flying time itself and not the time lost hunting suitable thermals.

Have improved kits reduced the number of boys who really have

Streamlined Pacemaker, James 60, at Creedmore. Plans in January A. T. Original used a Denny.

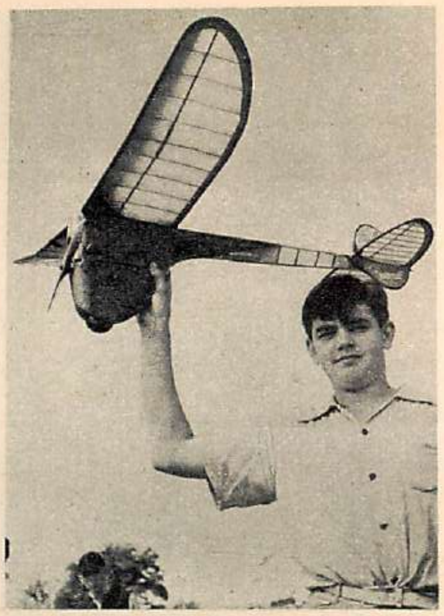
Dan Bunch, left, and Bill Butler, pres. Southern Cal. Gas Association, are Academy supporters.

California contests are gala occasions. These are a few of the jobs at Los Angeles August 25th meet. Pits stretched for one half mile.

Count New Rulers instead of sheep when your next brainstorm keeps you awake. This one flown by Bill Mason at Lock Raven.

Well, men, are we going to stand for this? Of course we are. The gals flip a mean prop. Bunny Geteskunot, Dorris Eggert, Quaker City.

A California Champ from September A.T., by Howard and Bill Salmor, Stan Ownes.

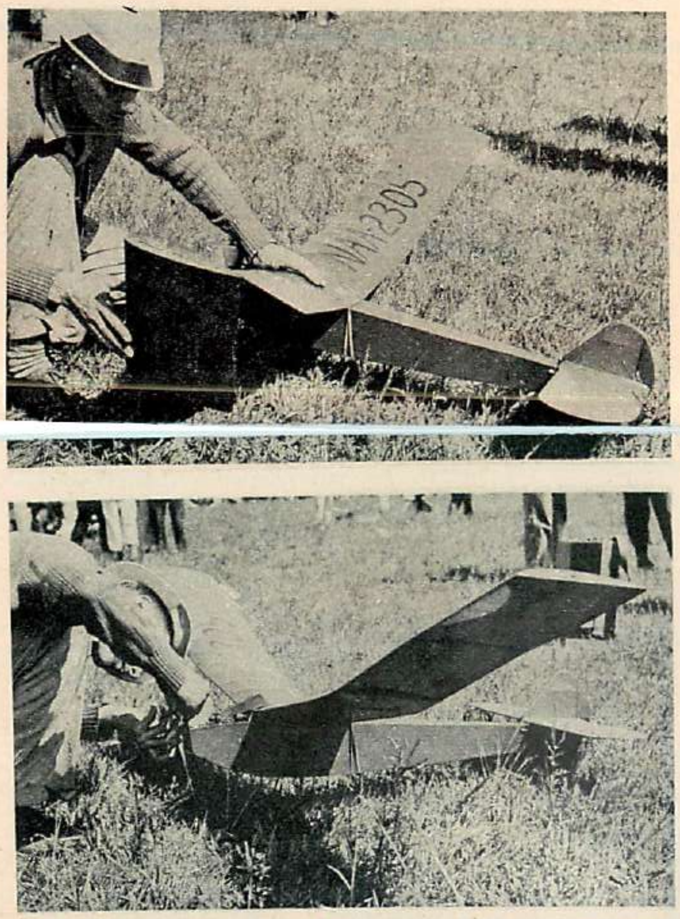


Tomahawk, Class B, from August Air Trails, by Dick Opperman. Seen at Philly meet.

a thorough knowledge of model design, building, and flying? In many cases the beginner can get satisfactory results by assembling a kit without going through the painful learning stage so necessary in the kitless era a few years back. This pain had its reward in teaching answers to those who hung on—something the kit builder is apt to miss, since the company designer does much of his thinking for him. By following instructions with reasonable accuracy, the builder gets results without knowing why.

A new type of gas flying was in the program of the Virginia Model Association State Championships. Known as the transport class, its purpose is to encourage model flying under conditions similar to those of the full-size ships. A weight rule calls for fifteen pounds per cubic inch motor displacement. Take-off must be unassisted. Buddy Jacobs of Hampton won this event with a ratio of 2.43. (Usual power flight to total flight ratios are 6 to 8 with thermal flights boosting it to 24 in rare cases.)

This sort of flying should be up Buddy's alley. His father, Eastman N. Jacobs, aëronautical engineer at the N. A. C. A. laboratories, presented the idea to the Academy convention last Thanksgiving week end. In his paper titled "Comparison of the Weight and Power Requirements of Model and Full-scale Airplanes," he pointed out that models flown under contest rules are overpowered and much too lightweight to be truly a scaled-down version of a large airplane. Yet a scaled-down model is the only type presenting the same problems of design and construction as the prototype. Model experiments will represent much more in actual research value if they are conducted on thè basis of a true flying scale model of some type of airplane. Using Froude's Laws of Comparison, he *(Turn to page 53)*



Idea of the month. Outer third of wing folds against bottom of wing for high, spiral climb; timer release springs tips into place for superglide. Amazing! By Herb Drake, Easton, Pa.

Maximum performance with minimum of plane. It's a Class C boom tail by Charles and Ted Ipsen, at Lock Raven, Md., meet.

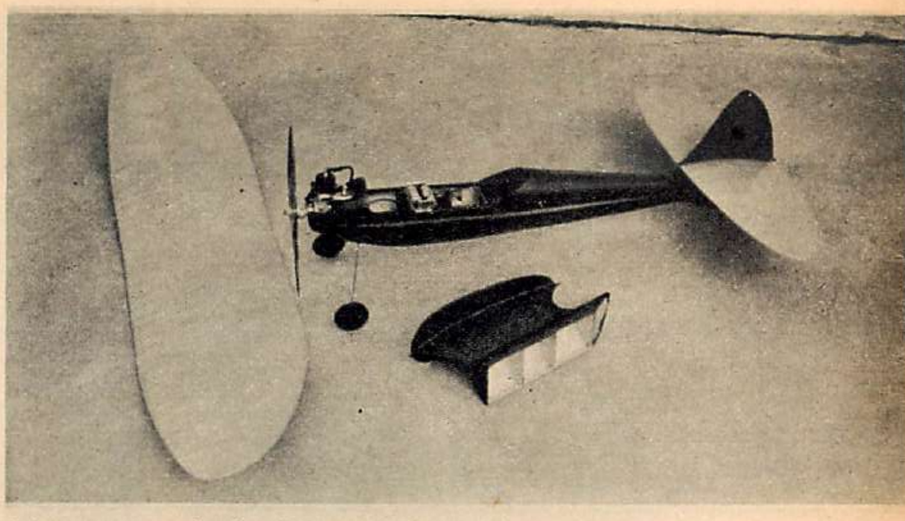
"Yehudi," Jerry Stoloff's pontoon job, uses three floats. Note curved step on main floats.

Air raid! Vosa, Trenton Model Engineers, gets off 14-footer. Co-designer, Chester. Molnar engine.

We all like the scale jobs. This Brownie-powered S.E.5 was built by F. Hernandez, Audubon, N. J.

THE ARROW

Champion A job of the Nationals, it flew 47:32 to set a national record. It's a winner, Class A or B.



Wing mounting pylon detaches from fuselage, giving easy access to batteries and timer.

Bill Gibson and the Arrow, after the winning flight at Chicago. Right—With Modelcraft perpetual trophy.

ESSENTIALLY the Arrow, like many planes, is not a completely original design. It is composed of the better elements of several planes which the designer has built and flown. Plans for the Arrow were first drawn in early December, 1939, and the original ship was finished late that month. As a matter of fact, the first test flight was made on a local golf course on the day before Christmas. The results of this flight indicated that we had all and more than we had expected on paper. The plane has a fast spiraling climb, and a slow soaring glide. The glide comes as a result of the ample wing area of approximately 392 square inches. The ship is quite strong and will stand the worst kind of contest flying. As an example, the original, built by Francis S. Beeler, has been flown all summer and is still in excellent condition, with its original covering still intact. Beeler has flown his ship in six contests, and according to their order, has taken the following places: two thirds, one second, one fourth, and two firsts. At the time of writing, the last contest he flew the plane in was at Chillicothe, Ohio, where the plane finally flew out of sight after a time of about six and one half minutes. His total time that day, for first place, was a little under eleven minutes. The plane was recovered three days later, having landed twenty-seven miles from the contest field, and was absolutely intact. All of these flights were in Class A, with an Ohlsson "19" for power. Beeler flew the plane once in Class B, using an Ohlsson "23" and took first place with a total time of about sixteen minutes.

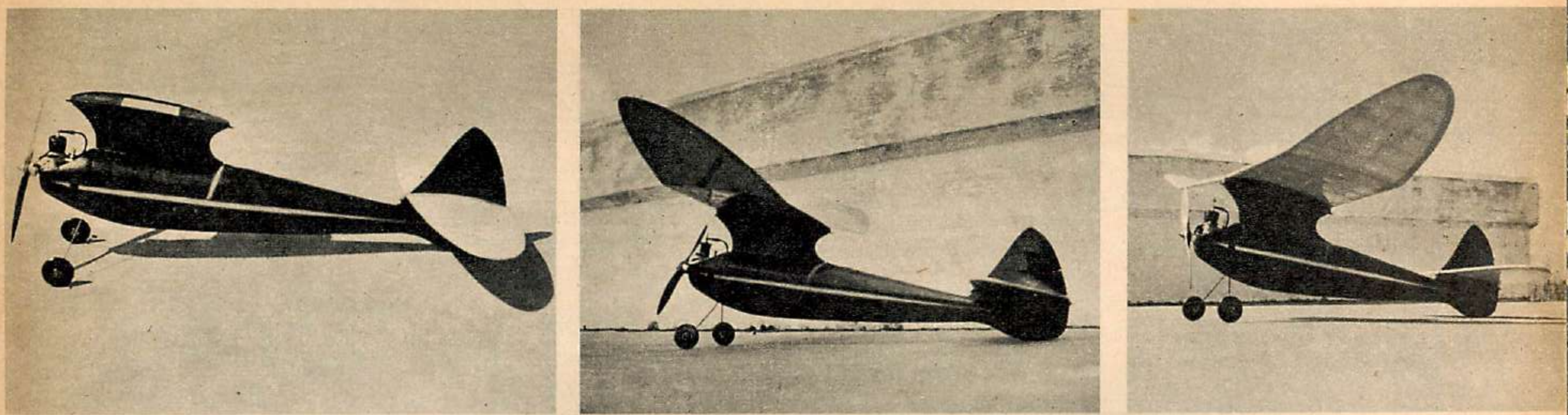
William Gibson, who has really done more with the plane than Beeler, has built several models of the original and has flown them in both Class A and Class B events, using Ohlssons "19" and "23" for power. In Class A he has won three firsts, one second and three thirds. In Class B, Gibson has always placed well up in the money in all contests. His most notable achievement with the plane was his remarkable flight at the Chicago Nationals, where he won the Class A open event. For forty-seven minutes and thirty-two seconds the plane soared around in view of the timers and finally came to rest at a point about seven miles from the field. This flight not only won the Modelcraft Trophy for Gibson, but established a new record for Class A flights.

On Sunday, August 11th, Gibson released his plane for his first Class B flight. After six minutes, the plane passed from the sight of the timers and was not recovered.

Amply tried and tested, this plane is offered for your use with the suggestion that instructions be strictly followed.

CONSTRUCTION

First cut out all of the body formers for the bottom half of the fuselage from $1/8''$ sheet balsa. Glue a strip of $1/16 \times 3/16''$ piece of hard balsa across the top of all open formers. Cut out the fire wall from $3/16''$ three-ply white pine or birch. Pine is better because it is lighter. Notch all formers and the fire wall as shown on plan.

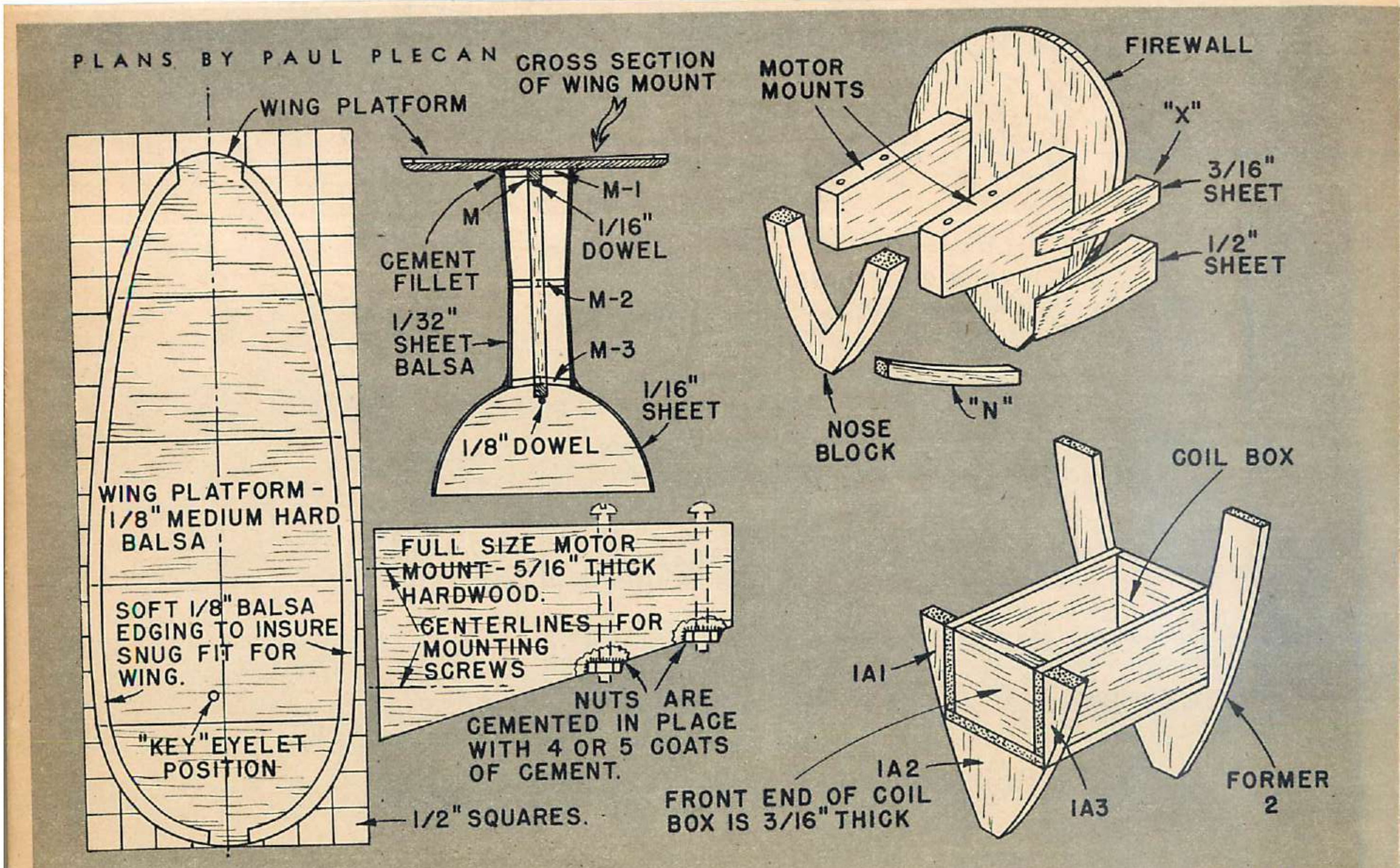


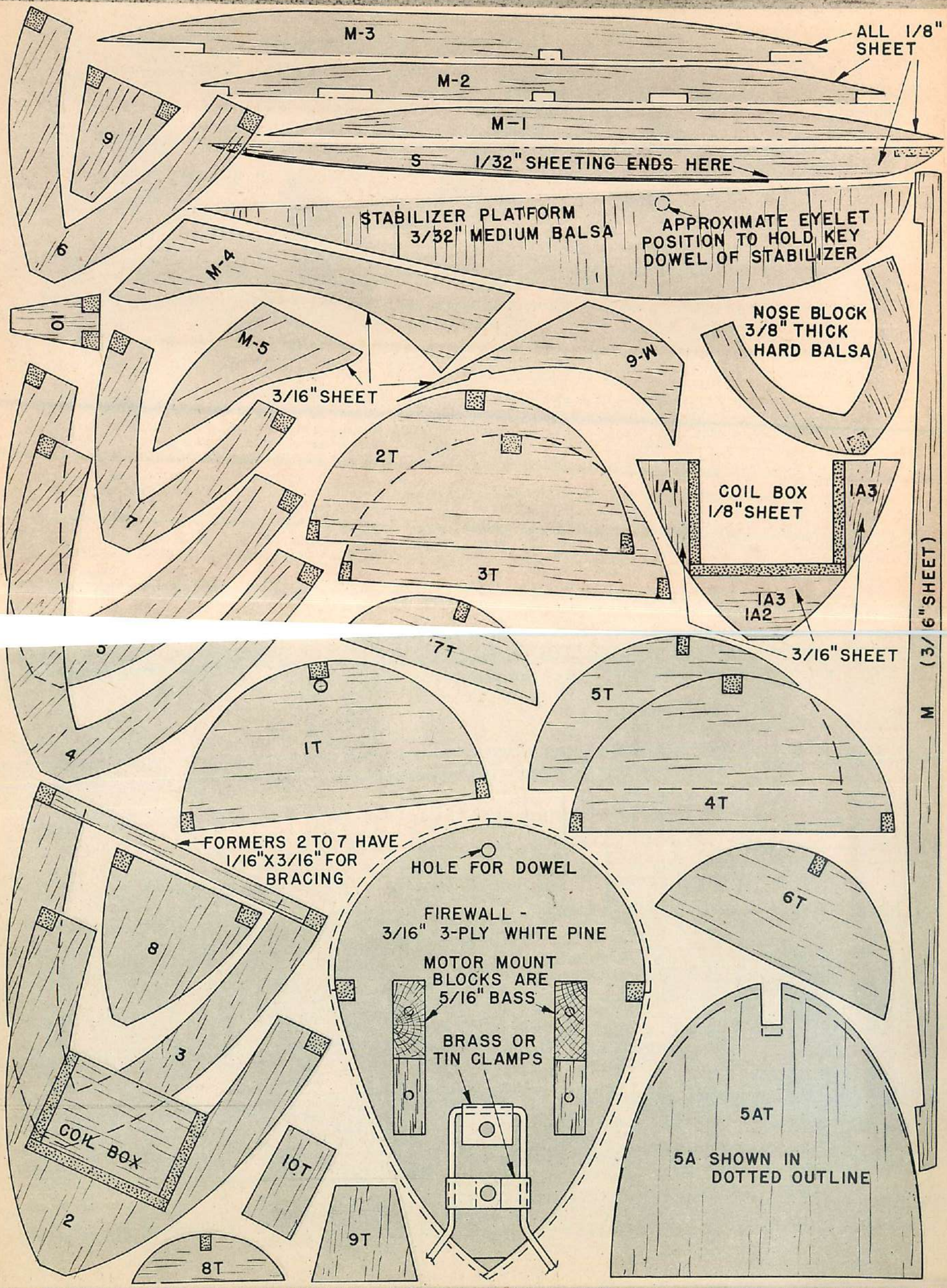
Left—With wing pylon in place. Center and right—The completed model, ready for first official. Its 392 sq. in. wing area affords exceptional glide. Climb is fast spiral.

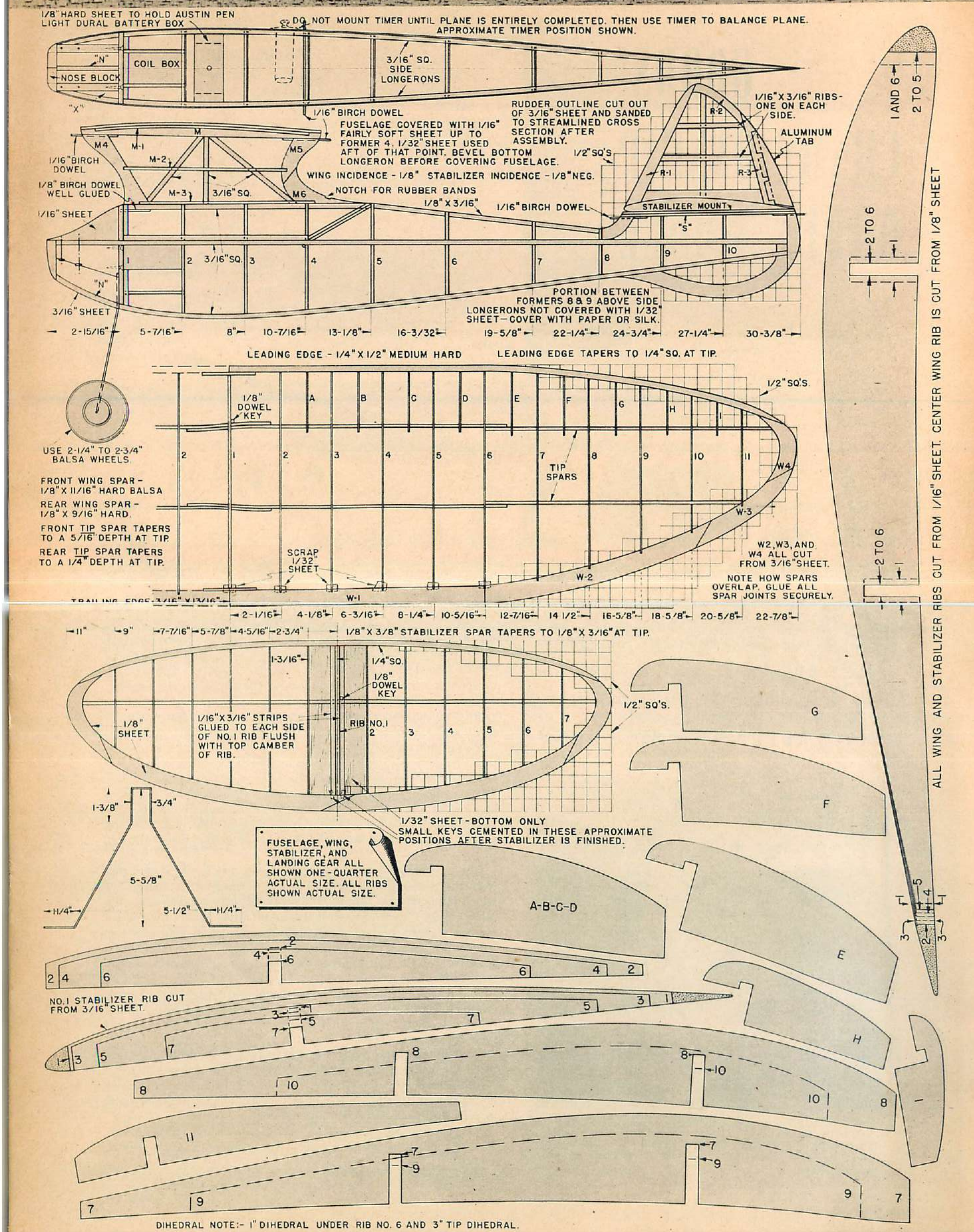
BY WILLIAM GIBSON AND FRANCIS S BEELER

Attach the $^5/_{16}$" bass motor blocks by using flat-head wood screws that are countersunk into the fire wall. Before screwing the blocks on, place plenty of glue on the joint. It is also well to screw the screws in about three quarters of their length, then remove them, fill the holes with glue, and then tighten the screws. It is best to use one-inch screws that are fairly narrow. Put two or three coats of glue around the joint on the wall. Attach the landing gear wire to fire wall. Use $^5/_{64}$" or $^3/_{32}$" music wire for the landing gear. The lighter wire is preferred. Drill the motor mounts for your motor. The width of the mounts and the holes shown are for either an Ohlsson "19" or an Ohlsson "23" motor. Glue nuts on the bottoms of the holes. Use three or four coats of glue. The screws can then be removed at will. Although it is not necessary to draw up complete three-views of the fuselage, it will be necessary to draw a top view with correct former spacings.

Next, take the top view of the fuselage and crease the plan along the line which indicates the back of the fire wall. (Former 1.) Secure a flat board, about three feet long, and place the top view of the fuselage on this board so that the crease along Former 1 is *exactly* perpendicular to the center line drawn through the middle of the top view and also is against the squared-off end of the board. Cover the plan with wax paper and pin the $^3/_{16}$" square longerons to the board and in the position shown. We recommend that you soak the longerons in water before pinning them. Slip the fire wall, upside down, onto the longerons and tack the fire wall to the end of the board with two thin *(Turn to page 42)*

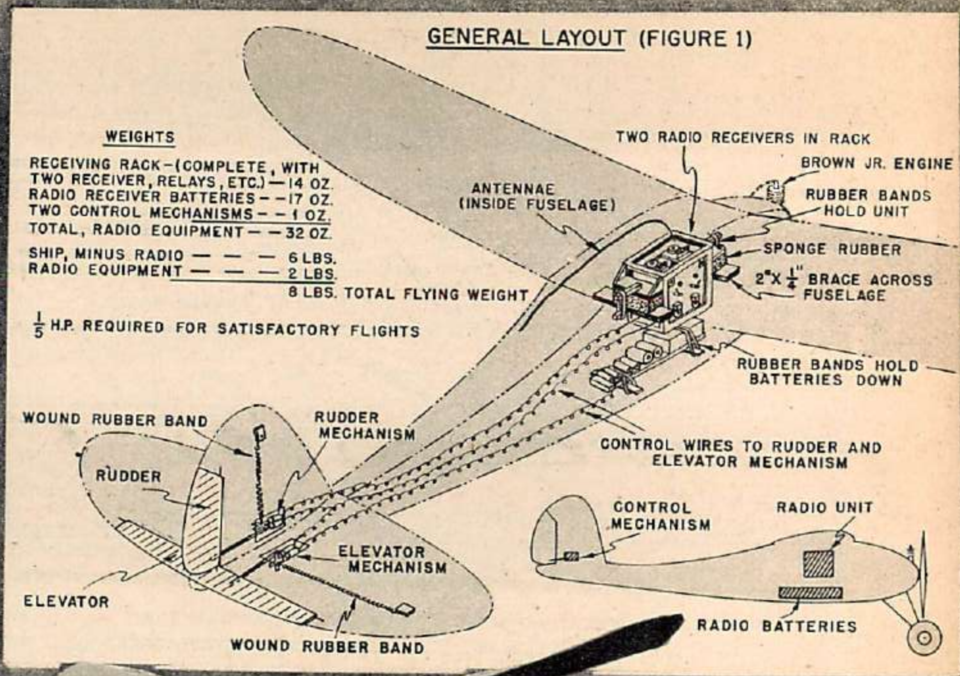


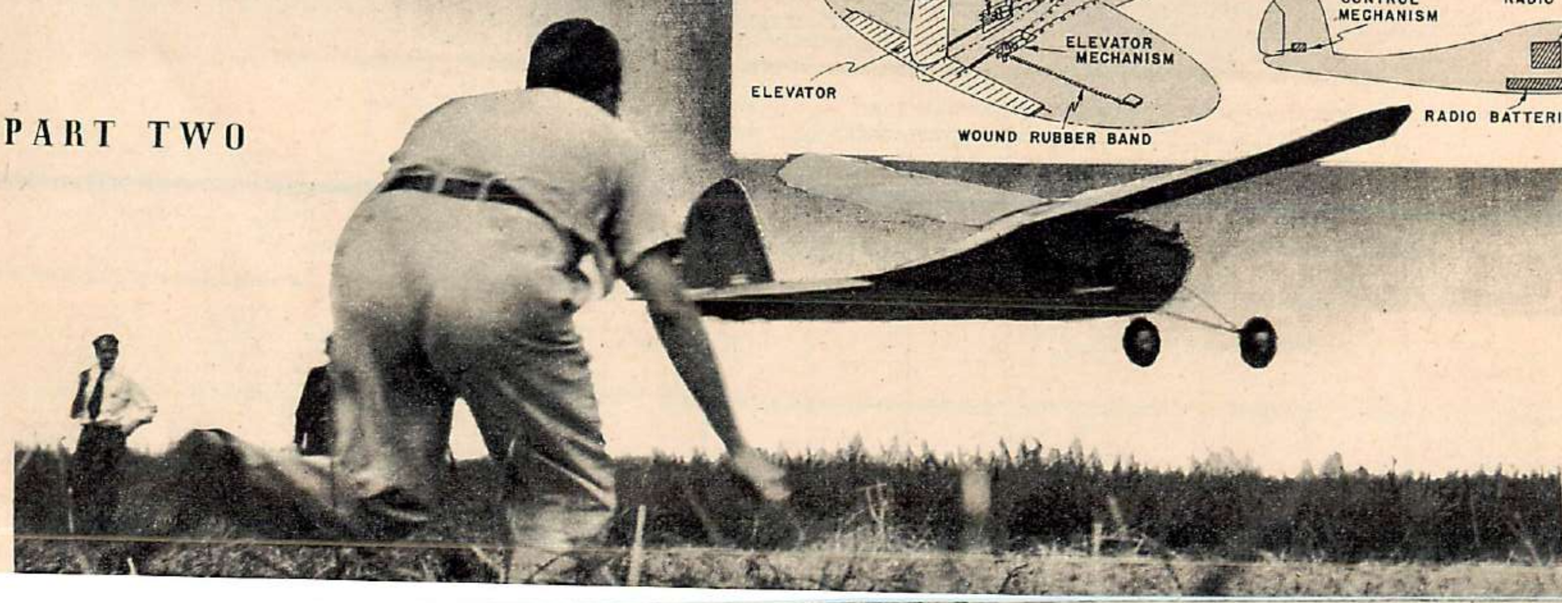

M-3
ALL 1/8" SHEET
M-2
M-1
S
1/32" SHEETING ENDS HERE
9
6
STABILIZER PLATFORM
3/32" MEDIUM BALSA
APPROXIMATE EYELET POSITION TO HOLD KEY DOWEL OF STABILIZER
M-4
10
M-5
9-W
NOSE BLOCK
3/8" THICK
HARD BALSA
3/16" SHEET
2T
7
1A1
COIL BOX
1/8" SHEET
1A3
3T
1A3
1A2
5
7T
3/16" SHEET
M (3/16" SHEET)
5T
1T
4
4T
FORMERS 2 TO 7 HAVE 1/16"X3/16" FOR BRACING
HOLE FOR DOWEL
FIREWALL -
3/16" 3-PLY WHITE PINE
MOTOR MOUNT
BLOCKS ARE
5/16" BASS
6T
8
BRASS OR
TIN CLAMPS
3
COIL BOX
10T
5AT
5A SHOWN IN
DOTTED OUTLINE
2
9T
8T


1/8" HARD SHEET TO HOLD AUSTIN PEN LIGHT DURAL BATTERY BOX
DO NOT MOUNT TIMER UNTIL PLANE IS ENTIRELY COMPLETED. THEN USE TIMER TO BALANCE PLANE. APPROXIMATE TIMER POSITION SHOWN.
"N"
COIL BOX
NOSE BLOCK
"X"
3/16" SQ. SIDE LONGERONS
1/16" BIRCH DOWEL
RUDDER OUTLINE CUT OUT OF 3/16" SHEET AND SANDED TO STREAMLINED CROSS SECTION AFTER ASSEMBLY.
1/16" X 3/16" RIBS-ONE ON EACH SIDE.
ALUMINUM TAB
1/2" SQ'S
R-1
R-2
R-3
1 AND 6
2 TO 5
FUSELAGE COVERED WITH 1/16" FAIRLY SOFT SHEET UP TO FORMER 4. 1/32" SHEET USED AFT OF THAT POINT. BEVEL BOTTOM LONGERON BEFORE COVERING FUSELAGE.
M
M-1
M-2
M-3
M4
M5
M6
1/16" BIRCH DOWEL
1/8" BIRCH DOWEL WELL GLUED
3/16" SQ.
WING INCIDENCE - 1/8" STABILIZER INCIDENCE - 1/8" NEG.
NOTCH FOR RUBBER BANDS
1/8" X 3/16"
1/16" BIRCH DOWEL
STABILIZER MOUNT
"S"
1/16" SHEET
"N"
3/16" SHEET
PORTION BETWEEN FORMERS 8 & 9 ABOVE SIDE LONGERONS NOT COVERED WITH 1/32" SHEET—COVER WITH PAPER OR SILK.
2-15/16" 5-7/16" 8" 10-7/16" 13-1/8" 16-3/32" 19-5/8" 22-1/4" 24-3/4" 27-1/4" 30-3/8"
2 TO 6
ALL WING AND STABILIZER RIBS CUT FROM 1/16" SHEET. CENTER WING RIB IS CUT FROM 1/8" SHEET
LEADING EDGE - 1/4" X 1/2" MEDIUM HARD
LEADING EDGE TAPERS TO 1/4" SQ. AT TIP.
1/2" SQ'S.
1/8" DOWEL KEY
A B C D E F G H I
TIP SPARS
W4
W-3
W-2
W-1
W2, W3, AND W4 ALL CUT FROM 3/16" SHEET.
NOTE HOW SPARS OVERLAP. GLUE ALL SPAR JOINTS SECURELY.
USE 2-1/4" TO 2-3/4" BALSA WHEELS.
FRONT WING SPAR - 1/8" X 11/16" HARD BALSA
REAR WING SPAR - 1/8" X 9/16" HARD.
FRONT TIP SPAR TAPERS TO A 5/16" DEPTH AT TIP.
REAR TIP SPAR TAPERS TO A 1/4" DEPTH AT TIP.
SCRAP 1/32" SHEET
TRAILING EDGE-3/16" X 13/16"
2-1/16" 4-1/8" 6-3/16" 8-1/4" 10-5/16" 12-7/16" 14 1/2" 16-5/8" 18-5/8" 20-5/8" 22-7/8"
11" 9" 7-7/16" 5-7/8" 4-5/16" 2-3/4"
1/8" X 3/8" STABILIZER SPAR TAPERS TO 1/8" X 3/16" AT TIP.
1-3/16"
1/4" SQ.
1/8" DOWEL KEY
1/2" SQ'S.
1/8" SHEET
1/16" X 3/16" STRIPS GLUED TO EACH SIDE OF NO. 1 RIB FLUSH WITH TOP CAMBER OF RIB.
RIB NO. 1
1/32" SHEET-BOTTOM ONLY
SMALL KEYS CEMENTED IN THESE APPROXIMATE POSITIONS AFTER STABILIZER IS FINISHED.
1-3/8"
3/4"
5-5/8"
5-1/2"
1/4"
FUSELAGE, WING, STABILIZER, AND LANDING GEAR ALL SHOWN ONE-QUARTER ACTUAL SIZE. ALL RIBS SHOWN ACTUAL SIZE.
A-B-C-D
G
F
E
H
NO. 1 STABILIZER RIB CUT FROM 3/16" SHEET.
DIHEDRAL NOTE:- 1" DIHEDRAL UNDER RIB NO. 6 AND 3" TIP DIHEDRAL.

GOODS' CHAMPIONSHIP RADIO MODEL

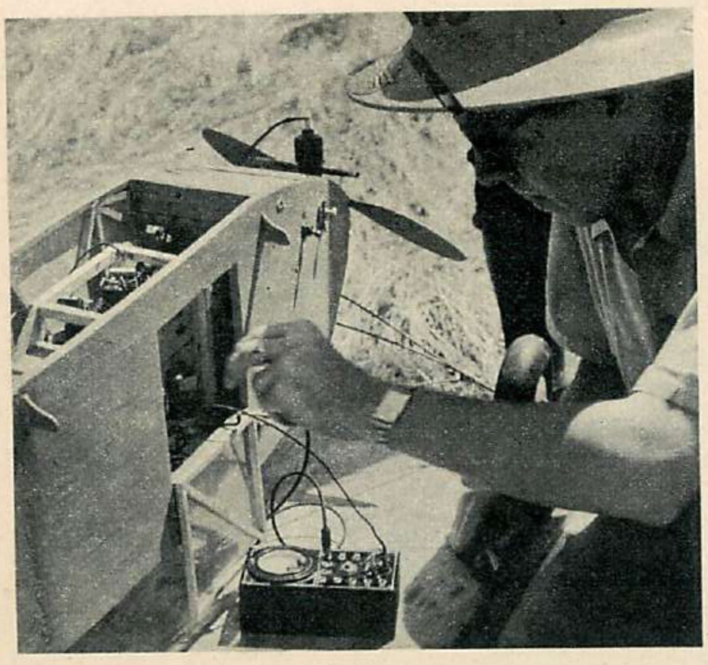
PART TWO





Reliable and workable, this equipment is the result of four years' experimentation. Has made over 150 good flights.

BY WALTER AND BILL GOOD



Walter tests responses. Large door provides access to receiver, visible through top of fuselage. Receiver mounted on sponge rubber.

HERE are the details of the radio equipment used in the Goods' Championship Radio Model which has proved its reliability by over 150 successful radio-controlled flights. Although the model has two controls, it is advised at the outset for the beginner to use one control, the rudder. This is because of the great versatility of the rudder control—and the increased complexity of additional controls.

The equipment is the result of over four years of experimentation—both in the laboratory and on the field—and hence represents a reliable, workable product.

Since not all modelers are endowed with a twin brother "radio bug" (Bill Good, W8IFD), hunt yourself an amateur operator before you start. He will have lots of good ideas, too. So you should easily be able to adapt this equipment to your own gas job.

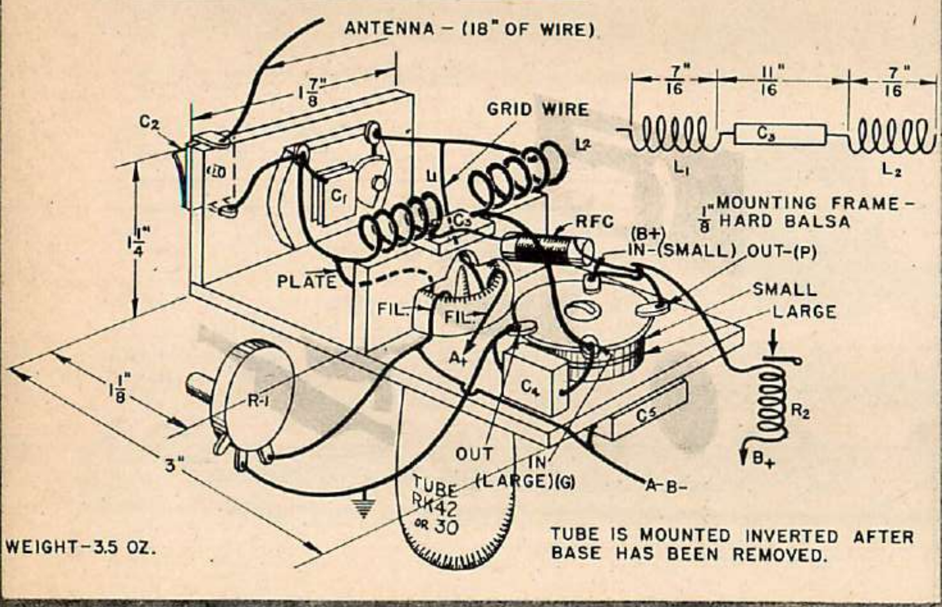
The basic radio-control circuit is shown in Fig. 1. The signal from the transmitter is picked up by the receiver (in the plane) which sends current through the sensitive relay. This causes the relay (really a switch) to close the circuit which makes the control mechanism turn the rudder. A similar outfit operates the elevator. Thus, for two controls, this system requires two receivers, two sensitive relays, two control mechanisms and a two-frequency transmitter. The details follow.

The receiver is a one-tube superregenerative type built to work on five-meter wave length. Extremely high sensitivity, broad tuning, freedom from ignition interference and low cost make this type of receiver suitable.

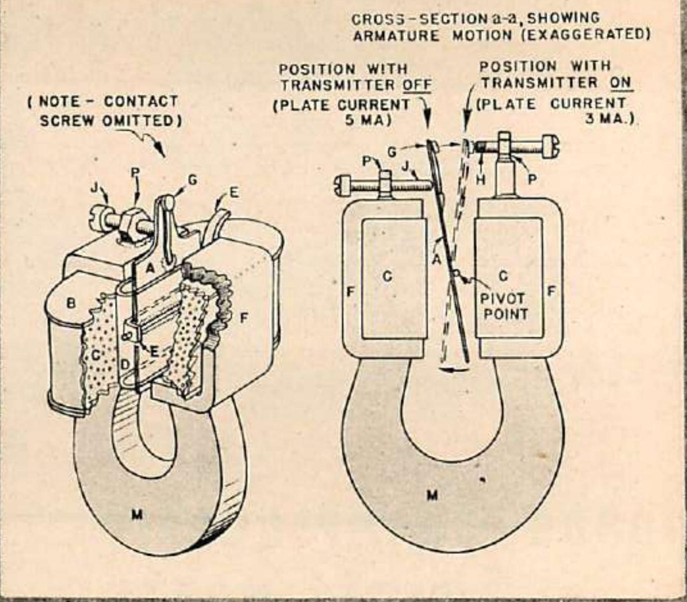
The circuit of the receiver is shown in Fig. 2 and below it are listed the values of the various components for using either the RK42 (not RK62) tube or the Type 30. The actual arrangement of the receiver parts is pictured in Fig. 3. Duplicate the parts as closely as possible, especially the national quench coil.

The receiver base of hard 1/8" sheet balsa has a hole cut in it for the tube to be glued in place. For lightness the base of the

ARRANGEMENT OF PARTS IN RECEIVER (FIGURE 3)



SENSITIVE RELAY DG-6 CUTAWAY SKETCH (FIG.4)



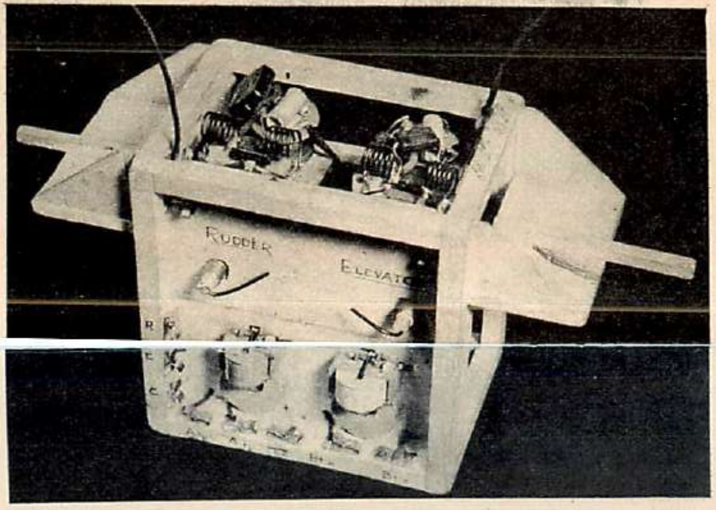
tube is removed (no, this won't bother the vacuum!) by soaking in hot water, unsoldering the wires at the prong tips, and gently working the base loose. Sometimes a coping saw will hasten this operation. The two center wires go to the filament, the outside wires to plate and grid. Glue the tube in place and also the quench coil and variable condenser. Note from the receiver photograph how the isolantite insulation has been chipped away to reduce weight. Careful use of a pair of pliers will do this.

Use as short wires as possible when wiring the receiver and make good soldered connections. Cement all parts in firmly so vibration cannot loosen them.

To obtain peak performance of the receiver a small amount of adjusting is required. If the construction has been carefully done and proper values used, this adjusting will be a minimum. The direct object in adjusting the receiver is to obtain the maximum possible plate current change through the relay and still retain good reliability.

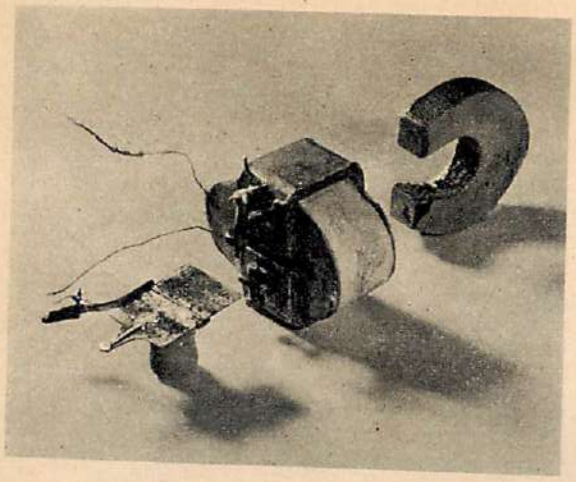
First hook up the receiver with the relay and a 5 or 10 milliampere meter in series. The antenna should be sticking up so as not to interfere with the operator's hands. Now there are three things to adjust, the main tuning condenser (c_1), the antenna padding condenser (c_2) and the variable grid bias resistor (R_1). To begin, screw the padding condenser about halfway down and set the grid resistor at full resistance. Turn on the transmitter with low power (or put it upstairs with high power) and tune (using an insulated aligning tool) the main condenser until a dip is noticed in the plate current. The receiver is in tune at the bottom of this dip. Leave this main condenser at this setting.

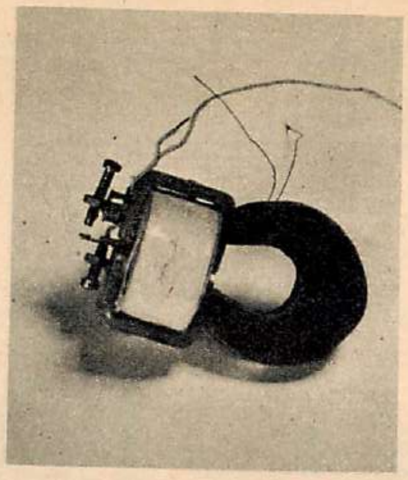
Sending slow dashes on the transmitter key should cause the meter to change about 0.3 of a milliampere. Keep sending the dashes and at the same time slowly decrease the grid resistor. The total plate current will increase and the change in plate current will do likewise. There will be found a certain region in the setting of the grid resistor, for which the change in plate current is tremendous. This is the setting we're after. The change is about 2 milliamperes for the RK42 and may be as high as 3 milliamperes for the Type 30 tube. Further decrease in the grid resistor brings only a very small change in plate current, or the set becomes inoperative. A systematic repetition of the foregoing procedure, starting each time with the antenna padder slightly different (say one half turn) will find the optimum operating conditions for the receiver. The current change will be rapid (not sluggish) in response and the setting of the grid resistor will not be critical. For the RK42 the idling plate current (transmitter off) is about 5 milliamperes, while the plate current with transmitter on is about 3 milliamperes. The Type 30 will have about the same or slightly higher values.



Receiver rack (two controls), shows two receiver antennae, sensitive relays, grid bias adjuster, battery clips. Wgt. 14 oz.; 6" high.

A Good family: Guffie, Class A; Guff, Class C; and the radio job, a development of the same design. Has both elevator and rudder control.



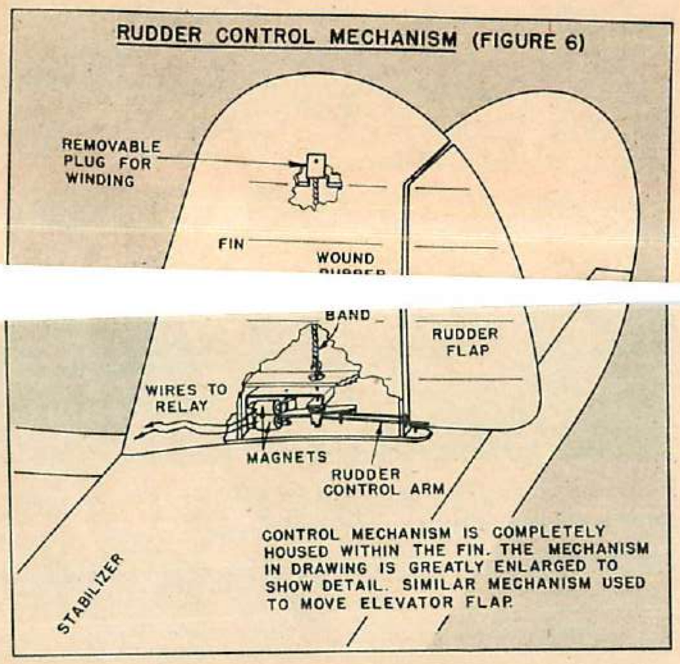


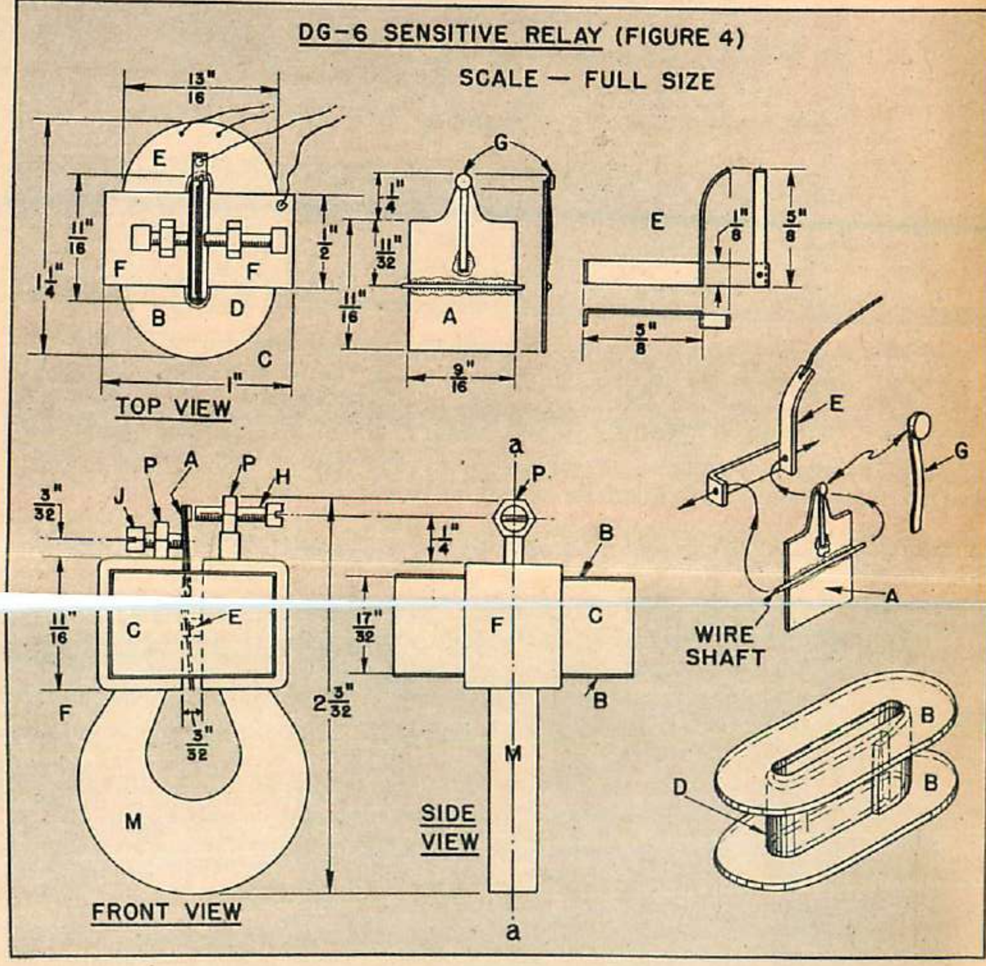
Far left—Sensitive relay (DG-6) unassembled, showing left to right: Armature and bearing, coil and field piece, and the permanent magnet. Left—The assembled sensitive relay weighs 2½ oz.

Below—Key: A—Armature ($^1/_{64}$" iron transformer lamination); B—Fiber coil ends ($^1/_{64}$" thickness); C—Coil (approximately 2,300 ft. #40 enameled copper wire, resistance 2,500 ohms); D—Celluloid coil form ($^1/_{64}$" sheet); E—Armature bearing ($^1/_{64}$" sheet brass); G—Armature contact and contact spring (contact, coin silver), (contact spring, shim brass ½ x $^1/_{32}$ x .010"); H—Contact screw (2-56, brass machine screw tipped with coin silver contact); J—Stop screw (2-56, brass machine screw tipped with cement for insulation); M—Permanent magnet (Alnico magnet); P—(2-56, nuts). Sensitivity of relay, one milliwatt. Weight is 2½ ozs.

GOODS' CHAMPIONSHIP RADIO MODEL

PLANS BY PAUL PLECAN





If a pair of headphones is inserted in place of the relay it is possible to hear the characteristic "hiss" of the superregenerative receiver. When a signal is tuned in, the hiss disappears and the drop in plate current occurs.

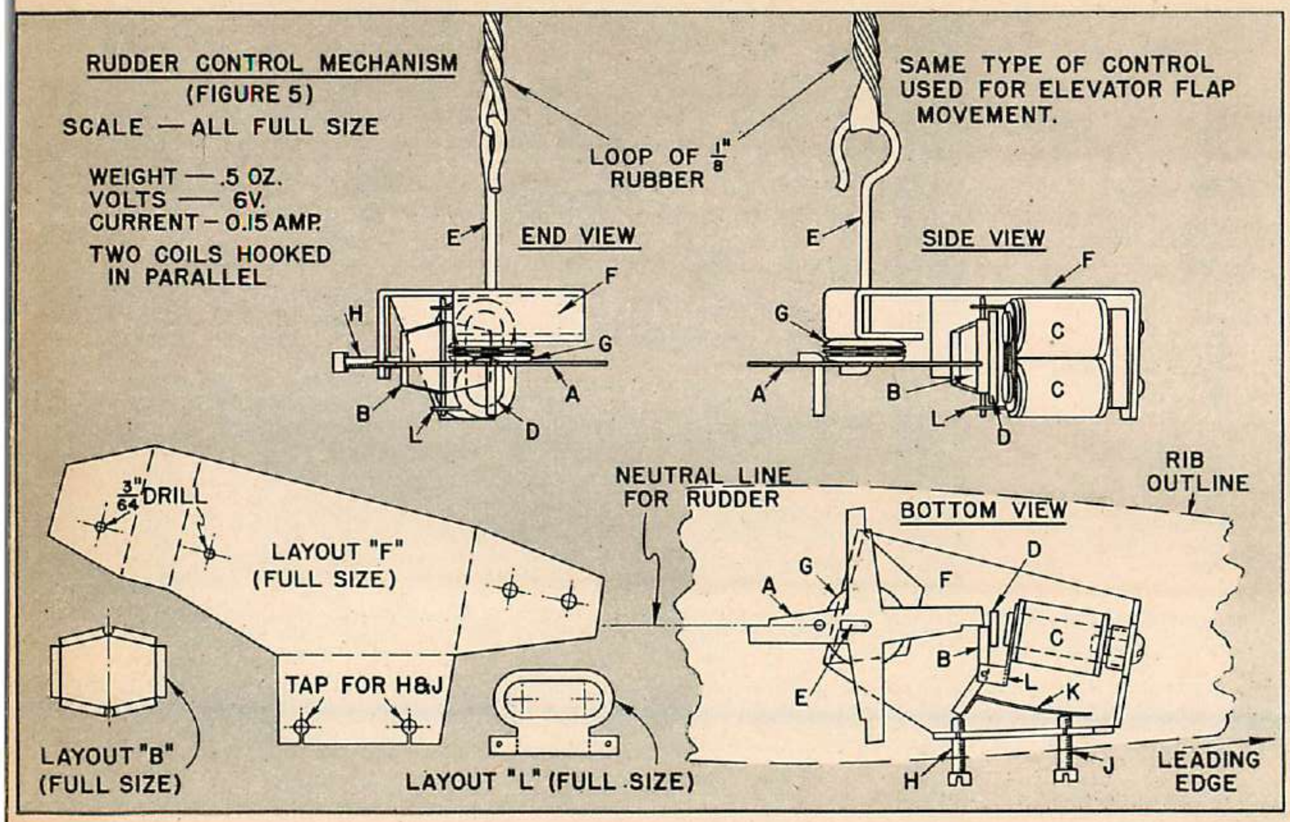
As the B battery voltage decreases with age, a slight readjustment of the grid bias resistor will be necessary. If the voltage falls below 40 volts, the capacity of the antenna padder may have to be reduced slightly. Experience will dictate how low a filament voltage may be tolerated. A voltmeter is extremely convenient for keeping a check on the voltage of the batteries.

By extending the recently developed superregeneration theory, it is not difficult to explain the theoretical basis for the required adjustment. Having the receiver well adjusted, now turn to the relay (Fig. 4).

Experience with the DG-6 sensitive relay will make its unique and excellent behavior apparent to the builder. The snap action will be surprising at first, but that makes for better control while flying. Here's the quickest way to adjust it. Put the milliammeter in series with relay (as when tuning receiver). The meter will read about 5 milliamperes. Back off both Screws J and H (see Fig. 4), leaving plenty of movement for the armature (A). Lean the armature against Screw H. Run in Screw H until armature just flips away and comes to rest on the other screw. Now with transmitter on (receiver plate current at about 3 milliamperes) run in Screw J until the armature leaps away from it. This sets the limit of swing of the armature. To assure positive operation, turn each screw in about one eighth turn.

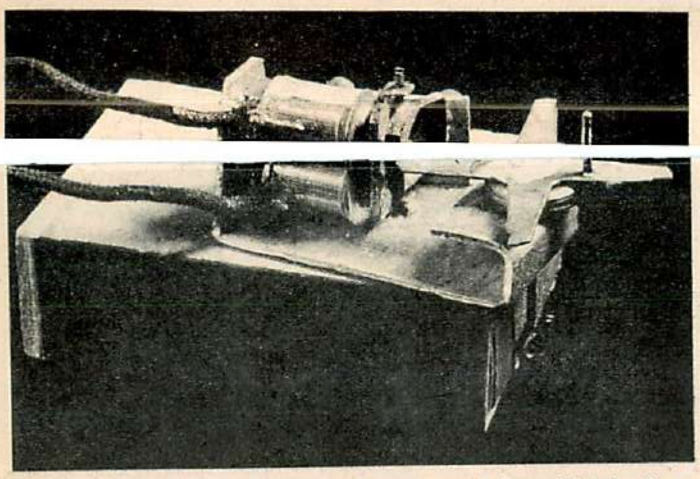
With transmitter on, the armature rests against Contact H. With transmitter off, the armature leans against Screw J. The relay will now respond to a rapid series of dots sent on a straight key or bug. Be careful you don't "while away" your evening just listening to the fascinating "click" of the relay.

The exact current at which the relay drops in and out may be determined by turning the grid resistor back and forth and noting the current when the relay clicks. In fact, it may be more convenient to adjust the relay to work half a milliampere "in" from either end of the operating range. That is, if the range is 3.0 to 5.0 milliamperes, then have the relay close at 3.5 and open at 4.5 milliamperes, thus giving both the receiver and the relay a little safety factor. A well-built DG-6 will work on a change of one half milliampere.

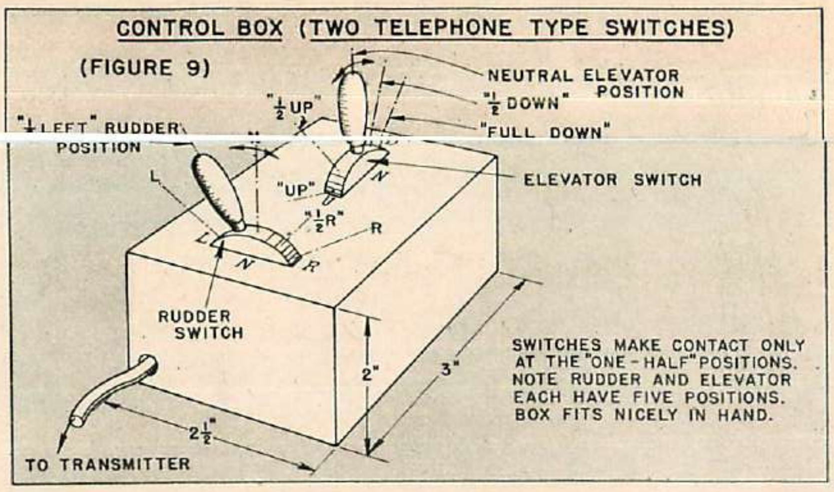


Rudder mechanism. Key: A—Escapement wheel ($1/_{64}$" sheet brass); B—Armature rocker (bent from 0.010" shim steel); C—Magnet coils, each coil 80 ohms, wound with #40 enameled copper wire (core $9/_{16} \times 3/_{16}$" diameter soft iron, back piece ½ x ¼ x $1/_{16}$" soft iron); D—Armature $1/_{32}$" soft iron; E—Wheel shaft $3/_{64}$" piano wire); F—Frame $1/_{32}$" sheet aluminum); G—Ball-bearing washer; H—Rocker adjustment screw, size 2-56; J—Spring adjustment screw, size 2-56; K—Rocker spring ($1/_{16}$" wide watch spring); L—Rocker bearing ($1/_{64}$" sheet brass, glued to end of coils).

The transmitter with control box on top. Due to theft of transmitter the night before the 1940 Nationals in Chicago, Bill Good had to build a new one from scratch in a single day. Was good enough to win!



Complete control mechanism resting on match box. Weighs ½ oz.



DG-6 SENSITIVE RELAY

The sensitive relay, called the DG-6, is one of the outstanding features of the receiving outfit. It has an unusual sensitivity of about one milliwatt, a high "drop-out percent" and a low weight of 2.5 ounces. A permanent magnet makes it a polarized relay. Its balanced construction and lack of springs causes it to be unaffected by vibration. (A very important point.) The contacts will easily carry 1.5 amperes. Inspection of Fig. 4 and the photographs reveals the essential parts. Study these carefully before construction is begun.

The coil form (D) is made from sheet celluloid bent around a $1/_{16}$ x ⅝" temporary core. The celluloid is overlapped and cemented and placed in a vise to dry. Cement on the fiber (or cardboard) coil ends (B) after being slotted. The coil (c) of some 12,000 turns is wound on this form. But that isn't as hard as it sounds. The No. 40 enameled copper wire may be obtained (places listed at end of article) on a fifteen-cent spool having just enough wire for relay and tail escapements. Wind the tail magnets and use the remainder of about 2,300 feet on the relay The resistance of the relay will then be about 2,500 ohms. Now we are ready for the winding.

Set up a hand drill (Pete Dillon used the family Mix-Master!) horizontally in the vise, with the coil form attached to the chuck. Also set up the wire spool parallel to the form and in front of it, making sure the spool spins freely. No. 40 wire is easy to break! Now crank the drill handle with one hand and guide the wire with the other hand. Even rows are not necessary or easy. Wind the coil firmly and as smoothly as possible. If the wire breaks, merely solder it, coat with clear dope (for insulation) and continue. It is wise to solder heavier wire leads to the fine wire. When finished winding, check the resistance and cover the coil with a strip of paper or empire cloth.

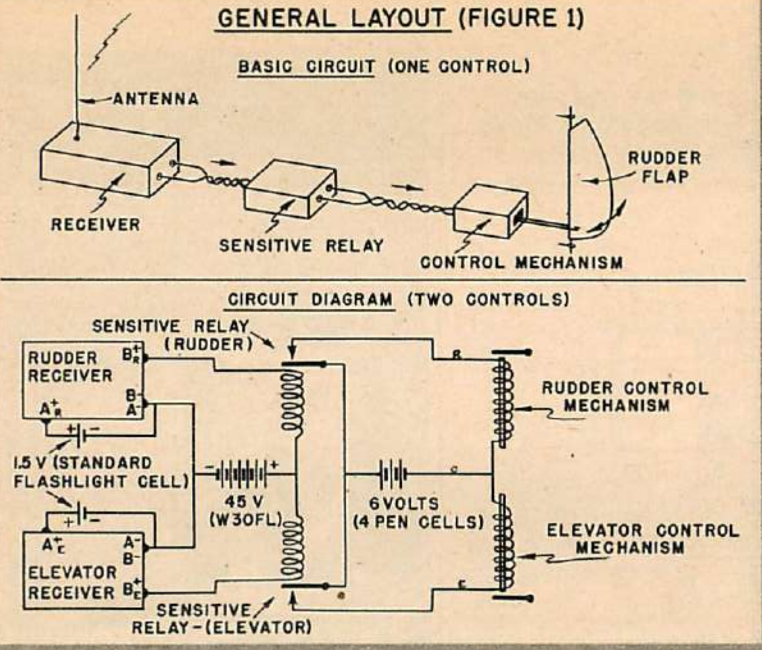
Cut out the armature (A) and solder to it the piano wire shaft. The contact (G) is a small piece of a dime. The contact spring (G) prevents the contact from sticking in operation, so it is very important. Solder the contact to one end of the spring and solder the other (lower) end of the spring to the armature.

Be sure to solder a connecting wire to (E), the brass armature bearing. The armature, when mounted in its bearing, should be capable of rotating freely back and forth through about 6 degrees.

The field pieces (F) are bent from soft iron. Solder on the two 2-56 nuts (P), noting one is mounted on a *(Turn to page 49)*

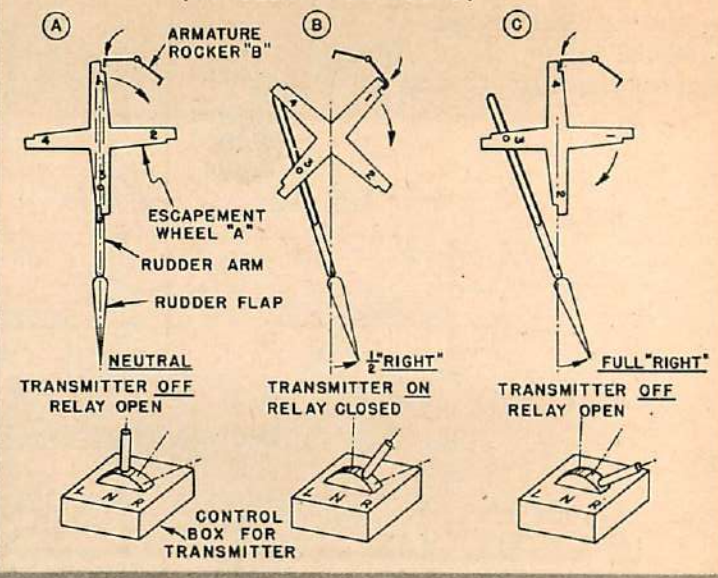
GOODS' CHAMPIONSHIP RADIO MODEL

GENERAL LAYOUT (FIGURE 1)

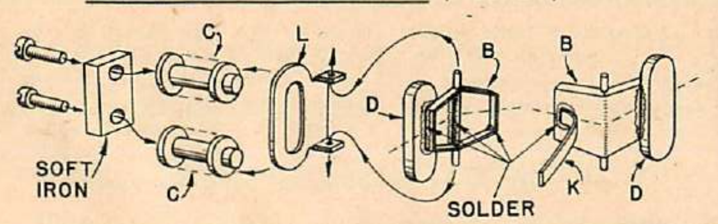


RUDDER CONTROL MECHANISM SEQUENCE (FIG. 6)

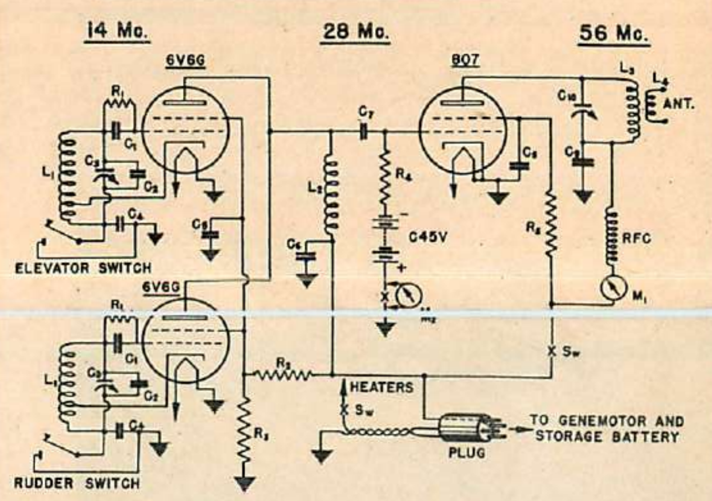
(AS SEEN FROM ABOVE)



RUDDER CONTROL MECHANISM (FIGURE 5)



TWO FREQUENCY R.C. TRANSMITTER (FIGURE 8)



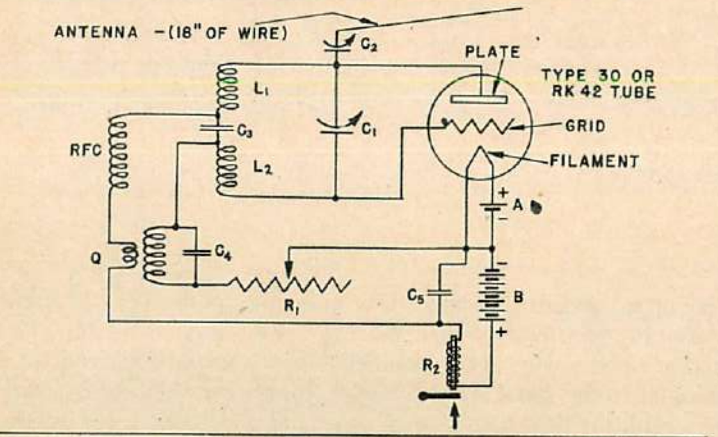
C_1, C_2, C_7 — 100 μμfd. MIDGET MICA
C_3 — 35 μμfd. MIDGET VARIABLE
C_4, C_5, C_6, C_8, C_9 — 0.002 μfd. MIDGET MICA
C_{10} — 15 μμfd MIDGET VARIABLE
R_1 — 0.1 MEGOHM, .5 WATT
R_2 — 50,000 OHMS, 2 WATT
R_3 — 150,000 OHMS, 1 WATT
R_4 — 25,000 OHMS, 1 WATT
R_5 — 25,000 OHMS, 10 WATTS
C — 45 VOLT MIDGET "B" BATTERY
M_1 — 100 MA. M_2 — 5.0 MA.

L_1 — 9 TURNS OF NUMBER 14, TAPPED ONE TURN FROM GROUND
L_2 — 8 TURNS OF NUMBER 14.
L_3 — 6 " " " 12.
L_4 — 3 " " " 12.

¾" DIAMETER FORM USED FOR ALL COILS MENTIONED ABOVE. WINDINGS SPACED DIAMETER OF WIRE USED. L_2 IS TUNED BY SQUEEZING OR PULLING OUT THE WINDING.

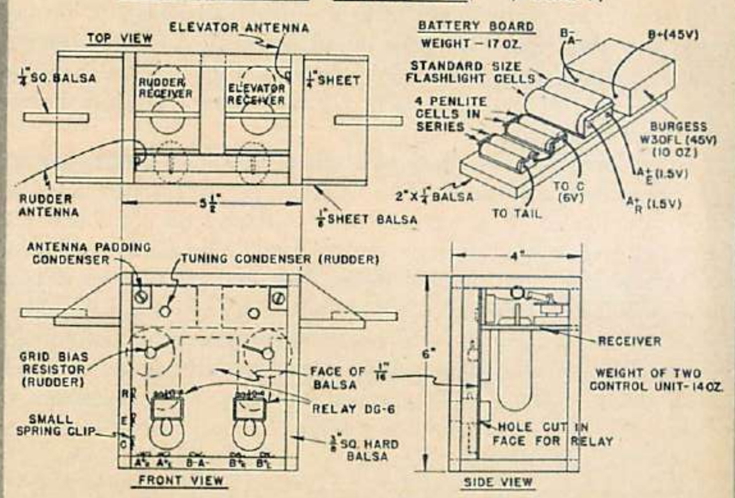
DESIGNED AND BUILT BY BILL GOOD, W8IFD.

CIRCUIT OF RADIO CONTROL RECEIVER (FIGURE 2)

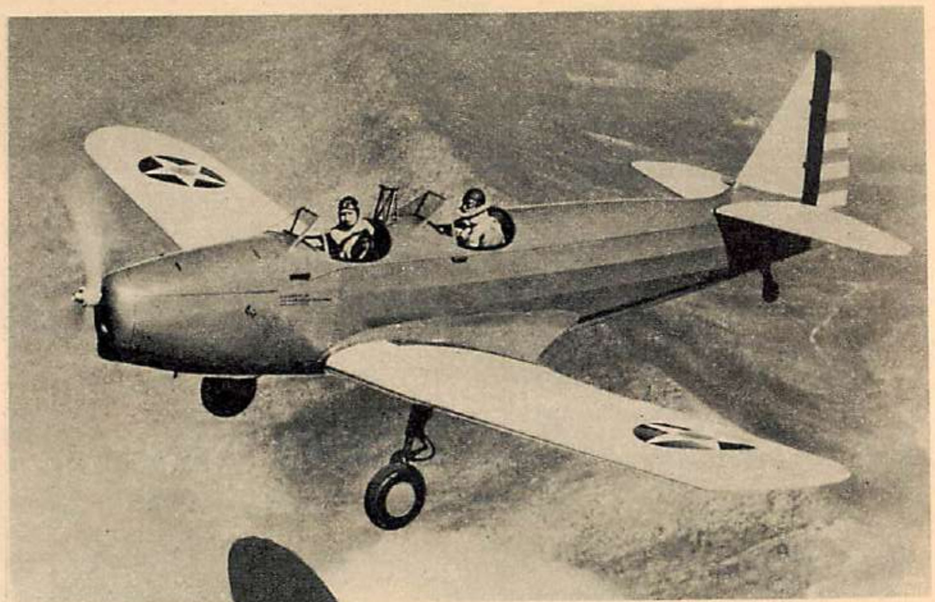


TUBE — TYPE RK42	TYPE 30
C_1 — 15 μμfd. NATIONAL ULTRA-MIDGET UM-15	C_1 — SAME
C_2 — ANTENNAE PADDING CONDENSER 3-35 μμfd. (SMALL SIZE)	C_2 — SAME
C_3 — 0.00025 μfd. MIDGET FIXED CONDENSER	C_3 — 0.00015 OR .0002
C_4 — 0.002 μfd. MIDGET FIXED	C_4 — .002 TO .005 μfd. USE VALUE THAT GIVES BEST RESULTS.
C_5 — 0.005 μfd. MIDGET FIXED	C_5 — SAME
R_1 — 10,000 OHM VARIABLE RESISTOR	R_1 — 25,000 OHM VARIABLE RESISTOR
R_2 — 2,500 OHM SENSITIVE RELAY - DG6	R_2 — SAME
L_1, L_2, - FIVE TURNS OF #14 WIRE, ⅜" DIAMETER SPACED TO OCCUPY A LENGTH OF 7/16".	L_1, L_2, — SAME
RFC - WIND #32 D.S.C. WIRE ON 5/16" DIAMETER FORM TO A LENGTH OF ¾". FORM IS MADE OF CEMENTED PAPER TUBE.	RFC — SAME
Q — NATIONAL QUENCH COIL. (LOW FREQUENCY OSCILLATOR COIL - NATIONAL OSR)	Q — SAME
A — 1.5 VOLT CELL, ONE REGULAR FLASHLIGHT CELL.	A — 3 VOLT BATTERY, TWO PENLITE CELLS
B — 45 VOLT BATTERY. BURGESS W30FL	B — SAME

RACK FOR RECEIVERS (TWO CONTROLS) (FIGURE 7)

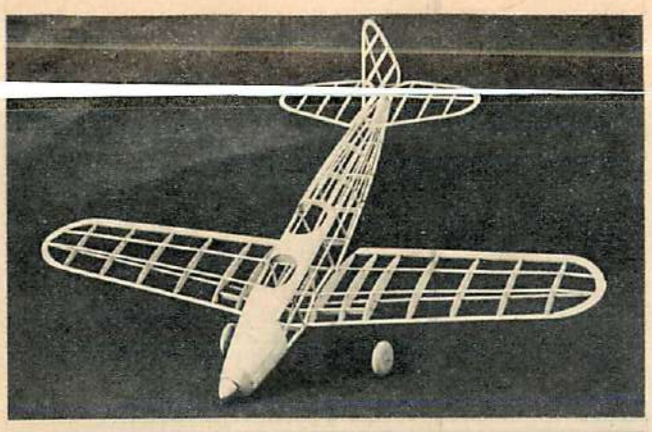


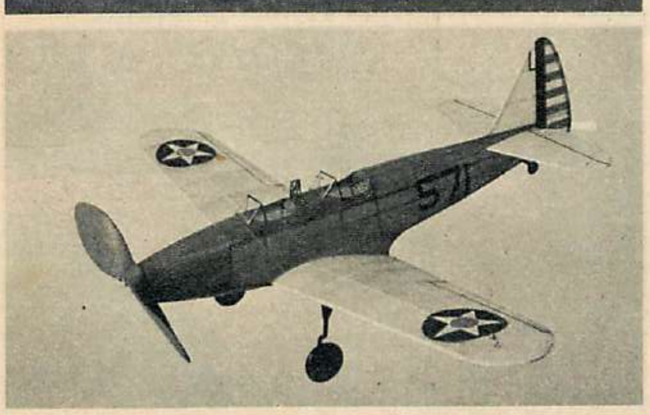
FAIRCHILD PT-19 ARMY TRAINER

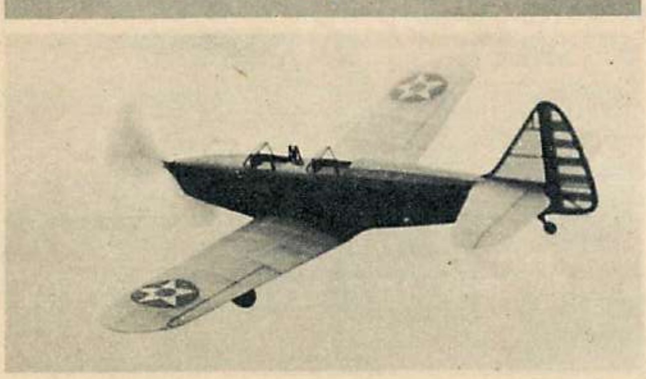


A real PT-19, breezing along at its 125 m. p. h. cruising speed, is the last word in primary trainers. Left—Completed model and, below, construction, ready-to-fly, and flight!

BY EARL STAHL







A "natural," either in the air or on the ground, your PT-19 model will be a standout.

DESIGNED to meet the rigid requirements for training planes of the United States army air corps, the Fairchild PT-19 is of a design similar to the majority of combat planes, yet it possesses the flight and strength characteristics required of training aircraft.

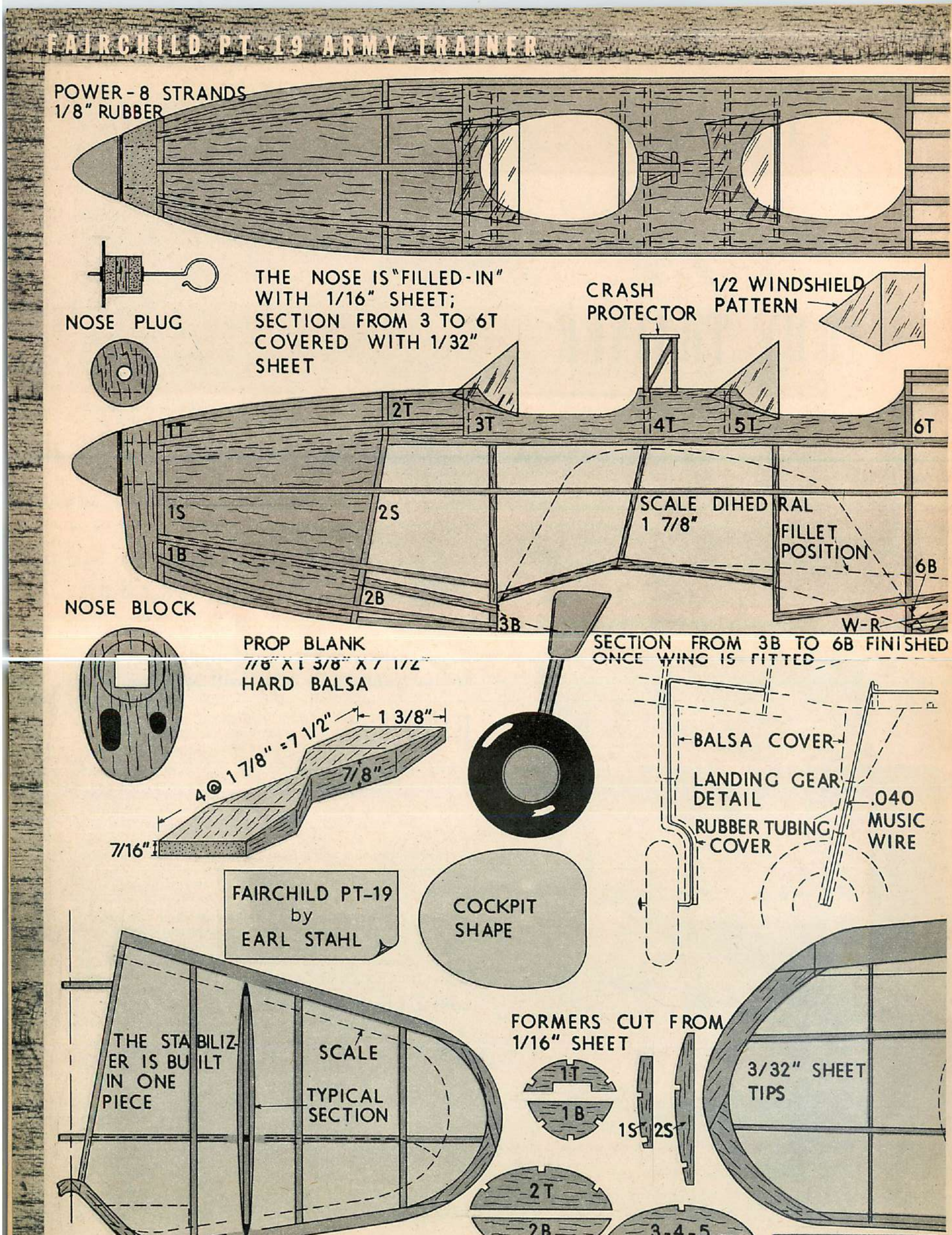
This two-place, low-wing monoplane is powered by a Ranger engine of 175 h.p. which gives a speed of 135 m.p.h. Construction is conventional, wood, metal and fabric being used; the cantilever wing is plywood covered. A high degree of visibility, an important factor in all training planes, is achieved by the use of the inverted, in-line engine and the open cockpits.

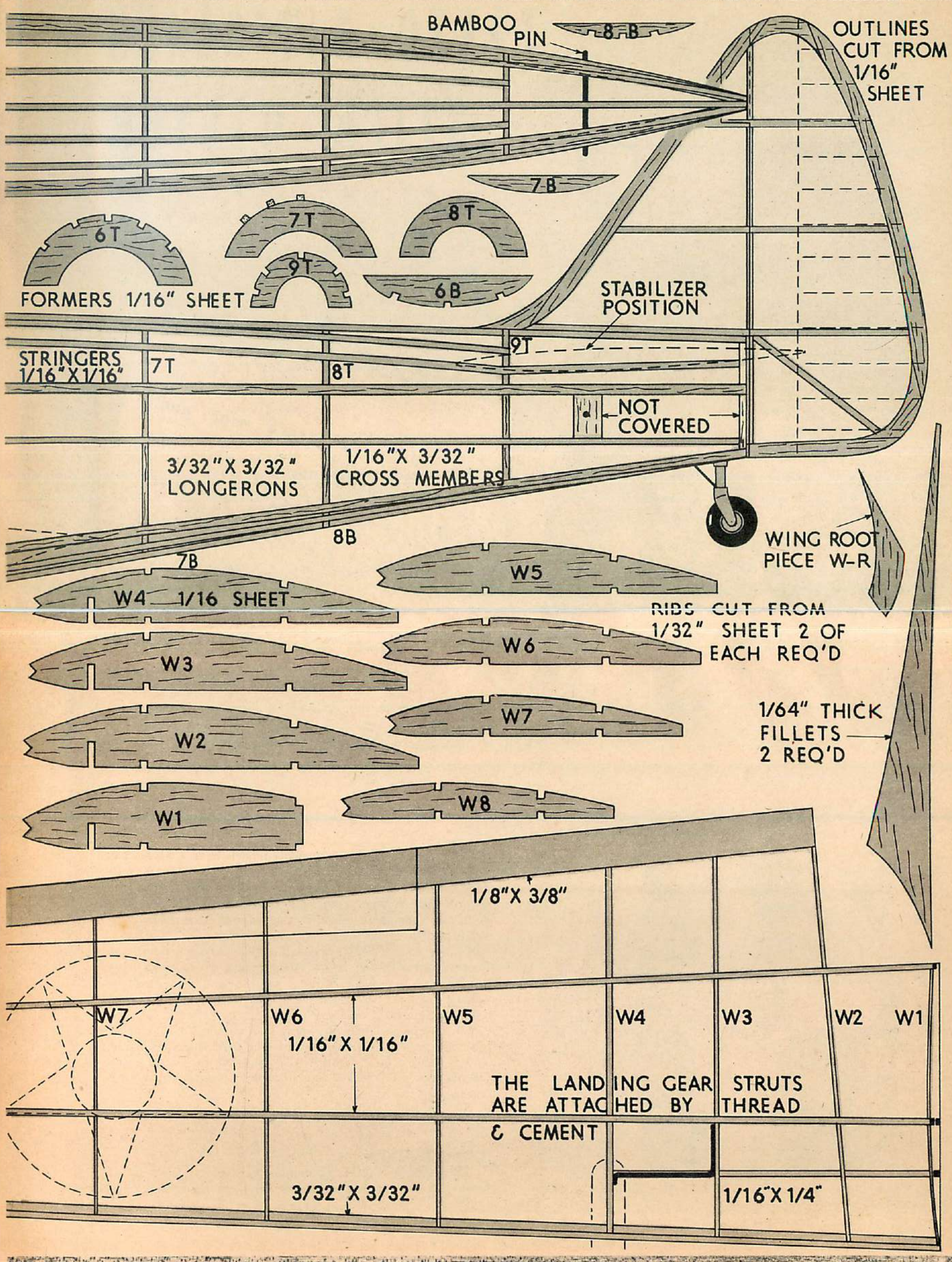
From the modeler's point of view the PT-19 affords a fine subject for a flying scale model. The test model was built to exact scale except for a slight modification of the stabilizer area and, of course, the enlarged propeller; it is capable of making flights of about one minute. Because of the plane's simple, efficient design, it is not difficult to construct an authentic, sturdy model from the full-size plans which are presented here.

CONSTRUCTION

The fuselage under-frame is constructed first. Work directly over the plan and make two side frames. The longerons are $^3/_{32}''$ square, while the uprights are $^1/_{16} \times {}^3/_{32}''$ balsa. When dry, the side frames are inverted over the top view of the fuselage and the cross pieces are cemented in place. Check frequently to assure proper alignment.

Formers are cut from soft grade $^1/_{16}''$ sheet balsa. It will be noticed that a number of the formers do not have notches for the stringers; where this is true, the stringers are to be attached directly to the sides, as shown. Cement the formers to their respective positions and then add the $^1/_{16}''$ square stringers. On the bottom of the fuselage between Sections 3-B and 6-B the stringers are omitted, since the wing is later placed in the re- *(Turn to page 46)*


FAIRCHILD PT-19 ARMY TRAINER
POWER-8 STRANDS 1/8" RUBBER
NOSE PLUG
THE NOSE IS "FILLED-IN" WITH 1/16" SHEET; SECTION FROM 3 TO 6T COVERED WITH 1/32" SHEET
CRASH PROTECTOR
1/2 WINDSHIELD PATTERN
1T
2T
3T
4T
5T
6T
1S
2S
1B
2B
3B
6B
SCALE DIHEDRAL 1 7/8"
FILLET POSITION
W-R
NOSE BLOCK
PROP BLANK 7/8" X 1 3/8" X 7 1/2" HARD BALSA
SECTION FROM 3B TO 6B FINISHED ONCE WING IS FITTED
4 @ 1 7/8" = 7 1/2"
1 3/8"
7/8"
7/16"
BALSA COVER
LANDING GEAR DETAIL
RUBBER TUBING COVER
.040 MUSIC WIRE
FAIRCHILD PT-19 by EARL STAHL
COCKPIT SHAPE
THE STABILIZER IS BUILT IN ONE PIECE
SCALE
TYPICAL SECTION
FORMERS CUT FROM 1/16" SHEET
3/32" SHEET TIPS
1T
1B
1S
2S
2T
2B
3-4-5
3-B


BAMBOO PIN
8 B
OUTLINES CUT FROM 1/16" SHEET
7 B
6T
7T
8T
9T
6B
FORMERS 1/16" SHEET
STABILIZER POSITION
STRINGERS 1/16" X 1/16"
7T
8T
9T
NOT COVERED
3/32" X 3/32" LONGERONS
1/16" X 3/32" CROSS MEMBERS
8B
7B
WING ROOT PIECE W-R
W5
W4 1/16 SHEET
RIBS CUT FROM 1/32" SHEET 2 OF EACH REQ'D
W6
W3
W7
1/64" THICK FILLETS 2 REQ'D
W2
W8
W1
1/8" X 3/8"
W7
W6
W5
W4
W3
W2
W1
1/16" X 1/16"
THE LANDING GEAR STRUTS ARE ATTACHED BY THREAD & CEMENT
3/32" X 3/32"
1/16" X 1/4"

LANZO NATIONALS STICK WINNER

BY CHESTER LANZO

A 300 square inch wing and timer rudder control enable this 4½-foot job to stick in any thermal. Best flight is 63 minutes!

Lanzo holds "bomber," Korda winding. Both are from Cleveland.

MOST of the present-day rubber models have a wing area of approximately 200 square inches and weigh almost 8 ounces. This makes the average model 2 ounces overweight. When figured in percentage it gives one something to think about, and, with this thought in mind, I designed this stick model, which won the 1940 Open Stick Contest in Chicago.

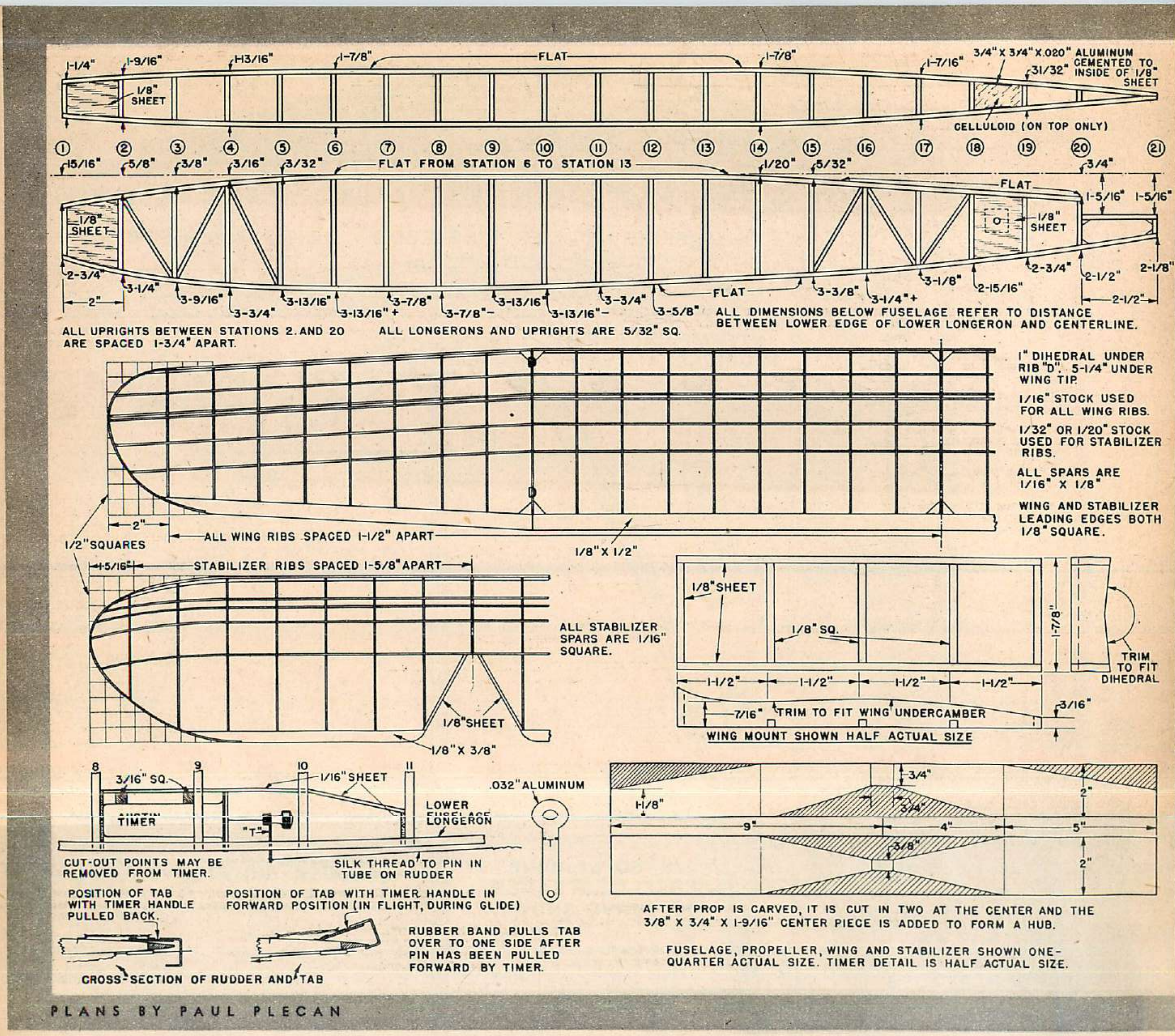
I knew a large 300-square-inch model would not weigh much more than the former 200-square-inch job, yet it would have a larger wing area and a lighter wing loading. This would produce a ship with improved flight characteristics. The original model weighed 9¼ ounces.

On its first test hop this ship did 7 minutes and on its first official flew 14 minutes without gaining more than 300 feet altitude. Other contest flights by this ship went for 15, 10, 63, and 30 minutes. It is stable, consistent, and sensitive to the slightest risers.

Second consideration was to produce a model of simple design and construction.

CONSTRUCTION

The fuselage being of rectangular cross section, the usual procedure of building the two flat sides first, and then placing in the



top and bottom cross pieces, was used. Details of the construction are included in the drawings. Before covering the fuselage round off the longerons and sand the outer framework, taking care that no bits of glue remain within the body, for, if they do, they will surely cut the rubber.

The flight timer is optional and may be discarded if the builder wishes. Note that the usual rear hook has been dispensed with. A $^3/_{16}$" dowel is slipped in place through the sides of the fuselage, and, in addition, small aluminum plates are cemented to the inside surfaces of the sheet-balsa fill-in. Upon finishing the nose block be sure to put in the proper amount of downthrust and sidethrust; otherwise the propeller blades will not fold properly against the sides of the fuselage. Paint a small red mark on top of both the nose block and the fuselage, so that the nose plug may be slipped quickly in place after winding.

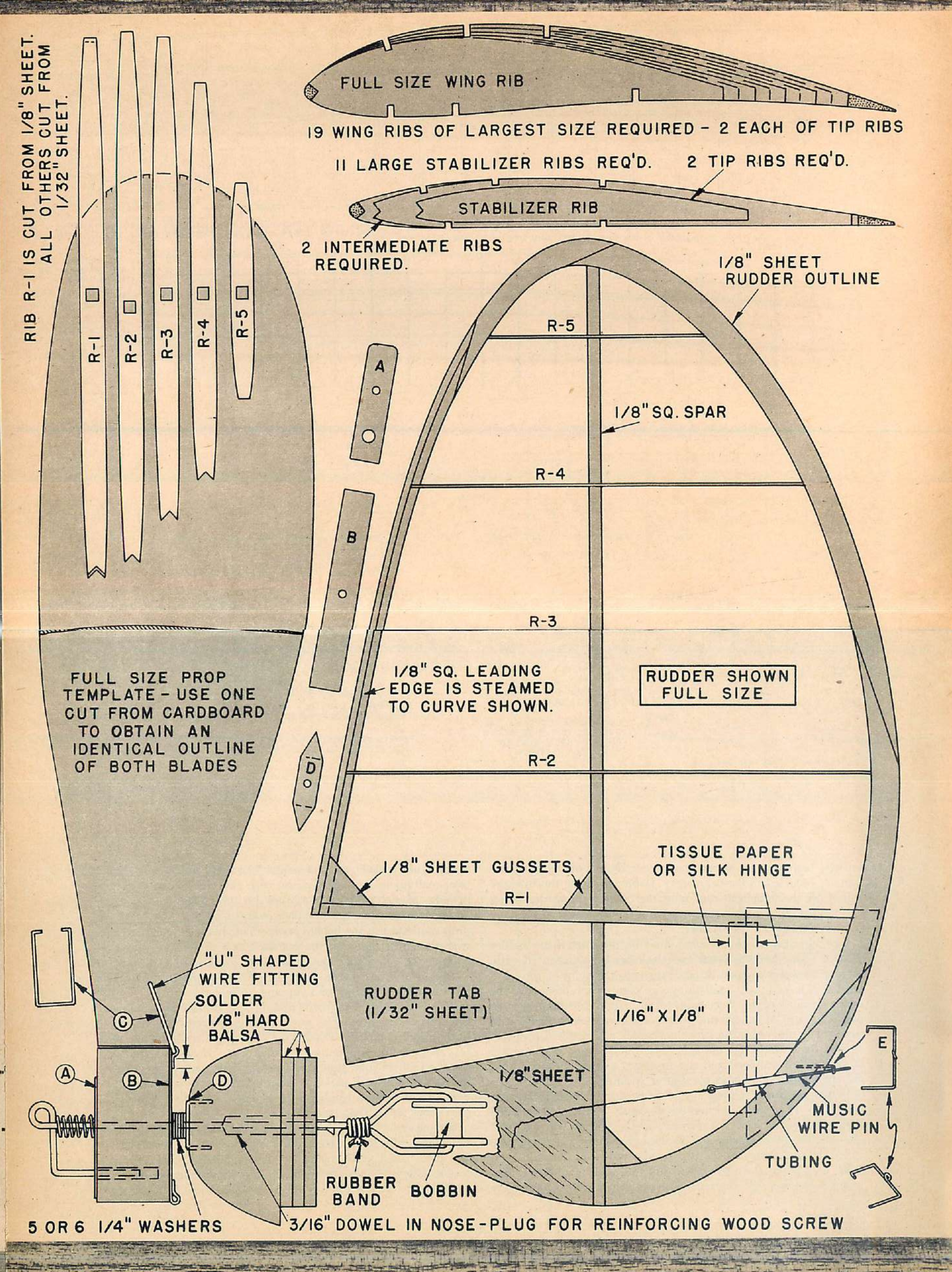
When carving the prop try to leave as much blade area as possible. This will give maximum climb. When making the hinge fittings be sure that they are loose, so they will not bind after the tensioner catches. This might cause the plane to spiral in. The $^1/_{16}$" holes in the prop and nose fittings should be a loose fit, so that the spring will pull the catch against the stop without binding. If the left-hand blade will not fold properly against the fuselage, a small rubber band will pull it up. Make two small hooks from .016 music wire and glue one at the trailing edge of the blade one inch from the hub. Glue the other one on the hub just one quarter inch from its center. To bend the prop shaft start at the bobbin hook. This hook should be square with the sides clamping the bobbin to prevent its turning and twisting, or "climbing" the hook.

The bobbin has proved itself beneficial in preventing cuts in the rubber and rattling or wrapping around the hook.

The wing is of a high lift section and utilizes the multispar type of construction. Cut out the necessary ribs and assemble in the usual manner. Be sure to prop up the trailing edge with $^1/_{16}$" balsa before cementing the ribs to it. If desired, the wing may be built in four panels. However, this necessitates getting the end ribs on each panel at the proper slant to allow for dihedral. I have found bamboo tips the easiest to make. They absorb shock better than balsa.

The elevator is quite large. It is built in the same manner as the wing. The ⅛" square leading edge must be bent over steam and then baked in an oven for a few minutes to make it rigid.

The rudder is of a streamlined section and contains only one main spar. When gluing the rudder on the *(Turn to page 58)*


RIB R-1 IS CUT FROM 1/8" SHEET. ALL OTHERS CUT FROM 1/32" SHEET.
R-1
R-2
R-3
R-4
R-5
FULL SIZE WING RIB
19 WING RIBS OF LARGEST SIZE REQUIRED - 2 EACH OF TIP RIBS
11 LARGE STABILIZER RIBS REQ'D.
2 TIP RIBS REQ'D.
STABILIZER RIB
2 INTERMEDIATE RIBS REQUIRED.
1/8" SHEET RUDDER OUTLINE
A
B
D
1/8" SQ. SPAR
1/8" SQ. LEADING EDGE IS STEAMED TO CURVE SHOWN.
RUDDER SHOWN FULL SIZE
FULL SIZE PROP TEMPLATE - USE ONE CUT FROM CARDBOARD TO OBTAIN AN IDENTICAL OUTLINE OF BOTH BLADES
1/8" SHEET GUSSETS
TISSUE PAPER OR SILK HINGE
"U" SHAPED WIRE FITTING
SOLDER
1/8" HARD BALSA
RUDDER TAB (1/32" SHEET)
1/16" X 1/8"
C
E
1/8" SHEET
MUSIC WIRE PIN
TUBING
RUBBER BAND
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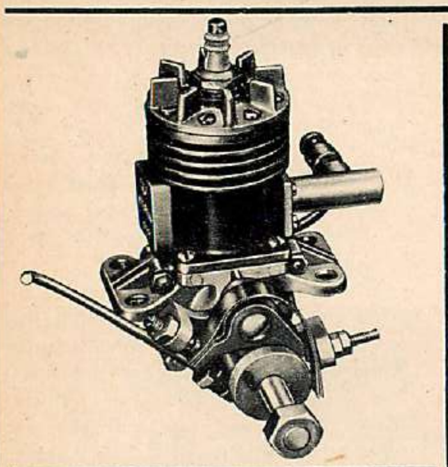

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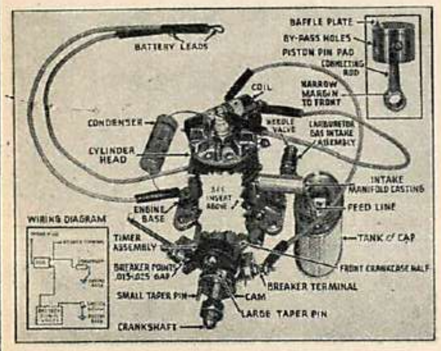

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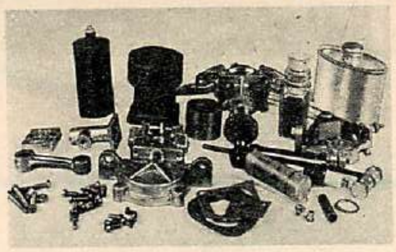

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H. H., Midlothian, Ill.—"Motor assembled correctly and performs perfectly. I am fully satisfied."

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D. D., Canton, Ohio—"Four fellows in my neighborhood have an engine like yours and they are well pleased. Please send me your $5.00 gas engine kit."

N. T., Sparks, Nevada—"I have one of your motors and it has given good service for nearly five years."

M. M., Richmond, Va.—"I received my gas engine Christmas and am fully pleased with it."

F. S., New Haven, Conn.—"I was very much surprised with the motor. It exceeded my expectations so far as construction is concerned and will compare favorably with motors three times the price."

L. N., So. Euclid, Ohio—"Received my finished motor. I am very pleased with it and runs fine. I will be glad to encourage others to get G.H.Q. motors."

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The Arrow

(Continued from page 26)

brads in order to hold it in position. Use a T square and be sure that the fire wall is mounted absolutely straight up and down and straight across. Cut the ends of the longerons and fit them to the motor blocks as shown. Before gluing them, glue a piece of $^3/_{16}$" scrap sheet, cut to shape, in the space between the longeron and the motor blocks. Then glue to longerons, to these pieces, and to the motor blocks. Glue pieces of ½" square balsa along the motor blocks, below the longeron (as shown on plan) and cut and sand to shape. Cut the nose block, making an opening to fit your motor, and glue to end of motor blocks.

Glue all formers to longerons as shown on plan. Then glue the bottom longeron of $^3/_{16}$" square balsa along the bottom of each former. Glue Former N from fire wall to nose block. Glue R1 in place. Formers 1A1-1A2 and 1A3 are not glued in until later.

Remove pins that hold one side of longerons and glue a piece of $^1/_{16}$" soft sheet balsa, four inches wide, to the side of the body. This piece runs from the *center* of the fire wall to the center of Former 4. Glue a piece of the same sheet from the center of the fire wall to the nose block. Then glue a piece of $^1/_{32}$" sheet, 4" wide, from the center of Former 4 to the center of Former 8. Do not glue $^1/_{32}$" sheet on the bottom rudder until you have covered the other side of the fuselage as last described. Trim off the balsa covering along the edge of the bottom longeron. Then remove the pins from the other longeron, and cover the other side of the fuselage as you covered the first side. Trim off excess balsa from the edge of the bottom or keel longeron. Cover the body from Former 8 to the front edge of S2 with one piece of $^1/_{32}$" sheet balsa. This piece covers R1 and forms part of the bottom rudder. As quickly as you can, cover the opposite side of the fuselage in the same manner, making sure that the rudder lines up properly. All sheets can be held with pins until the glue has dried. The writer neglected to mention that all sheet should run *only* to the center of the longerons along the middle of the body. This will leave a lap for gluing the top sheeting.

As soon as the glue has set well, remove the fuselage from the board by first pulling the brads holding the fire wall. Check the fuselage and be sure it is in perfect alignment. If it is not, soak it in hot water, place it on a flat surface, weight it down and allow it to dry at least twelve hours.

Next build the entire wing-mount section as indicated on the plan and fit it carefully to the fuselage. Be sure that the peg which goes through the fire wall fits tightly and does not allow the wing mount to move in front. Cover the vertical part of the wing mount with $^1/_{32}$" sheet. Then cover the rounded part of the mount with soft $^1/_{16}$" sheet.

Glue Formers 5AT and 5T in place and be sure that Former 5AT fits flat against Former 5A on the wing mount. Glue the rest of the body formers in place. Glue Former S in place and follow this by gluing Former S1 in place. Glue tail-mount pegs in place, using plenty of glue to hold them. Cover top of body, one half at a time, with $^1/_{32}$" soft sheet from Former 5AT to Former 8T. Also cover with $^1/_{32}$" sheet from Former 9T to S2. This sheet runs from middle of side longerons to top of Former S. Glue tail-mount platform in place.

Glue $^1/_{16}$" round birch dowel in place along Former 4 as indicated, for holding wing-platform rubber bands. This dowel runs through entire fuselage. Glue 1A1, 1A2, and 1A3 in place. Build coil box and glue in place. Glue in strip of ⅛" hard sheet after having attached battery box to it. Wire motor according to standard hook-up, but leave unattached wire for wiring to flight timer. The timer is used for balancing and does not go in until entire plane is finished, including covering and doping. Booster points are not indicated on the plan, this being left to the modeler's own choice and judgment.

Cover the fuselage and wing mount with silk, wet and shrink. Give the same no more than two coats of colored dope. Be sure to coat the motor blocks, fire wall and inside of the nose with two or three coats of dope.

The sheet $^1/_{16}$" balsa, covering the top part of the nose, is attached last and should be cut out to fit your motor. Cover this with silk and dope inside and out with two coats of colored dope.

In making the wing, cut out W1, W2, W3, and W4 from $^3/_{16}$" medium-hard sheet balsa. Glue W2 and W3 together. Place wing plan on a flat surface, cover with wax paper and pin W1, W2, and W3 in place. Place a piece of $^1/_{32}$" scrap balsa under trailing edge of wing at each notch in trailing edge. Do not extend the $^1/_{32}$" scrap back more than ⅛" under the trailing edge. This scrap piece is used to maintain the undercamber of the airfoil. Next soak the leading edges in hot water and pin in place on the plan. Bevel the edge of W4, where it joins the leading edge and W3, in order to secure a good fit, and glue it in place. Glue Ribs 7, 8, 9, 10 and 11 to the leading and trailing edges. When glue is dry, slip spars in place and glue well. Glue Ribs 2, 3, 4 and 5 in place. Slip spars in place and glue well. Be sure all spars do not extend below the bottom of the ribs as this would spoil the contour of the airflow. Remove pins that hold the tip end of the wing to the working surface and lift it off the plan. File or sand the leading and trailing edges and tip of this section, to proper airfoil shape as indicated by the plan. With the aid of blocks, place the tip section in place with the tip itself raised 3" from the working surface. Cut the ends of the spars, where they are glued to the center-section spars, so that Rib 6 will fit flush against the ends of the tip spars and will also be perpendicular to the working surface. Also level the leading and trailing-edge joints to secure a good fit. Glue the tip section to the center section,

using plenty of glue, and allow to dry well before removing from plan. After the wing half has dried and been removed from the plan, glue the bracing strip in place behind the joint of the center and tip sections, where the leading edges join. Glue Rib 6 in place. Sand or file the leading edge and trailing edge of the center section to proper shape. Glue False Ribs D and E in place. Place wing on a flat surface and check for warp. If there is any warp, soak the wing in hot water, place on flat surface and hold down with weights. Allow twelve hours for drying. This will remove any warp.

Build the other half of the wing in exactly the same fashion as above outlined. When the two halves are completed, they can be joined in the center. In this place, the spars are overlapped by pushing the two spars on one half of the wing inside of the two spars on the other half of the wing. Try this first one way and then the other in order to determine which combination brings the leading and trailing-edge joints together for the best fit. Bevel the spar tips and leading and trailing-edge tips to secure a perfect fit. Pin one side of the wing to a flat working surface, place the other half in position and use blocks to raise the other half of the wing two inches above the working surface at the point where the polyhedral begins. Be *positive* that at this point both the leading and trailing edges are exactly two inches above the working surface. This will insure a level wing without warp. Glue the wing well at the center and allow several hours for drying. Remove wing from working surface and glue in braces along leading and trailing edges where they join in the center. Sand all joints to proper shape. Glue Rib 1 in place. With fine sandpaper, *carefully* sand the top and bottom edges of Ribs 2 and Rib 1 down about $^1/_{32}$". Glue pieces of $^1/_{32}$" sheet balsa across center section between Ribs 2. This sheeting should be glued to the bottom first. It runs, with the grain crosswise to the ribs, from Rib 1 to Rib 2 on each half. Glue in the piece of birch dowel which is used as a key. This piece extends out of the bottom of the wing about ⅛". Then cover the top of the center section with $^1/_{32}$" sheet balsa. Sand this covering until it is smooth.

We recommend covering the wing with Silkspan as it is light and strong. Cover the bottom of the wing first and be sure that the paper is glued to each rib in order to maintain the undercamber of the airfoil. The grain of the paper should run from tip to tip. Dampen the paper, one half at a time, and place on flat surface with weights until dry. Then do the same for the other half. Dope each half, one side at a time, and weight on flat surface while drying. Do not give the wings more than two coats of dope. This method of weighting the wings, while it takes longer, will insure a flat wing when you are finished. When the bottom half of the wing is covered and doped, then cover and dope the top half in the same manner, except that you do not have to glue the papers to each rib. The finished wing should not weigh over four ounces.

(Turn to page 45)

The Arrow

(*Continued from page 43*)

After finishing the wing, it should be placed upon the wing-mount platform, carefully aligned, and an eyelet glued into the wing-mount platform to hold the birch key. The writer used only one key and aligned the wing after each flight. Glue pieces of balsa along the edge of the wing-mount platform and sand to the shape of the wing undercamber. Be sure to secure a snug fit for the wing on the platform. Also be sure that both the trailing edge and the leading edge are resting on the platform. The use of balsa strips along the edge of the platform increases its strength and prevents splitting.

The stabilizer is of conventional construction and uses a modified "Clark Y" airfoil. It is of large area and is extremely effective.

Place the plan on the working surface and cover with wax paper. Glue the trailing-edge parts together on the plan, holding them down with pins. The leading edge is one piece of medium-hard ¼" square balsa. *Soak* it well in hot water, knead with your fingers to approximate shape, and glue in place. Hold it on the surface with pins. It is an excellent idea to put a coat of glue along the inside edge of this piece, as this will reduce pull and warping tendency. Glue the tapered spar in place. Glue all ribs in place. When the glue has dried for at least six hours, remove stabilizer from plan and glue a piece of $^1/_{32}$" sheet, in one piece, from the leading edge to the back of the trailing edge and between the No. 2 ribs on the stabilizer. The piece of sheet is glued on the bottom of the ribs. Glue the tail key of the ⅛" round birch dowel in place, extending about ⅛" below the surface. There are two pieces of $^1/_{16}$x$^3/_{16}$" balsa which run along the joint where the rudder is glued on top of Rib 1. These pieces should not be glued in place until after the rudder is glued onto Rib 1. The pieces run from the leading edge to the trailing edge, add strength to the rudder mount and also provide a place for attaching the covering. Sand the edges to proper airfoil shape.

The rudder is of conventional construction and needs little in the way of construction hints. Glue the outline (R1-R2 and R3) together on the plan. Allow glue to dry. The airfoil is streamlined and is formed by gluing $^1/_{16}$" balsa strip on each side of the $^3/_{16}$" square spar. We suggest that you glue the spar to the top of the rudder and at the same time glue the bottom strips in place, holding them with pins. Be sure to glue both strips (i. e., on each side) at the same time. Then glue the remaining strips in place. Cut the rudder tab out of light sheet aluminum. Bend the hinges so that two fall on one side of the trailing edge of the rudder, and the middle one falls on the other side of the trailing edge. The rudder should be sanded to streamline shape before gluing the tab in place. Glue the finished rudder on top of Rib 1 on the stabilizer after gluing the two $^1/_{16}$x$^3/_{16}$" strips, mentioned above, in place. Place the stabilizer on the fuselage platform, align the rudder perfectly and mark the key position. Glue an eyelet at that point and on the stabilizer platform. Next, holding the rudder in perfect position, turn the fuselage over and carefully mark a line with a pencil on the bottom of the stabilizer and along the rear edge of its platform. Remove stabilizer from fuselage and glue a small piece of ⅛" square hard scrap balsa along each side of the stabilizer, at the point indicated by the pencil marks. The pieces will key the stabilizer in place.

Cover the bottom of the stabilizer with Silkspan. Shrink and give no more than two coats of dope. Be sure there is no warp. Cover the top of stabilizer and the rudder with *tissue*. Shrink and give two coats of dope.

When the entire plane has been completely finished, doped, wired, motor placed, batteries in sockets, and everything made ready for flight, with the exception of the flight timer, carefully balance the plane at the exact center of the wing—fifty-percent point of wing chord. By balance, we mean with the thrust line horizontal to the floor. Reach this point of balance by moving the flight timer around inside the fuselage until you have it in the proper place. Then mount it at this point. Your plane, finished, should weigh from twenty-two to twenty-four ounces.

FLYING

Take the plane to an open, smooth field, where you have plenty of room. You can, if you wish, try gliding it by pointing the nose at a spot about sixty feet ahead of you on the ground and give it a firm shove—into the wind. If you have balanced according to instructions, the plane will ride out with a slight tendency to nose up. Here is an unusual statement. If you have built this plane according to instructions, have the rudder set in a neutral position, you can open your motor wide for a test flight. Obviously you probably will not have perfect adjustment on the first flight, but this model will not spiral into the ground. It is extremely stable and will pull out of almost any bad position.

With your rudder set in a neutral position, make your first flight and observe the climb under power, and the glide. The climb should be in a slow spiral—either right or left. If the climb is too straight and the model hangs on the prop, move the tab very slightly either right or left until you have obtained a proper climb. If, after the motor cuts off, the plane glides straight, it should have a tendency to dip a little. This indicates proper balance. Subsequent rudder tab adjustments to cause the model to circle either right or left in about four-hundred-foot circles will eliminate this dip.

With respect to motors, this plane operates best with the Ohlsson "19" or motors of like bore and stroke. The smaller bore Class A motors will not bring out its peak performance because of insufficient power. An Ohlsson "23" takes it up like a skyrocket.

Engineering Made Easy

(Continued from page 18)

use that is most helpful when those formulas are to be used in an examination.

I had been building gas models for four years before I entered Boeing, and had spent many hours tinkering with motors and looking for the thousand and one bugs that always creep into this type of ship. I came to regard all of this taking apart, regasketing, and rewiring as part of the price paid for being an advanced aëromodeler. Model engines, however, operate upon exactly the same principles as do the real ones, and the knowledge gained from work with the little ones is applicable to the real thing. The fact that model engines are practically all of the two-stroke cycle type does not prevent their teaching a lesson about dirt in the bearings or in the fuel. The same thing can be learned from a real engine, but the boy who has had his Baby Cyclone ruined by grit has learned his lesson just as well as has the mechanic who has ruined a twin-row Wasp.

The school's electricity course covers many elaborate features of ignition systems, but the wiring of gas models provides a fundamental knowledge of the subject that is not wasted merely because the material is gone over again and elaborated upon in complete detail.

The wood shop gave my ten years' experience in the handling of thin strips of wood a chance to express itself, where high school and college manual training shops, with their bulky projects, had not. Steaming strips of wood and holding them in jigs was practically a habit, as was the cutting of gussets and clamping of glued joints.

The construction and repair of aircraft is another shop course where model experience comes in handy. Models, while smaller and more simple than real machines, are nevertheless faithful replicas of them as far as basic structures and principles of operations go. The course covers all the major parts of the airplane, and the lessons learned from models again prove their worth. In one project, for instance, the problem is to determine the pitch of a certain propeller. Having done this with model props many times makes this problem a familiar, and therefore simple, one for a model builder.

The same course teaches, among other things, about dope and its uses. What the class learns from the lecture, model builders learn from experience: namely, that doping is best done in a warm and dry room. Many model color jobs are ruined by blushing or by uneven drying before the builders catch on, but that lesson, taught by experience, is as well learned as is any classroom demonstration.

Model experience has helped my meteorology course in more ways than one. I have had experience with thermals, lee eddies, convection and deflection currents just from flying models, but in traveling to contests I have acquired a pretty good knowledge of the topography of the surrounding country for a radius of three hundred miles, and am able, therefore, to understand just why different parts of the State have such different kinds of weather.

It is in mechanical drawing, though, that model experience has given the most help. My model drawings have always been several jumps ahead of my school drawings. In designing my first gliders, I had to use projection drawings before ever enrolling in a drafting class. The building of tapered wings and elliptical fuselages made it necessary for me to work out a method of lofting ribs and formers long before reaching that advanced stage in a drafting room. In addition to this, I acquired a practice in the use of instruments that would have taken many hours of classroom time to get.

The examples that I have given here are a few that will show how working on model airplanes has helped me with my study of the real thing. The fundamentals of the subject can be learned from a book, or they can be learned from experience, but experience is generally the best teacher, especially when the situation calls for a bit of independent research.

I do not mean to imply, however, that model airplanes can be used as a substitute for a course in a specialized aëronautical school like Boeing. The experience gained in the designing, building and flying of models is basic, and provides a sound foundation upon which the school, with its scientific treatment and correlating courses, can build a substantial education.

I have a year at Boeing still before me, and I expect during that year to find more ways in which the lessons taught by the building and flying of models can help me.

Fairchild PT-19 Army Trainer

(Continued from page 35)

cess. Stringers which run back the sides are cemented directly to the under-frame.

To represent effectively the metal engine cowling of the real Fairchild, the nose forward of Section 2 should be "filled in" with pieces of $1/16''$ sheet. Accurately cut the individual pieces so they will fit neatly within the space between the stringers and formers. The nose block is cut from a medium-grade piece; cut out the square hole, as shown, for the rubber motor to pass through. Cement the roughly cut block to the nose and then sandpaper the whole nose to a smooth, attractive shape. If desired, the nose can be covered with thin sheet balsa instead of the suggested method.

The top of the fuselage from 3-T to 6-T is covered with soft sheet. Space limitations prevented making a complete pattern of this part but the cockpit shape is indicated. A piece $1/32 \times 2 \times 4\,9/16''$ is required; check the plans for the exact position of the cockpits. Cement the covering in place, using pins to hold it fast until dry. Finish the section between 2-T and 3-T by "filling in" with sheet balsa as before.

It is necessary for the wing to be of sturdy construction since the landing gear is attached to it. Ribs are cut from $1/32''$ sheet with the exception of W-4 which is $1/16''$ thick; two of each are required. A full-size left wing plan must be made. The various parts are assembled directly over the plans. Sizes of the various spars, et cetera, are noted on the plan. The $1/16 \times 1/4''$ hard balsa spar to which the landing struts are attached is not placed until the dihedral is added. Scale dihedral of $1\,7/8''$ proved satisfactory on the original model, but to those not interested in exact scale we recommend an increase of about $1/4''$ in each wing for an added measure of stability. The wings must be joined together accurately and solidly. Attach the $1/4''$ deep spar and reinforce the junction necessitated by the dihedral. Trim and sandpaper the leading and trailing edges as well as the tips.

Any excess weight in the rear of the model must be balanced by additional weight in the nose, so exercise care to prevent any unnecessary weight in making the stabilizer and rudder. Both are constructed in a similar manner; the outlines are cut from $1/16''$ sheet and the spars and ribs are $1/16''$ square medium stock. Light strips are cemented to both sides of the ribs and when dry they are cut and sanded to the streamline shape indicated on the plan. Surfaces constructed in this manner are light yet they will not warp readily.

The landing-gear struts are fashioned from .040 music wire. The wire is bent in such a manner as to join the spar provided for that purpose and Rib No. 3. Attach the struts in place with thread and plenty of cement; use a needle and sew right through the rib and about the wire. Be sure to make a right and left strut. The balsa and rubber tubing covers are added after the wing is covered.

Wheels are made from laminated disks of balsa, or they may be purchased. Bearings should be cemented to the sides so they will revolve accurately and smoothly.

A neat, attractive covering is necessary for any fine flying scale model. The frame must first be prepared for the covering by lightly but thoroughly sanding every part to remove all flaws and roughness. Blue and yellow colored tissue is used. Cover the fuselage, first using the blue tissue. Thin dope or banana oil is used as adhesive to stick the tissue to the frames. Grain of the paper should run from

(Turn to page 48)

Ladeez—Gents 'n' Folks: Meet the New Lightweight Champ!

I don't know nuttin' about no labatory t'eeories, see—but I knows a tough, fightin' champeen when I sees one, see! 'n' take it from me, folks, this new Super ATOM is got what it takes!

It's built rugged-like, like a champ should be, see, tall-like and lean—without a excess bulge on its frame. The fin area of the new high compression cylinder has been tremendously increased which means it runs cooler—and you know what that means in steppin' up the stamina!

I seen many a champ in my days,—but I'm tellin' ya this Super ATOM is the busiest, fightin'est, speediest ever—it's a honey! Take a tip, folks, put a Super in *your* corner and you're a cinch to cop the duke.

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When first introduced, The MIGHTY ATOM established a new era for Class 'A' flight (construction economies, higher speeds, greater endurance) this new, SUPER ATOM raises the ceiling even higher!

The Super is more ruggedly-built, more masculine in looks—tougher—and its enormously increased power will keep it the darling of the Class 'A' flyers.

In the sub-piston alone, the ball and socket joint has been *trebled* in strength! The Super will fight its very heart out for you—up to 9,000 RPM (with prop) without missing a beat—without fatigue! We guarantee this engine will develop the highest-power-to-weight ratio of any engine regardless of price.

Cylinder porting has been enlarged almost 60%! Results in lower gas velocities (minimum power loss) plus the fastest, most complete scavenging ever achieved.

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WEIGHT Complete with TANK & PLUG **1¾ ozs.**

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IF YOUR DEALER cannot supply you, rush coupon (giving dealer's name) for same day shipment.
(New ATOM descriptive Booklet 6c)

Fairchild PT-19 Army Trainer

(Continued from page 46)

the nose to the tail. Numerous small pieces of tissue must be used to prevent wrinkles; individual pieces should be lapped neatly. The nose and other wood parts should be covered with tissue, too. The wings and tail surfaces are covered with the yellow tissue; the grain runs spanwise. Attach only the extremities of the area being covered. Tips, et cetera, require separate pieces. The parts are lightly sprayed with water to tighten the tissue, but they are not doped until the model is assembled.

The various parts should now be assembled. Cement the wing in place; if the structure has been reproduced accurately the angle of incidence will automatically be correct. Finish the under section from wing to fuselage with pieces of $^1/_{16}''$ square. Wing root pieces W-R are cut from $^1/_{16}''$ sheet and attached between the wing and fuselage. Fillet pieces to be cut from $^1/_{64}''$ sheet are shown on the plan. The pattern indicates the shape of the fillets on the original model, but since more miniatures will vary a little, paper patterns should be made to fit your model exactly before the sheet balsa ones are cut. After the fillets are cemented in position, they are covered with blue tissue, as is the uncovered portion under the wing. It will be necessary to cut the rear of the fuselage temporarily to admit the stabilizer, which is attached at the exact angle indicated. Offset the rudder a bit to counteract torque. Tissue fillets are placed between the stabilizer and rudder. Any wrinkles in the covering should be moistened with water and permitted to dry before the entire model is given a coat of clear dope. Dope should be applied in a dry room to minimize the chance of "blushing."

Numerous details can be added to improve the model's appearance without harming the flight ability. Streamline covers at the top of the landing gear struts are made from pieces of balsa, while the lower part of the strut is covered with rubber tubing of the correct size. Washers soldered to the ends of the axles will hold the wheels in place. The stars, rudder stripes, "U. S. ARMY," et cetera, are made from colored tissue and the effort required in making them will be amply repaid by the snappy appearance they add to the model. Control surfaces are outlined by thin strips of black tissue. The pylon between the cockpits—it protects the pilots in the event of a turn-over—can be made from thin pieces of bamboo. Celluloid windshields, the tail wheel and other details should be added.

For best flight performance any flying model must have an efficient propeller. Select a hard block $^7/_8$ x $1^3/_8$ x $7^1/_2''$ and cut out the blank as shown. Carve a right-hand prop with a bit of undercamber in each blade. The spinner is made in two pieces and glued to the sides of the prop. Cement a washer to the back so it will revolve smoothly. A freewheel device of some sort should be used to help improve the glide. Sand the propeller and color-dope to a nice finish.

The removable nose plug is shown. A disk of $^1/_{32}''$ plywood forms the front while the back is laminations of balsa. Fix the thrust line by cementing washers to the front and back of the plug.

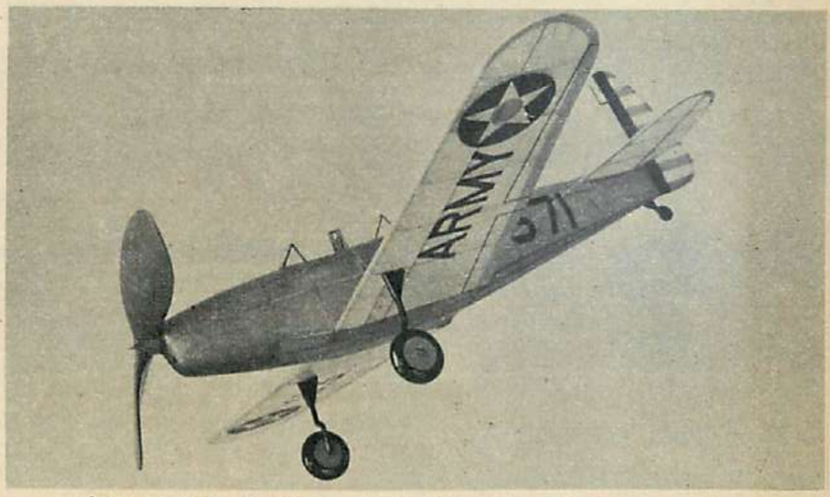
For the prop shaft .034 music wire is used. A loop to which the winder can be attached should be bent on the front of the shaft. Place several washers between the propeller and nose plug.

Eight strands (four loops) of $^1/_8''$ brown rubber are used to power our trainer. Hook the rubber to the prop shaft and with the aid of a weighted string drop the other end through the fuselage. A bamboo pin holds the motor in the rear.

FLYING

To prevent damage to the model at this crucial stage, test flights should be made over deep grass. The descent from a hand glide should be flat and smooth; a small corrective weight may be required to obtain the desired results. Once the glide is good, all further adjustments are made at the nose plug. Right or left thrust will control the amount of circle and a bit of downthrust will correct a tendency to mush or stall.

The author's PT-19 has been flown many times and proved to be an excellent performer. When winderwound it climbs in large left circles until the power is exhausted and then it descends in easy right spirals. It is tough, too, having emerged from encounters with trees and other model catchers with only minor tears in the covering.



Earl Stahl's fine PT-19 is the result of careful work. Take your time.

Goods' Championship Radio Model

(Continued from page 33)

small lift. (Solder a conecting wire to this same piece.) The 2-56 brass screw (J) is tipped with cement for insulation. A small piece of coin silver (from dime) is soldered to screw (H) for a contact. The relay is now ready for assembling.

Slip armature (A) and frame (E) into the coil slot (C). Frame (E) should fit snugly and armature should be free to rotate. Cement field pieces (F) in place with a spacing of $^3/_{32}$" between their ends. This spacing affects the sensitivity and range of the relay. Glue the permanent magnet (M) to the bottom of the field pieces. (Small Alnico magnet, thirty-five cents, Central Scientific Co., Chicago, Ill.) Note that when in operation, *the armature does not touch the field pieces.* The movement of the armature will be about equivalent to the thickness of a sheet of paper. The contacts will easily handle ten times the current needed to operate the control mechanism.

CONTROL MECHANISM

The control mechanism (Figs. 5, 6) for rudder and elevator is the rubber-powered electro-magnet escapement type. It has several distinct advantages. Its small weight of one half ounce makes it easy to mount directly within the fin or stabilizer, resulting in a direct mechanical connection to the flap. The five-position cycle and rapid action results in a fast, yet precise control. The escapement stays "in step" with the special transmitter switch (Fig. 9) and may be jerked through as many as four or five complete cycles per second without missing. Little electrical power, 150 milliamperes at 6 volts, is needed, thus conserving batteries.

Examination of Figs. 5 and 6 shows the details of the mechanism. The operation is as follows: In Fig. 6a the escapement wheel (A) spoke (1) is held against the armature rocker (B) by the tension of the wound rubber band. Note in spoke (3) the pin which travels in the slot of the rudder arm. Turning on the magnet (by turning on transmitter) pulls the armature rocker away from spoke (1) and stops it in the position in Fig 6 (b). This is the "one-half right" position of the rudder, giving a large right circle. Turning off the magnet (transmitter off) releases spoke (1) and stops spoke (4) in Fig. 6 (c). This is the full "right" position of the rudder and results in a small right circle. Thus it is seen that turning the transmitter on and off advances the spokes one quarter of a turn. A complete cycle would be N-½R-R-½R-N-½L-L-½L-N, giving a variety of positions. This fast-acting escapement can pass through the whole cycle in one-fifth second!

Construction should not be difficult with the help of Fig. 5 and the photograph.

Each of the coils (c) has about 80 ohms resistance and will require about 70 feet of No. 40 wire. The fiber coil ends are glued to the iron core and the core is doped with thick

clear dope for insulation. Wind the coils in the same manner as the sensitive relay. Cover each coil with a strip of paper for protection and connect them in parallel.

The armature rocker (B) is bent from sheet steel and the corners are soldered. To the rocker (B) solder the armature (D), the shaft, and the spring (K). The rocker assembly is slipped into the rocker bearing (L) which is cut from sheet brass. Cement the bearing (L) to the face of the coils. When closed, the armature should fit flush over the whole core ends. A thin hard coat of clear dope over the end of the cores will prevent the armature from sticking (magnetically).

The frame (F) is cut from sheet aluminum. Take particular care with the holes for shaft (E). Cut escapement wheel (A) from sheet brass and solder shaft (E) and the control pin to it. Note ball-bearing washer is same type as used on outdoor rubber job. Installing adjustment screws (H) and (J) finishes the construction.

Adjust screw (H) so the armature travel is $^1/_{32}''$. When armature is closed, the spokes should just clear the stop. Shimming the back of the coils takes care of this adjustment.

Set the spring tension with screw (J) so armature will close, using $1\frac{1}{2}$ volts (without rubber). Before placing the mechanism in the plane, hook on a loop of $^1/_{32}''$ rubber and wind in several hundred turns. It is possible to make it work on 3 volts. However, adjust it to function on $4\frac{1}{2}$ volts. In the plane we'll use 6 volts—just to

Cement the mechanism in the fin or stabilizer, making sure the alignment is true, to give a neutral and an equal left and right. About 500 turns in the loop of rubber will be sufficient for several flights.

MOUNTING

The adjusted receivers and relays are mounted in a balsa rack shown in Fig. 7. Wires from the receivers are led to spring clips along the front of the rack. The battery wires are brought up to the clips. The front panel of $^1/_{16}''$ sheet balsa is recessed so that none of the parts projects out in front of the rack. The rack may be built one-half size for one control.

The rack is tied down with rubber bands onto blocks of sponge rubber mounted in the ship. This isolates the unit from motor vibration and landing shock.

The battery board used with the two RK42 receivers is also shown in Fig. 7. Standard battery cases are used. Bind the batteries to the floor of the plane with rubber bands, remembering that the c. g. position of the plane is not to be altered.

Three wires from the rack back to the tail are tipped with spring clips at the tail end to allow easy removal of the tail surfaces. The complete circuit is detailed in Fig. 1.

TRANSMITTER (By Bill Good, W8IFD)

After some difficulty in awakening the airport manager at 5 a. m. to get into the hangar to plug our AC-operated transmitter into the 110-V circuit, it was decided to design and build an all-portable, 5-meter "superdooper" transmitter just for radio control. Here is the result.

For both rudder and elevator control two wave lengths are needed. The transmitter is a two-frequency one, powered by a storage battery and genemotor. It represents one workable version involving the least number of parts and still retaining reliability. In brief, it consists of two 6V6G electron-coupled oscillators with their respective cathode coils tuned to 20 meters and a common tank circuit tuned to 10 meters. The 807 amplifier doubler is capacity coupled to the preceding plate coil and its output circuit is tuned to five meters. In other words, the single 807 acts as an amplifier for both frequencies, determined by the oscillators. Inasmuch as it is almost imperative that the transmitter be built by a licensed amateur radio operator, because it must be licensed and operated by a person who is licensed, constructional details will be kept to a minimum.

The circuit constants shown (Fig. 8) should prove satisfactory. However, some of the variable condensers used happened to be those that were on hand, and don't have to be followed too rigidly. The frequency of the electron-coupled oscillators may be set at any desirable point in the band with the aid of a 5, 10 or 20-meter receiver. Naturally, if using a 20-meter receiver, keep the oscillators between 14,000 and 15,000 KC; if using a 10-meter receiver, stay between 28,000 and 30,000 KC; and if using 5 meters, stay within the limits of the band—

ing condenser across the oscillators plate tank L_2. This coil is tuned by merely squeezing or stretching the coil itself. We tuned ours to the middle of the band by setting one of the oscillators to 14,500 KC and manipulating the coil until maximum grid current to the 807 was obtained (3 to 4 MA). At other frequencies in the band the grid current will naturally be less. Just one mil of grid current with the 807 in operation gives satisfactory results. The grid current is regulated by choice of resistors determining the screen voltage of the 6V6G's. Higher screen voltage—higher grid current. The plate current of the oscillators runs about 25 to 30 MA each. The 807 runs from 50 to 80 MA depending on the loading. Twenty watts input seems to be plenty for most flying. The final tank condenser is tuned halfway between the two frequencies used. A flashlight bulb with a pickup coil held near the plate coil can be used to indicate when the power output of either frequency is about the same (with antenna connected). To eliminate all relays it was necessary to bias the 807 so that its plate current wouldn't be excessive while not being excited—without bias the power drawn is within the plate dissipation ratings, but we hate to see our storage battery run down any faster than necessary! The bias battery is one of the small 45 V ones that has been discarded after serving its usefulness in the plane. If only one oscillator is used the 807 could be keyed in the cathode and the bias battery would be unnecessary.

One novel feature in the design and

operation of the transmitter is the incorporation of a switch in the positive lead going to the 807 plate and screen. When this switch is off, a weak or low-powered signal is given off when the oscillators are keyed, allowing the operator to tune his receivers at a distance of 10 or 15 feet from the transmitter and have about the same signal strength that the plane will experience should it get several miles away, after full power has been turned on. We call this our "hi and low" power switch, and always check the controls with both high and low power before taking the ship off.

The power supply for this transmitter is a 400 V-125 MA dynamotor powered by a 6-volt storage battery. Genemotor or vibrator packs of the 300 V, 100 MA variety are less expensive and will serve the purpose just as well. Be sure you use heavy wire from dynamotor to storage battery. We have a 300-volt DC power supply for testing and tuning of the equipment around the house where 100 volts AC is available.

The antenna consists of two autowhip antennas mounted horizontally with an overall length of about 8 feet, fixed at the top of a 9-foot fish pole. The antenna is fed at the center with a half-wave-tuned line. The easiest way to adjust the line is to cut it to approximately the right length and slide the antenna in and out until maximum loading on the 807 occurs. If your whip antennas just reach 8 feet, as did ours, tuning can be accomplished by leaving the antenna set (at 8 feet), snipping off the feeders (approximately 8 feet) until maximum loading occurs. The antenna coil was quite closely coupled to the cold end of the 807 tank coil.

In the picture one can see the 6V6G oscillator tubes with their respective cathode coils in the shields-tuning knobs on the ends of the shields—located in the lower right-hand corner. The 807 on the left with its plate tank and antenna coil, in the upper left. Center right finds the plate milliameter and plate (hi-low power) switch. The hole above contains the bias battery and the control box with its 15 feet of flexible three-wire cable.

The switches on the control box (Fig. 9) were made from revamped Western Electric anticapacity switches and were positioned so as to simulate actual airplane controls. The switches were modified so that a dash was sent—contact made and broken—as the switch was pushed from neutral to left or right positions. This allows the rudder movement exactly to duplicate the position of the tiny "control stick" on the box. A push button may be used, for it is obvious that for every pulse sent from the transmitter the rudder moves through one position. It is only necessary to know what position the rudder is in to figure out the number of dashes or pulses that need be sent to the ship to get the required effect. The small "control stick" switch mentioned above saves a little brain work while on the field.

Our transmitter mounting was a semibrainstorm built of Presdwood—fastened where necessary with aluminum brackets and squashed inside a one-dollar "airplane luggage" overnight bag measuring approximately 5½x7¼x11" on the inside. The han-

dle was moved from the side to the top for portability.

It should be emphasized that *any* 5-meter transmitter with a few watts output will work the controls. Therefore, it isn't necessary to duplicate the one described, although it has proved highly satisfactory.

Again we repeat what has been mentioned in previous radio-control articles. The business of transmitting radio signals is regulated by the government, therefore a licensed radio amateur *must* be an integral part of your transmissions. So find yourself one of these hams to help you with the radio end of the control. He may already have a 5-meter transmitter! If you don't know of any amateur in your vicinity, write to the American Radio Relay League, West Hartford, Conn., for the name of the secretary of the local radio club. This contact should enable you to locate a dandy, interested amateur.

Remember, there is plenty of work and two fellows are a minimum. Some are working on R. C. as a club project.

The next and final installment will give in detail the operation and flying of a radio-control model. This includes necessary ground tests, plane adjustments, maneuvers, precautions and, yes—a few tales.

Radio parts can be obtained at: Rissi Brothers, Inc., 443 S. Division, Grand Rapids, Mich., or 5027-31 Hamilton Ave., Detroit, Mich; Allied Radio Corporation, 883 W. Jackson Blvd., Chicago, Ill.; Radio Wire Television, Inc., 901-911 W. Jackson Blvd., Chicago, Ill.; Burstein-Applebee Co., 1012-14 McGee St., Kansas City, Mo.

All these companies have free catalogues.

TO BE CONCLUDED.

Break Formation!

(Continued from page 15)

Time of stations (in plane cockpits), taxi-out, and take-off.

Assembly (place, time, altitude, and formation. If more than one squadron is to participate, "assembly" will mean rendezvous point where the squadrons join up).

Rally (reorganization of elements and flights following withdrawal from the combat, type of formation).

Landing instructions (designation of airdrome, and the order in which elements come in for landings).

Ammunition (type, such as ball, armor-piercing, incendiary, or explosive, amount of ammo. Bomb loadings, if any, will include type and fuse settings).

Special measures for *ground defense*.

Supplied this data, the pilots have a pretty fair idea of just what is to be done. Now our squadron taxies out for the take-off. According to circumstances, or the commander's dyspepsia, the planes may be ordered to take off individually, by three elements, or by flights. The commander's element slows up, at the assembly point, and the others catch up and fall in formation. (If other squadrons are participating, they, too, fall in their respective positions at this point.) Our force is "supporting" certain friendly operations and pursuit opposition is expected momentarily, so a combat formation is employed.

Each of the three three-element flights is flying an echelon of V's, and each of these patterns is, in turn, echeloned backward and to the left, each 1,000 feet above and behind the other. The lower, or guiding, flight is called the "assault echelon," and this unit tangles with the enemy craft first. The second flight, 1,000 feet up, is the "support echelon," and this group of nine planes drops down to support the leading group immediately upon contact with the enemy. Highest in the squadron formation flies the third flight, or "reserve echelon," whose duty it is to reconnoiter above until it is apparent that no enemy craft are lurking above, then the echelon dives to pick off stragglers or disorganize enemy pursuits. Clever? When the three-squadron group is awing, it comprises a chain of these assault, support, and reserve echelons; the latter flying very high—15,000 to 30,000 feet—so that the enemy cannot attack without being completely sandwiched.

Planes do not just go up and fight, but follow definite routine which consists of four phases. First of these is the approach. Immediately upon sight of the enemy, our squadron enacts this all-important phase which has to do with the most effective direction of approach and the best disposition for concentration of fire power—the manner in which the forces "spar off." Second is the *combat*. Put very briefly, the tangle is a duel in which pilots fence—maneuver—for an opening, then drive home the vital thrust.

Above the roar and heat of battle, the smell of burnt powder and oil, the sight of flames and blood and horrible collision, the emotional strain of fear and anger and uncertainty, the physical reaction to 5-G verticals, rolls, and dives, and perhaps the pain of wounds—the pilot must keep the four axiomatic combat principles foremost in his tortured mind:

1. Surprise—in order to strike *first* by taking advantage of sun, clouds, or other conditions of visibility. And, after engaging the enemy, to further surprise him by attacking from within his blind angle, or taking advantage of his "preoccupation" and catching him unawares.

2. Offensive—in that one must seek to be the aggressor; attacking and *following up* all thrusts in a determined manner. If placed on the defensive, the pilot must strive to outmaneuver the enemy and regain the offensive as *soon*—seconds count—as possible.

3. Concentration of effort—wherein fire power must be directed to the most vulnerable parts of the adversary's ship—pilot, fuel tanks, or controls, in that order. (It would seem to the author that, with the advent of successful leakproof fuel tanks, the order might be changed. When using incendiary ammo, however, a tank can be set afire after it is half empty —leakproof or no.)

4. Security—in that one must not take undue risks. One must watch the sky as well as enemy; particularly the sky above. Don't sacrifice—or be tricked into surrendering—superior altitude, for top man is usually best man. Don't fly *straight at* the enemy when within range of his fire power, unless actually firing at him. Don't fly or dive *straight away* from him when withdrawing from close combat.

Of course, it is difficult to remember these under physical and psychological stress, but this is a part of indoctrination—so to inculcate these principles that the pilot reacts to them subconsciously, as a matter of *habit* and training. The enemy, meanwhile, is applying them, too; all of which makes combat plenty tough.

The third phase is *exploitation*, which follows the shock of attack if the enemy is at a disadvantage. This is carried out in a determined manner until the enemy is destroyed, or has eluded pursuit: a military way of saying, "Get him down and don't hesitate to kick him while he's down!" There is no more "sportsmanship" in do-or-die combat affairs.

The *withdrawal* is the final phase. This is conducted in a precise, orderly manner upon some prearranged plan or radio signal. Now the squadron reforms and carries out the "rally," then heads home in the formation, et cetera, prescribed by the combat orders. Neither gas nor ammo last long in pursuits powered by 1,000 h.p. motors and having four or more 1,200-round-per-minute machine guns.

Formation fighting—it should be obvious without going into the discussion of the technique—sounds thrilling in fiction, but has yet to be made practical for fighters and pursuits. Interceptors, which engage, for the most part, in hit-and-run tactics, can and do employ certain formation attacks, but even these are limited. Pursuits, because they are more maneuverable than interceptors and are therefore employed for close-in fighting, cannot maintain formation after the enemy is engaged. Sooner or later they all break up; when that occurs, the *individual's* ability to perform aërobatics, shoot accurately, and think for himself determines whether or not he shall survive—figuratively speaking. The outcome of combat also is dictated by the pilot's mental attitude (morale and experience) and circumstances, or "breaks." Today's air warrior fights on his *own* initiative and not that of his squadron commander!

Today, they're all aces. The staffs seated around their respective tables are playing for the highest stakes in history. Playing with their cards close to their chests. They've aces back to back on the board, and aces wing to wing in the blood-red sky.

Model Matters

(Continued from page 25)

scaled down a typical transport in current use to a true flying scale model.

	Full Scale	Model
Span	85 ft.	6 ft.
Weight	18,500 lbs.	6.5 lbs.
Wing loading	19.4 lbs./sq. ft.	1.37 lbs./sq. ft.
Power	1,420 h.p.	1.33 h.p.
Power loading	12.8 lbs./h.p.	49 lbs./h.p.

Possibly the business of building and flying a gas model would become a more scientific and exacting task if we confined our designs within the limits set up by scaling down full-size airplanes.

Marvin K. Wallach of University City, Mo., sent a time-worn clipping from an October, 1933, magazine. It showed a photo with description of Maxwell Bassett's gas model which had just won the New York City Nationals. Marvin was somewhat upset by the technical description of the motor. Here it is: "The small mouse-power motor is stream driven, developing $^1/_{10}$ h.p. for a sustained flight of several hours. A compressed-air tube feeding into a gas burner heats the boiler, which is shielded against the wind currents." This is the way they described a Brown Jr. motor back in 1933. (The magazine was not a model magazine but a semi-technical publication that certainly should have known better.)

Builders are not particularly happy when their pride and joy soars out of sight. It's financially discouraging to see your investment take wings and disappear. But what really burns up the boys is having their models stolen. F. E. Pepin of Rock Island, Ill., is a builder who is really burned. His Denny (#2,000)-powered Guff was stolen after its first official flight at the Ottumwa, Iowa, contest July 28th. He gave his Ohlsson "23" (#8,947) to a fellow club member and this ship was lost on its first flight. Karl Girten of Milwaukee was fortunate in recovering his through a dealer in Des Moines. Another builder had to wrestle with two rascals whom he caught stealing his. One ship was stolen from the processing tent after it had been returned there. Several others were misplaced. In general it was the sort of day that makes a manufacturer happy. If anyone comes across motors with the above-mentioned pedigrees, restore Pepin to his normal happy self and tell him about them.

"Don't let that 'grand-champion' title fool you; I was lucky"—so says John T. Dilly of Galt, Ontario, when asked about his winning this title at the Canadian National meet in Toronto. It's one of the summer's big meets and attracted about 250 entrants from Canada and the United States. Whether he admits it or not, John is probably tickled pink since he's been itching for such a victory since way back. He's too good a builder and has followed this crazy business too long for bad luck always to haunt him. But we couldn't blame bad luck for liking John, since we, too, think his company is just fine.

The 1940 contest season is over. Now is the time rule changes for 1941 are considered. There's no strong feeling for changes other than an indication that fifteen-second motor run would be preferred to the present twenty-second. Virginia Model Association has been promoting a new rule based on power-flight to total-flight ratio with the duration of the motor run left up to the individual builder. While this rule has worked out nicely in State and sectional meets, many feel it has yet to pass the test in a large-scale contest where any additional bookkeeping is troublesome.

The Air Cadet Corps is planning nationwide expansion. Originated in Chicago and sponsored by the *Times*, membership has grown to 40,000 in this city alone. Maurice Roddy, aviation editor of the *Times*, has nursed the idea from the beginning and will handle the national organization. Activities will operate through twenty-some newspapers throughout the country with the interest divided between large and model planes. Roddy has always done right by the builders, his efforts reaching a new high at the last national meet where he went to bat for the youngsters regardless of how unreasonable the request. The A.C.C. is the largest group in the country affiliated with the A.M.A.

Contest model builders are probably all crazy. But they represent the frame of mind you are certain to fall into if you get at all serious in this business of building models. So, unless an organization can get along with the contest builder, it's unlikely it will go far past attracting the coupon-clipping youngsters who join every organization that comes down the pike. Roddy's success with the Chicago group is well founded in this respect and it's pleasing to see the A.C.C. expand.

The boys in Little Rock, Ark., financed their third annual meet September 1st by selling gas model wing space to advertisers. About a dozen ads were sold at five dollars per. As the models climbed over the crowd the announcer would give the advertiser a plug over the public-address system. One advertisement was traded for the wooden runways and another paid for the P.-A. system. The flying field rent was traded off for the refreshment concession and the ten-cents-per-car admission fees. The arrangements left everyone happy, including the club treasurer, who reported the club bank still jingled even after the last bill had been paid.

Memphis gang took first in Class B and C, which embarrassed the Little Rock boys. But they were so busy working out the details of the meet, they didn't have much time for actual flying. Anyone who doesn't win with this as the reason is gracefully excused.

ON THE FIELD. (By Carroll Moon.) Out in good old California, land of ready-made and ever-present thermals, one of the biggest gas events of the year is the Second Annual Gas Model Contest, staged by the Midget Air Race Association of Los Angeles. It was held August 26th this year. Frank Knapton, manager and head of the airport, conducted the meet and arranged for the awards; he had some job on his hands judging by the

fact that there were 282 entries in the three classes. One hundred seventy-four fliers entered in Class C, eighty-eight in Class B and twenty in Class A.

A Zipper (powered by a Bunch Tiger) took the top honor of the day, turning in one flight of 24:32, top single-flight performance of the meet. Frank Cummings, who flew the plane, worked twenty-three hours straight to finish the ship, and the seventy-five-dollar cash award and trophy were well worth it.

The same association held a night precision contest on August 24th, ships being judged by a committee. The ships were required to have lights built in. Further points were awarded for flight characteristics, and precision flying paid big dividends. John E. Brodbeck won this event. Hans Wall was second, with Willard Strange third. Howard Broughton reported the meet for Air Trails. Bill Butler is president of the Southern California Gas Model Association, and one of the biggest supporters is Dan Bunch, of Bunch Motors.

The Canadian Nationals of 1940, held on August 26th and 27th in Toronto, in conjunction with the Canadian National Exhibition, set a new high in enthusiasm despite the fact that many prominent Canadian modelers are now members of the R.A.F. The 1940 Canadian Nationals was the tenth held to date and was the largest ever conducted in Canada. Nearly 300 contestants were registered, coming from all parts of Canada and the United States. The Canadian National Exhibition has been an active sponsor for the past seven years, and was of great help in making the meet the success that it was.

National emergency deprived the modelers of the use of planned facilities, and indoor flying was transferred to the Maple Leaf Gardens, where effective ceiling was from 55 to 100 feet, with a maximum of 140 feet. Joe Matulis of Chicago set a new Canadian high mark in the adult indoor stick, turning in 15:29. Lawrence Mark set a new high in junior indoor stick with 12:14, while Dave Rosenberg established a new semi-scale record of 3:14.

Outdoor events were held at the airport of the Toronto Flying Club on August 27th and weather conditions were none too good, judged by any standard. With a temperature of 70°, and a wind velocity of 24 m.p.h., fliers just "did their best." High time of the day was turned in by Bob Dodd's gas job with 7:51, which helped to win him top honors in the senior-junior event. Fred Smith, of Buffalo, won the open gas event with 3:19. In rubber, Fred Bowers (of the 1939 Canadian Wakefield Team) was top flier with a first in stick of 7:19. In the Wakefield Class, Jim Broderick of Chicago averaged 3:10, followed by Roy Nelder (Moffett Trophy winner twice) taking second. Other winners were: junior stick—Brenton Rowe; senior stick—Roy Thomason; open stick—Jim Bohash, first.

Contestants were guests of the president and directors of the C.N.E., on the final evening at a banquet in the dining hall of the Administration Building of the Fair. "Most Active Girl Contestant" award was given to Dorothy Templeton of Toronto, and John T. Dilly of Galt, Ont., was declared the Grand Champion of the meet.

One of the largest gas model meets to be held recently in the Eastern part of the country was the Second Annual Sky-scrapers Gas Model Meet at Creedmore, L. I., on September 22nd.

The day was clear, but a twenty-mile-an-hour wind kept flying times down considerably, none of the contestants establishing new records. Top prize winner of the day was Frank Mesa, of the Manhattan Airscrews, who turned in the high single flight of the day—7:05, and the high average of 2:37 with his Class C original design. His ship was powered with a Brown motor. The performance won Frank the International Balsa Trophy, for the high flight, the Sky-scraper's Trophy for first in Class C, a Super-cyclone motor and a kit.

Class B flight times were the lowest in the meet. Ernest Roff, of the Gas Monkeys, took first in the class with a nice average of 2:36, and a high flight of 6:50. His plane, powered by a Torpedo motor, was an H. & F. Bee. In Class A, Fran McElwee, of the Linden Model Aëro Club, was first with an average of 2:41.7 and high single flight of 5:27. In keeping with the rest of the first six winners, Fran used a Bantam motor. Miss Wilma Clemons, of Brooklyn, won the Ladies Trophy, flying a Bantam-powered Bay Ridge Mike to ninth place in Class A. Her ship averaged 1:19.4 with a high flight of 1:40.

New York police estimated that at the height of the meet, nearly 10,000 people were in attendance. All timing, checking, policing and general supervision duties were handled very capably by the Sky-scrapers.

Once a year, amid loud cheers, faint hisses and many side remarks, the Scripps-Howard organization (newspapers, y'know) sponsors the Junior Air Races at Akron, O. This year's races were held August 29th, 30th and 31st, and once again the Cleveland

Photo Credit List

The following list shows the sources from which credited photos were obtained. Abbreviations: Bot., bottom; T., top; U.L., upper left; U.R., upper right; L.C., left center; R.C., right center; L.L., lower left; L.R., lower right; Cen., center; T.C., top center; B.C., bottom center.

Page 8—T.R., William Larkins; T.L., Rudy Arnold; Cent., Wide World; Bot., Rudy Arnold.
Page 9—All by Rudy Arnold.
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Page 26—L.Cent., Al Daraghy; Bot., Al Daraghy.
Page 27—T., Kulick; Bot., Al Daraghy.
Page 35—T., Acme.
Page 38—Al Daraghy.

Balsa Butchers (Dick Korda et al) were declared champs.

Of course, there were literally hundreds of entrants, and classes ranged from indoor to outdoor in all sizes. First, however, it behooves us to discuss the gas events. Carl Goldberg, flying a Zipper (honest!) powered by a *secret* (shhhhh) motor in Class C, won the open event with an average of 14:38—not bad time at all. Oh, yes, Walt Good finished thirteenth and Ed Naudzius, who was voted the "outstanding modeler at the meet," took fifteenth. Jack Liendecker took first in the junior-senior gas event, with a 9:45.4 average.

Despite the high times, gas events were not the big moments at the meet. Al Blatter took the junior fuselage event with a 5:34 mark. Owen O'Malley was first in the senior fuselage event, hitting an 8:38 mark. Ted Just (on the 1939 Wakefield Team) finished fifth, just to give you an idea. V. Wallschlager won the open fuselage event. Wallschlager's time was 7:41.4. Oh, yes, Dick Korda (Wakefield champ) finished twelfth —s'too bad.

In the Original Design event, Bruce Halleck was top man. Walt Good (the Guff, remember?) was fifth, and Ed Manning (Lackey Zenith) was twelfth. Carl Chakmakian was first in Flying Scale. Chet Lanzo (an old-timer) was ninth.

Henry Thomas won the speed event hitting 65 m.p.h. Chet Lanzo was eighth in this event. Phil Weatherwax won the towline glider event. Time was 1:13.2. Dick Korda took a sixth here, with Henry Thomas seventh and Chet Lanzo fourteenth, just to show how the mighty finish "waaaaay down." Jerry Wylemski took the junior class stick, turning in 2:08.8. Bob Davis, with 3:10.7, took senior stick. Russell Shaffer was first in open stick, averaging 3:59. Chet Lanzo, who, incidentally, used a gas model timer as part of his ship, took second, and Bill Allsopp third. Dick Korda was fourth again, and Earl Stahl (you've seen his articles, of course) finished fifteenth.

Norm Tyson won top honors in a contest sponsored by the Norristown Flying Wings of Norristown (Pa.) A light rain spoiled the list of entries, but Norm managed to turn in 159.4 seconds for top place. Gerald Paul was second and Bill Paige third. Ken Allerton, who was contest sponsor, was Air Trails correspondent.

The Frank Lahm Cadets Aëro Club of Mansfield, O., held a meet September 1st. Harold Heston won the gas event, with an average of 2:05. Carl Ridgway won the rubber event, with a 1:10 average. Ridgway also won the glider event. Gerhart won the tow-line event. Gerhart won the Fox Trophy for high-point score.

Times weren't so high in the gas model meet held in August in Marshall, Mich., but a grand day of flying was reported by the Junior Chamber of Commerce, cosponsor of the meet. Leslie Hard won Class A open with a total of 269 seconds. Ralph Littler won the senior event in Class A with a total of 1,085 seconds. In Class C, open, Carl Thunder piled up 658 seconds to take first. Carl is president of the Marshall Model Club. Wayne Hallack took Class C senior.

Between the "Junior Nationals," the "Nationals" and the "Little Nationals" we're slowly but surely growing nuts. However, they're all big events and it's our duty to report them. The Northern Indiana Gas Model Association of Gary, Ind., sponsored the Little Nationals on September 1st, and reported a success for the third successive year. J. B. Pasko, Jr., president of the club, was Air Trails reporter of the event. Bob Roberts was contest director.

Dick Parker, of Fort Wayne, won Class B gas, with a total of 986.3 seconds, and also took the Grand Award. Chas. Eves was first in Class A. Bob Kreigh took what honors Dick Parker left in Class B, with a 549.6-second total. In Class C, Frank Parmenter, with a 780-second total, was first.

The second annual gas model meet of the Pretzel Gas Model Club of Freeport, Ill., held August 11th, was one of the big events of the Middle West during the month. Due to rain the number of contestants was limited, but flight times were good and prizes were even better.

E. Tschernoscha took first in Class C with a time of 566 seconds. Joe Konefes (remember the Buzzard Bombshell?) was ninth and his brother, Ed, was tenth. In Class B, Ralph Muchow turned in a time of 805 seconds for first. John Conusy took first in Class A, with 499 seconds. Contest director was Nolan Kleckner, while Don Whalen, secretary of the club, reported the meet. Thanks, Don—how about a report covering motors used next time?

The Louisville Junior Board of Trade, in co-operation with the Louisville Model Club, held a contest on August 25th, according to Addison Yeaman, chairman of the aviation committee. Gas models were entered in one class (ah, the pity of such things) and E. A. Cheek won first with an average of 2:42. We don't know the plane, class or motor, but Cheek averaged 2:42, which won him cash, trophy and motor. B. Graham won the fuselage model event with a 2:26 average. C. J. Cooper, Jr., won the junior fuselage. Carter also took senior stick with a 2:41 average. Junior stick was taken by Alexander with a 59-second average. Barney Cowherd took the glider event, aver-

aging 1:28. Fred Harwood won the speed event. In the gas event, H. Bonner, who finished tenth, turned in the best single flight—6:12.

Although previously unheralded, southern New York State is becoming a mecca for gas modelers, according to our reporters, who state (with pardonable pride) that the Tri-cities Gas Model Meet, held in Endicott, N. Y., early in September was one of the biggest and best ever held in the locality. Five thousand spectators and more than 150 entrants also acclaimed the meet as one of the "biggest and best" in history. They (meaning the Endicott Gas Model Club and the Kiwanis Club of Endicott) arranged "everything," including bleachers for the spectators (at last) and two parachute jumps (not by disgruntled contestants).

Times were moderate, although eight ships were lost in the rubber events. Four models landed in the river, but the committee had provided an outboard outfit for just such an emergency.

New clubs reported: Prop Spinners in Jamaica, L. I., and Gas Gulls of Brooklyn, N. Y. Good luck to them. We solicit any news from new clubs. Include list of officers, and anything of news value.

One more thing. *Please* report motors used in all gas contests. We think such information is valuable to the field and that it is really news. Also tell whether the time you report is total or average of three flights. Thank you and—see you On the Field.

Navy Pilot Mill

(Continued from page 9)

Your first impression of the NRAB is this: The base is actually a going concern. There are a few dive bombers (SBC-4s), for the training of former Pensacola graduates on two-week active-duty periods—to which *you* may return some day. There are six—soon to be many times that number—of navy-built yellow trainers called N3N's. There are older Grumman Scouts, also flown by reserve aviators, a Grumman JF-2 amphibian, and a scout-trainer built by North American.

As each of these planes is overhauled by the NRAB, shop facilities are needed, such as magnafluxes, drills, presses, lathes, magneto stands, and radio equipment. In fact, an airplane can be completely torn down, inspected and reassembled at a naval reserve base—coming back into operation looking and performing like new. By completely torn down is meant the removal of wings, stripping of fabric, realigning, recovering, doping, and reassembling. Of course, the engine is also completely torn down, inspected and assembled.

You are now a part of a growing, expanding organization that is pinch-hitting for Uncle Sam. Consider that in 1935, when the aviation cadet program began, that there were less than four hundred reserve aviators! That this pitiably small number of pilots is now available to train more pilots! That they are needed badly because the regular navy is no longer in a position to furnish aviators for its airplanes—indeed, if the entire output of the Naval Academy at Annapolis were utilized there would still be a dearth of pilots. As a high-ranking naval officer said recently, "The air arm of the navy is becoming so important that as far as the United States fleet and aviation is concerned, it will soon become a case of the tail wagging the dog."

When training starts, you climb into the back seat (soon to become the rear cockpit!) with a pair of speaking tubes called gosports attached to your helmet. Two brother students wind the inertia starter—you'll do it for them in the afternoon—and the prop spins.

At first, your flying seems strenuous; the reserve instructor, who went through the training just as you go through it, demands accuracy, precision, and aptitude for military flying. You must do things right the first time, or at least profit by your mistakes. If you do not, it is to everyone's interests that training be stopped early in the game before you stop it involuntarily.

Of course, you may not be started on simple maneuvers if you are an advanced student in the C. A. A. pro-

gram, but for the most part navy students receive ten hours in fundamentals such as level flight, medium turns, glides, landings, and take-offs. Under present schedules the time required for each student prior to solo is ten hours, and it takes about a month to fly that amount. Before solo the navy's method requires that you pass a flight check with another pilot, also a reserve aviator. The importance of this "check" worries students—maybe you are the type that becomes very nervous on check rides, getting what is called "checkitus," and therefore flying with less skill than you usually fly. But don't worry about it—almost everyone is subject to such nervousness, and almost everyone passes.

During the check you bank, turn, glide, and land. If you held your altitude around the field, seemed to be safe during the simulated engine failure, and made a few good landings, the reserve lieutenant will say, "It's an up," which, translated from navy parlance, means, "The flight test was satisfactory."

Then comes your first solo—you make one trip up and around the field. Be careful of the bombing target on the tip of the island—the SBC's are practicing and at intervals a bomb comes whistling down from a roaring SBC-4! Come in for the landing, banking the yellow wings of the sturdy N3N trainer; the speaking tubes are silent, and the front cockpit is very empty. The ground comes up—and you are on, taxiing to a stop.

First solo? Well then, into the drink with you. The first solo is always honored by a ducking—that's an old navy tradition. Or if there's no tossed by your envious classmates will cool your fevered brow!

Next will come your appointment as an aviation cadet, then about nine months at Pensacola. If you graduate, there will be an ensign's commission (corresponding to the army rank of second lieutenant) for you with three to seven years duty to follow. Or perhaps you'll be selected as one of the fortunate officers to be given commissions in the regular navy, which means that you could make the navy your career.

But a great number will return, in normal times, to civil life, and upon request will be assigned to the nearest NRAB. On Saturdays a navy plane will be available, and for two weeks during the summer there will be an active-duty training period. If such is your inclination, you'll report to the NRAB to which you are attached and get back into the swing of things, trying to keep that feel of the air that was so great a part of you during your years with the fleet.

You'll be part of a reserve squadron. In war time a squadron is an operating unit consisting of eighteen planes, a few spares, and a scouting plane (if a fighter squadron), but at present the reserve squadrons are below strength. There will be the commanding officer, known as the "skipper," an executive officer, and other pilot-officers carrying out the duties of gunnery, operations, matériel, communications, and engineering. The crew, consisting of from thirty to eighty men depending upon conditions, will carry out its duties in its respective departments.

In gunnery, these duties are many. The ammunition must be made into belts, and the tips painted so that each pilot may have an identifying color when (and if!) he hits the target. The targets and line (landlubbers call it "rope") must be in order. The planes must be gassed, scrubbed, and hangared before "Secure" is sounded each night.

Because you must navigate if you're a navy pilot, the mornings will be spent in class. You'll take on a few problems, such as:

Given the aircraft carrier *Lexington* on course 90°, speed 25 knots, wind 15 knots from 30°. Problem: Scout a relative sector to the *Lexington*, going out on course 180° relative and returning on course 165° relative. Return to ship at end of four hours. Required: Compass course, actual track, actual miles traveled.

After teasing yourself with that for a while the chief radioman comes in and shoots some mixed code groups to you at fifteen words a minute such as: "LKDMA ZXYPO RSUVK L3JRP C5G7X." After a few minutes of intense concentration it all starts to come back, but about that time you receive a message in plain language to which a reply is asked. You reach for the telegraph key in front of you, trying to send the message as your mind forms it. No spoken words are permitted because you are supposed to be actually flying a plane—perhaps spotting shell splashes in the Pacific!

The last class of the morning is really not a class, but a session in the Link Trainer. After your long lay-off you begin with simple instrument flying, such as level flight, timed turns, harder, until at the end of the two-week cruise you will do an actual problem on a radio range and find the cone of silence, provided that rabbit's foot is still working.

In the meantime the crew has gassed the SBC-4s and towed them to the line. In the gun are sixty rounds of .30-caliber ammunition, with your identifying color, red, marking the steel jacket of each round. You climb in after lunch and follow the white cotton sleeve out on the range, high above Lake Erie and outboard from coastwise shipping. The firing runs will consist of every manner of approach that might be used in combat: from above, below, side, and ahead. The only firing position not used is the one from dead astern, because to fire from that position might embarrass the pilot towing the sleeve.

Once in position, you start your dive, watching the airspeed indicator creep toward 200, and trying to get that dot in the telescope sight to stay on the target. But before you can steady the plane you flash by the sleeve without firing a shot—it takes constant practice to get hits in gunnery. *Could we produce 50,000 military pilots overnight?* You wonder.

The next hop is dive bombing, using small, miniature marker bombs that produce a small puff of white smoke to mark the point of impact. From 5,000 feet you look down at the little 200-foot target on the southern tip of Grosse Ile. It is clear, and there seem to be no little yellow trainers hovering around it; switching the

gas selector valve to reserve, the prop to high pitch, opening the split diving flaps and closing the throttle to 1,000 r.p.m., you roll over into your dive.

A real 70° dive seems very steep—you are out of the seat, almost standing on the rudder pedals. As the speed picks up you must apply more left rudder than usual, and this tends to move the sight off the target. You estimate the wind, trying to figure your lead, and as the target grows larger in the sight you glance at the "ball" in the turn-bank indicator. It is hard to aim and wait, roaring earthward at high speed, but you reach down for the bomb release lever and hold it until you are at 2,000 feet. After the bomb is dropped, you pull out gradually, assuming level flight at 1,000 feet.

For a minute you are busy closing the split flaps, opening the throttle, decreasing the propeller pitch. The plane roars raucously over the target as you bank and turn to get a look at that white puff from the marker: it goes off just outside the circle A miss—try again!

At the end of the day's duty the two-week "cruise" is well begun. Now the planes must be cleaned, serviced, and hangared. The duty section (or guard) must be mustered at 1800 (6:00 p. m.) and if you are so fortunate as to be the O. O. D. (officer of the day) you can get up between midnight and 0300 (3:00 a. m.) to see that all is well. At 0600 you get up, muster the crew at 0755, and see that operations are started promptly at 0800.

The days roll by, with the old feel of the plane coming back slowly. There will be night flying, of which the average pilot does so little, and before taking off you want to check the plane's instrument panel carefully, noting all switches, rheostats and landing lights.

In the darkness you circle Detroit, watching the long line of lights on Michigan Avenue, with the silhouette of the SBC-4 upon it and the blue-white flames spurting from the twin exhausts beneath the cowling. When the turtleback light flickers the signal, you ease from V over to echelon, wondering if the pilot below you is ducking his head!

Coming in to land, you check your landing list carefully: gas, carburetor, prop, wheels, flaps, cowling—and then when you're all through, do it again. Especially the wheels. At five hundred feet the field lights come on, and at three hundred feet you reach down for the switch you memorized prior to take-off and flip your own landing light on.

The two weeks at the naval reserve aviation base rush by. The students are half through now, the base officers working hard to procure another bunch for training, and the reserve squadron holds its formal inspection. During the next year you will attend drills twice a month and try to retain your proficiency, but you wonder when there will be adequately armed planes for reservists to fly—planes with eight machine guns instead of a single .30 caliber. Planes with pilot armor, planes that will fly faster, planes with modern puncture-proof gas tanks, planes with cannon. It takes time and hours in the air to become familiarized with a new airplane—to say nothing of flying gunnery, bombing, night flying and tactics.

As you put your 'chute away and start packing your gear for the trip home, you notice the paper: "Navy to train pilots. Pilots needed. Great expansion." That's all very well, but what are they going to use for planes—bases—mechanics? You ask yourself: Who is going to teach these kids to fly?

The squadron yeoman slips an envelope into your hand and you open it. The paper in it looks official, but that's nothing new. It probably is more routine. You read:

"Upon receipt of these orders you will proceed to NRAB Detroit (Grosse Ile) for duty . . . as instructor."

One of your questions has been answered.

Lanzo Nationals Stick Winner

(Continued from page 39)

fuselage attach just the main spar, leaving the leading edge free to take turn adjustments. After adjusting the model the rudder may be fastened permanently in place.

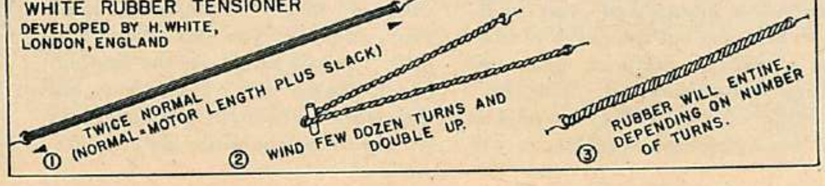
Although E is given in full size, it may be necessary to make a second one (larger or smaller) to produce the right amount of turn in the glide. E is necessary if the flight-timer idea is not used. The flight timer does, however, tighten up the circle in the glide, enabling the model to stay in the thermals.

ADJUSTING

The best climb and glide is obtained when the ship flies in circles of 400 feet diameter. Before putting the model into the air fully wound be sure the glide is perfect. In preliminary hand glides the leading edge should be at Station 8. A piece of $^1/_{16}''$ square under the leading edge of the stabilizer will improve the glide.

Side and downthrust may be adjusted temporarily with thin paper matches. The nose block can be cut away or added to later. Wind the ship three quarters of the full amount of turns on hot days, as the ship will hit thermals at low altitudes. It has climbed out of sight on rubber run alone.

The white rubber rope tensioner is used on the motor and the prop should fold back at about forty turns. Use thirty-two strands of $^3/_{16}''$ flat brown rubber, 40″ long.



Air Adventurers

(Continued from page 22)

you want and point your efforts along that line. You want to get into the air corps, but you do not have a couple of years of college. So what? You can still join the air corps as a buck private, take the training course at Chanute Field, which is free; and you have the best training in the world! Then, as you go along, all you have to do is to show interest, let your superior officers know what you want, and then prepare yourself for pilot training. There are hundreds of noncommissioned men getting pilot training and heading for commissioned rank today. Why not you?

So you want to be an air-line pilot, but they won't even let you on the field to watch the mechanics take the engines down. Isn't that too bad! If you want to be an air-line pilot, what are you actually waiting for? A rich uncle to die? An old maiden aunt to get suddenly generous, or are you a real Air Adventurer? If you want to fly a big airliner and you happen to be bumming it along the railroad tracks wondering where your next meal is coming from, you can still fly an airliner. Many a first officer today started from a tougher scratch. If you have all you started with in the way of physical ability and really want to fly an airliner, you know darned well that the law says that you must have so many solo hours to your credit. You know, also, that it costs so much an hour to get the time. You also know that you must spend about two years as a copilot before you can take over.

So what? That's the answer to it all. Go out and get it.

Two hundred and fifty hours at, say, ten bucks an hour is $2,500—and you are ready for a job that pays more than that a year. If you took up the medical or legal profession, you would pay out much more and earn a darn sight less for years! What do you want, gravy? If you can earn fifteen dollars a week, you get $780 a year. In three years you have earned $2,340. You can save some of it unless you must have your movies, your fancy rags and your other luxuries. You can get a lot of training either as a ground man or a pilot for one third of that $2,340, remember. All you have to do after that is to figure out how you can get twenty a week, or even twenty-five. By that time, once you have established yourself as a wage earner who can be trusted, you can borrow money to get what you lack—if you really want to be an air-line pilot and get at least $6,000 a year.

Where else in the world can you do that, and what are you waiting for?

Aviation owes you nothing, but aviation offers more than any other profession. If you want any part of it, the profession is wide open. If you have certain physical defects, quit worrying about them and feeling sorry for yourself and be tickled to death you are not in a wheel chair or on a street corner with a tin cup selling pencils.

There is a man in Britain today who has lost both legs. They gave him the Distinguished Flying Cross recently for shooting down his nineteenth German plane. They tried to steer him out of the game because he had had an accident that took off one leg below the knee and the other just

About the SOLO CLUB and how to become a member

Feeling that there is a definite need for a means of recognizing those pilots who have experienced the supreme thrill of their first adventure alone into the blue on man-made wings, Air Trails has formulated and founded the SOLO CLUB.

This club is open only to those who have actually made a solo flight in heavier-than-air craft, either motorless or powered. It does not matter when or where such flight was made. Applicants must furnish the membership committee with satisfactory proof of their qualification for acceptance. There are no dues. Once a member, always a member.

To obtain your sterling silver SOLO CLUB lapel wings and life membership identification card, comply with any of the following requirements and sign. Send with fifty cents to the SOLO CLUB, Membership Committee, Air Trails, 79 Seventh Ave., New York, N. Y.

Proof of Qualification as a SOLO CLUB Member

1. Dept. of Commerce license and number if held..........................
2. F. A. I. license and number if held..........................

Or attach any of the following:

3. Evidence of military or naval air-corps service.
4. A letter from your instructor testifying to your solo flight, giving his rating and license number.
5. A notarized statement, preferably with witnesses, giving all details and data of solo flight and plane used.

In submitting the above for membership in the SOLO CLUB, I certify my willingness for the Membership Committee to investigate my application.

Applicant.. Age..............
(please print)

Street.................. City or Town.................................. State..............

below the hip. Today, he'll bet you all the tea in China he can get in and out of a Hawker Hurricane quicker than you.

An individual case, we grant you; but yours is an individual case, too, remember. You yourself have certain qualifications no man may take from you. You have certain skills in your hands or fingers. You are adept at something. You can do certain things better than anyone else in your group. Why not capitalize on these things and add to them the other qualifications you have and accomplish that which you have set your heart on? After all, all the money in the world will not *buy* flying ability.

So, there it is in the plainest words we know. Stop grousing that you can't be in aviation. Ask yourself plainly if you have even made a puny effort to get into aviation. Be fair to yourself and take stock of what you have, what you can get and how much work you care to put into this business of getting into the greatest profession the world has ever seen.

It's a very strange thing, but the men we have met who have gone far in aviation are the quietest people in the world. They don't have time for talk or squawk; they are too busy working to get further.

Let's use a little midnight oil and quit spreading the old vocal oil!

Are you with me, Air Adventurers? Let's go—for aviation!

More next month.

Your Flight Commander,

ALBERT J. CARLSON.

It Takes Pull!

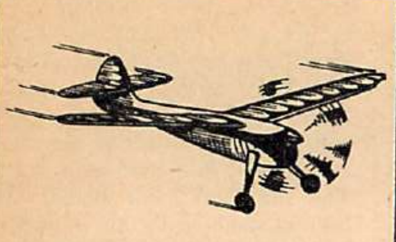
(Continued from page 20)

with a ring for a hold-back rope. One end of the hold-back rope is tied to some heavy object, preferably a car, while the other end, after being passed through the ring in the tail, is held by a crew of several men. Another crew takes hold of the loose ends of the V of the shock cord, the number of men depending on the weight of the glider, its distance from the slope and the overspeed required; the usual number is six on each end. One man keeps the wing of the ship level.

All signals are given by the pilot of the glider. When the pilot shouts, "Walk!" the shock-cord crew takes a few paces forward, stretching the cord. On his command, "Run!" they start running, and when the elastic cord is stretched almost to its limit he shouts, "Let go!" At this the tail crew lets go of the tail rope and the ship is catapulted into the air like a stone from a slingshot.

The second method, the auto tow, was introduced in the United States by Hawley Bowlus, builder of the famous Bowlus Albatross and Baby Albatross sailplanes, who is credited with originating it. The gliding fraternity did not take kindly to it at the beginning, and I distinctly remember many of my gliding friends accusing me of foolhardiness and a mild form of insanity when I started the auto tow method here in the East after

"I'm sending your application right in!"



FLY SAFELY

Follow A. M. A. Rules

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Abide by the common-sense, safety regulations of the Academy of Model Aeronautics.

★ ★ ★

A nationwide safety campaign has been launched to call to the attention of all aeromodelers their responsibilities and the need to "think" before flying model aircraft, especially gas powered models. Aviation leaders, government officials, model club directors, leading contestants and designers, and thousands of licensed Academy flyers have signified their desire to cooperate and conduct their activities with due regard for others.

★ ★ ★

You can help by following the official regulations and having all aeromodelers you know adhere to the rules. You can [illegible] Academy license. These licenses are good for 12 months and indicate your affiliation with the governing body for model aviation in America . . . they are required for entrance in officially sanctioned competitions. Rubber model flyers receive an official Academy license and lapel emblem pin, registration certificates for their model airplanes, a copy of the official regulations, and official sticker for their automobiles and an Academy emblem decal. Gas model flyers, in addition, receive a set of license numerals for the wings of their gas models.

★ ★ ★

The Academy was established in 1934 to keep model aviation "of, by, and for the model builder" and to advance the activity in every way possible. It is a division of the National Aeronautic Association. It issues manuals and helpful aids for running clubs and conducting meets. A.M.A. Headquarters assists model aviation leaders. For full details concerning the A.M.A. and official sporting licenses, mail the coupon below with a 3c stamp to Academy Headquarters.

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AT1

ACADEMY of MODEL AERONAUTICS
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having been given instructions by Hawley. The reason for this antipathy was that many fellows, knowing little not only of stresses imposed on gliders in steep climbs under conditions of excess speeds, but literally knowing nothing of flying, hooked gliders to their cars and proceeded to carom across field and dale with total disregard for the strength of the wind, while the pilot in the ship frantically hauled the stick back as far as he could. Result, the machine got de-winged, as the English call the process of shedding wings. Used sanely, auto tow is the best method of teaching a student to fly gliders when a two-place machine is not available, and at present is the only method used for instruction in the United States. The equipment used for auto tow consists of an automobile, preferably a roadster able to do at least thirty-five to forty miles per hour in second speed, and rope five sixteenths in diameter, the length depending on the size of field available. For instruction purposes about 350 to 400 feet are sufficient; experienced pilots use 1,000 feet or more. It is preferable for the car to be equipped with a seat facing the glider during instructions. Both car and glider should be provided with release hooks so that the rope can be dropped from either end. In towing, strict attention should be paid to the wind conditions, and the combined speed of the tow car and wind should be equal to the flying speed of the glider. That is, if the flying speed of the glider is 35 m.p.h., the wind during the tow 10 m.p.h., the car should not exceed 30 m.p.h., giving the glider [illegible] of 5 m.p.h. being to insure a decent rate of climb.

The glider itself should not be climbed too steeply, as this imposes undue stresses on the wing, the best angle of climb being between twenty and thirty degrees. At the moment of take-off the ship should be climbed gently until approximately 100 feet of altitude is reached, after which a sharper angle can be assumed. As the desired altitude is attained, the ship should be leveled off and the release pulled.

The winch tow is the most popular means of launching gliders and sailplanes. In the United States it was introduced by Gustave Scheurer, one of the pioneers of our gliding and soaring movement and organizer of the Aëro Club Albatross of New Jersey. The advantage of a winch tow is that the field from which winch operations are conducted does not have to be as smooth as that required for auto tow, the operations themselves are accelerated as the rope is brought back to the starting point the moment the glider lands, and a take-off can be made almost immediately after landing.

The procedure of piloting the glider from winch tow is similar to the auto-tow method with the difference that the ship gets off the ground much more rapidly. We will not endeavor to describe all the different types of winches in use, as there are quite a number of them and practically every club has its own idea for one. There are some which have a drum attached to the rear wheel of a car, others which use independent power plants for operating the drum. Still others use friction drives consisting of tires mounted on wheels attached to the drum, the whole unit getting its rotation from being lowered onto the wheels of the car, so that the car's tires, being in contact with the tires of the drum's wheels, drive it through friction. The drum has 3,000 to 5,000 feet of rope wound on it and is equipped with a level winder, automatic or hand-operated, which winds the rope evenly on the drum as it is taken in during the tow. A cutting device for the rope, called guillotine, is affixed to the pulleys through which the rope runs to the drum so that it may be cut off in case of failure of the release mechanism on the glider.

Winch driving requires a good deal of skill from the operator, and it's best to have a man who is well acquainted with flying to drive it. Here's how it's done. The winch is put on the far end of the field so that the ship would take off directly into the wind. It is jacked up if it's a friction drive, or the drum is located on one of the rear wheels, and the front wheels are blocked. The free end of the rope which has a ring and is to be attached to the glider is hooked to a car, which proceeds to the take-off point, unreeling the rope from the winch drum. At the take-off site a flagman is located with three flags, red, yellow and green. As soon as the winch operator sees the yellow flag he starts the engine of his winch. At the next signal, the green flag held up straight, he puts the winch in high gear and takes up the slack. As the green flag drops he accelerates the winch and takes the ship into the air. Here he must watch carefully for a signal from the pilot in the glider. If he sees him wigwagging the wings he should accelerate the drum, for the signal means "not enough speed." If the ship fishtails from side to side it means "too much speed," and he should slow up. As the glider gains altitude the speed of the winch should be slackened. As the drum reeling in the rope gets bigger in diameter and the air speed of the glider rises proportionately at the end of the climb, the speed should be diminished by at least thirty percent. If the ship is almost directly above the winch and no visible attempt to release is made, the winch should be thrown into neutral and practically stopped to warn the pilot that it is time to release. If still no attempt to release is made, the guillotine should be put into operation and the ship cut off from the winch. Failure to do so may result in a fatal accident, as the ship will be jerked to a stop stall and spin in. Another method, if the guillotine does not operate or is not present on the winch, is to shift it into reverse and pay out enough rope so that the pilot can make a turn back to the field and attempt a landing. This particular method has been successfully accomplished by myself when a friend of mine whom I was towing failed to release and, not knowing that he was still attached, proceeded to make a turn. The flying speed of the ship increased by better than 20 m.p.h. because of the resultant rope drag, and only because of his skill as a pilot and the fact that enough rope was

payed out to him did he land the ship without so much as a scratch.

The final method, airplane tow, is the most fascinating way of launching, but is subject to strict government regulations. The sailplane must be licensed for airplane tow as well as placarded for the maximum permissible speed for towing. The glider pilot must have a commercial glider pilot's certificate, and the tow pilot a power plane commercial license. Both pilots are required to wear parachutes, and even the length of the rope is regulated, the minimum being 300 feet for local tows, 400 feet for cross-country tows. The ship used for towing should have a rearward vision and be supplied with a suitable release for the tow rope. The rope diameter is the same as used for winch and auto tow, although some pilots prefer using one-quarter inch Manila. Once everything is in order, both glider and power plane are wheeled onto the field and pointed upwind. One end of the rope is attached to the glider release hook, the other to the tail-skid release of the power plane. The rope should not have any slack once it is attached to both ships. One of the crew members is stationed near the power plane, another at the wing of the glider. Once everything is in order the sailplane pilot gives the O. K. to his wing man, who waves to the power-plane pilot. The tow-plane pilot guns his ship and the flight starts. The glider will be in the air long before the power plane. As he rises to approximately fifty feet he should dive slightly toward the ground and put slack into the rope; this decreases the drag on the power plane and helps it to get off. In flight the sailplane should always ride slightly above the tow plane. If the pilot gets below he is in danger of getting into the propeller slipstream, receive a bad shaking up and lose control of his ship. The tow-plane pilot should always bear in mind to fly his ship as close to the placarded speed of the glider as possible. Although a slight overspeed is permissible, too much will put severe strain on the glider. This is especially true in bumpy weather where gust loads are apt to strain the ship to a breaking point. Once the glider reaches the desired altitude the pilot releases; a slight jerk on the power plane indicates that the ship is free.

Air Corps Questionnaire

(Continued from page 13)

Question: When most of us hear the words "air corps," we think of the army air corps, but I don't think many of us know exactly what part it plays in our defense. Could you enlighten me a little more on this subject?

Answer: The air corps is the arm that contends with enemy forces of the air, attacks his ground troops from the air, and destroys by bombing his supply depots, his factories where war supplies are made, and his military installations of all kinds. A modern and powerful air arm is one of the main reliances of our army for the defense of the nation. The air units of the United States navy would, in war, co-operate with the fleets of the navy to destroy hostile ships and thus keep an enemy from our shores. The air corps of the army, however, would co-operate and help as needed against an enemy's forces on the seas, though it is organized primarily for operations against the enemy in the air and on the land.

Question: What are some of the different types of planes?

Answer: The air corps has three basic types of combat airplanes: pursuit, bombardment and observation. Pursuit airplanes are of two types: interceptor and fighter. Interceptor airplanes are primarily used for meeting and destroying hostile aircraft attacking objectives in our own territory. Fighter pursuit airplanes accompany bombardment planes and protect them against attack by hostile airplanes. Bombardment airplanes are of three general kinds: light, medium and heavy. Light bombardment airplanes are designed to give fire support to ground troops by machine-gun fire and bombs.

Heavy bombardment airplanes are

designed for long-range bombardment and reconnaissance flights over land and sea. Medium bombardment airplanes are lighter and less expensive, and are designed for bombardment or reconnaissance missions that do not require extreme range. The purpose of observation airplanes is to furnish short-range observation, photographic, command, courier and liaison service to corps and divisions, including their component infantry and artillery units. Observation service includes both visual and photographic reconnaissance and air ground radio communication. All of these combat types of airplanes are armed with machine guns for self-defense against enemy airplanes and have as much speed as their weights and engines will permit.

Question: You say that these are combat planes. What kinds of noncombatant planes are there?

Answer: There are three kinds of basic, noncombatant airplanes: training, cargo and transport, and experimental. The training planes are of various types including primary, basic and obsolescent service types. Transport and cargo airplanes are used to carry both troops and supplies. Experimental airplanes are those under development.

Question: If I am to be a part of all this and decide to join, just what would I expect to learn—i. e., what are some of the different subjects I would have to take up?

Answer: Upon entering, the new flying cadet at once begins his military training and at the end of a few weeks his ground and air training as a flier begins. The ground instruction consists of lectures, demonstrations, laboratory, and class-room work, and includes studies in theory of flight, airplane rigging, and structures. There are courses in airplane engines and trouble shooting; in air navigation, including maps, compasses, radio aids to navigation, and flying instruments; weather; radio code; and airplane weapons. The work at the Air Corps Training Center is divided into three phases, the first being about two months and the other two lasting approximately three months each: primary flight training given at one of the civilian schools selected by the government and basic flight training given at Randolph Field, followed by advanced training at Kelly Field, San Antonio, Texas.

On completing the course, a flying cadet receives his "wings" and the rating of airplane pilot, and soon thereafter a commission as second lieutenant in the air corps reserve.

Question: When I was born my folks had my birth certificate made out Chauncy John Doe. I never liked the name Chauncy and therefore went by the name of John and dropped Chauncy entirely. All through grammar as well as high school I was known as John, but my birth certificate still has my first name as Chauncy. When I turn in my certificate to you, will it make a difference because the name on the school record and the rest of my papers do not have the first name?

Answer: Yes, you will either have to change all your papers around to read like your birth certificate or make out an affidavit stating the facts about the difference in your name. In the case of a man having changed his surname, he must present an affidavit that his name has been officially changed.

Question: In the event I fill out the application, when I sign my name and have my signature notarized, does that obligate me in any way to the government?

Answer: No. When your signature is notarized it just proves that the aforesaid statements are true and correct to the best of your knowledge. You are not obligated in any way to the government until you raise your hand and are sworn in.

Question: May I at any time get married during my period of service?

Answer: No. A flying cadet cannot be married. However, upon being discharged as a flying cadet and appointed second lieutenant in the air corps reserve, he may be married if he so desires. For those who do, Uncle Sam has made pleasant provisions. He is furnished a set of quarters to live in, free gas, electricity and heat, along with free medical and dental care.

Question: I understand that one's eyes play an important part in the physical examination. Suppose a man has almost perfect eyesight, say 20/20 in one eye and just a little over in the other, will they pass him on the strength of one eye being perfect and the other just a fraction off?

Answer: Your eyes are very important, not just alone to you but to the government and its personnel. Faulty eyesight may result in the loss of many lives, especially when and where judgment plays such an important part. Lack of judgment due to faulty eyesight has been the cause of many accidents. Both your eyes must be 20/20 bilateral, without glasses; unimpaired ocular muscle balance; unimpaired optical organism. We are reminded of the experience of an applicant who took the exam and passed everything until he came to the optical part. It seems he was asked to cross his eyes, but try as he would he couldn't make them come to that affectionate stage and had to give up—whereupon he failed the entire examination. Now why, just because he couldn't cross his eyes, didn't they pass him? You have the answer in muscular control. The flight surgeon deemed it inadvisable to pass this man because he didn't have complete control of his eyes. The average person, though, much to his surprise, finds his eyesight is normal. Color blindness is one of the chief causes of disqualification.

Question: I've been told that applicants don't have to be supermen to pass the physical exam, that the requirements are only "normal." Maybe so, but what do you mean by "normal"?

Answer: Well, certain rare individuals are able to read only 10 millimeters high from a distance of

20 feet. Flying cadet applicants are required to read letters double that size, 20 millimeters tall, from the 20-foot distance. Twenty millimeters is slightly more than three-fourths of an inch. Try it yourself. "Just normal visual acuity," the flight surgeons declare.

Another test of the eyes is depth perception, ability to judge comparative distances of objects. Two black rods are mounted on a sliding base. Strings are attached to these rods so that the pilot-to-be can move them from a distance. The idea is to adjust the rods so that they will be more or less equidistant from your eyes. An error of 30 millimeters is allowed by the air corps. "Just normal," medicos say, for some persons can adjust the sticks with an error as small as five millimeters.

Still another eye test—color blindness. If the applicant has trouble in distinguishing the "stop" light from the "go" light, he will probably have difficulty in passing this phase. Otherwise his chances are good.

"Perimetric field of vision," is another eye test. Test yourself by holding your head steady while a friend moves a pencil about two feet from your left ear. Have him gradually jiggle it forward, upward, downward. Can you see it in these various positions? If you can, your field of vision is in all probability sufficiently broad.

"My heart's O. K.," all applicants boastfully declare when that portion of the exam starts. Perhaps it is and perhaps it isn't. Blood pressure reclining, pulse rate reclining, both are checked against the same readings taken while standing up and, also, after exercise. A numerical value is given each reading, and all combine to give a final result. An 18 is perfect, the medicos say, but potential pilots need only a plus 8. "Just normal," they reiterate.

Flying cadet applicants are spun round and round in a Barany chair to test the reactions of the middle ear, where the sense of balance is located. A check on the blood pressure is made meanwhile. Occasionally a candidate has difficulty with this phase, but not often.

Can you make your hands and feet behave? Well, let's see. Get into the chair of the Automatic Serial Reaction Machine. Facing the applicant are three double rows of lights. One row is red, the other green. Also in front of the cadet-to-be is a control stick and rudder pedals, similar to the controls of a plane. Instead of controlling a plane they control the lights. The entire machine is automatic from this point on. Three red lights flash on, and you move the controls until the green lights are lighted directly opposite the red ones. When correct, the time to perform this task is registered. Another set of red lights flashes on, and then another and another until the applicant has solved forty settings. This determines his reaction time.

That's about all to the physical examination except the psychological test which consists merely of a chat with a flight surgeon. He probes your mind, seeking for any hidden phobias that may exist, even without your knowledge.

Fine Feathers Make Fine Birds

(Continued from page 17)

Early models, although of sound aërodynamical design, lacked power and consequently were slow, sluggish, and hardly suitable for cross-country flying. Much of the credit for the present perfection of the light plane must be given the engine manufacturers because of the constant improvements made in their efficient little power plants. It was the fifty-horsepower engine appearing on the market only in 1938 that really started the current light-plane boom. With the addition of only ten horsepower to the old forty, the little ships started moving along vigorously even under conditions that had previously kept them hopelessly grounded. From the fifty it was a short step to the sixty-fives, seventy-fives, eighties. Each time a few horsepower were added to an engine, the scope of the light plane became greatly enlarged. More power meant more speed. Engineers had to work overtime making refinements on the old flivver. Drag was being eliminated, cabin space made more spacious, larger gas tanks and more baggage space were added, improvements made in the controls and in the landing gear, and the requirements of comfort for pilot and passenger received increased attention.

A wider market caused competition to mount among the manufacturers to a point where luxuries were being installed. Well-known industrial designers were hired to add eye appeal inside and out. The flivver of today can be had in all kinds of fancy color schemes. A streamlined cowl embraces the powerful little engine and the cylinder openings are hidden behind chromium grille work. Some are equipped with engine mufflers and so well soundproofed inside that a conversation can be carried on easily without raising the voice. Brakes and tail wheels are almost standard equipment, as are wheel pants, propeller spinners, cabin heaters and ventilators. Fancy dashboards are well planned to provide for radio, and any number of desired flight instruments and plenty of baggage space are provided. The three-place light plane has been added to the conventional two-place models. One ship, the Stinson 105, is equipped with flaps; another one, the Culver Cadet, with a retractable gear.

Power has been mentioned as one of the main factors in light-plane progress. From current developments in the engine field it would seem that power will play an equally big part in advancements of the immediate future. The geared engine has been introduced and will no doubt see further development. Fuel injection now being featured by one manufacturer, Continental, will eventually eliminate the grave ever-present danger of carburetor icing. And while this is being written news is received of a new six-cylinder light-plane en-

gine with an output of well over one hundred horsepower.

In addition to all these improvements, one singularly outstanding development has taken concrete shape after years of discussion and spasmodic experiments, and that concerns simplicity and safety in flying. Light planes today seem to have an inherent dislike for anything except conventional and safe flying maneuvers. Although the recklessness and carelessness in human nature can't be erased, one can incorporate features in the machine that will do much toward canceling these faults. Wing slots incorporated in two of the most popular models, Culver and Stinson, are making it difficult to stall these particular ships to a point where they will fall off into a dangerous spin.

But the most significant innovation we've come across personally is a new light plane which is fundamentally designed as a safe flying machine without sacrifice in speed and essential maneuverability. We call it new because production got under way only last fall, although it has been in the making for, believe it or not, a period of ten years, and its prototype was flown and demonstrated more than a year ago. We refer to the Ercoupe, one of which we had the good fortune to pilot recently. That was an enlightening experience!

The Ercoupe is an all-metal, low-wing light plane powered by sixty-five horses and equipped with a tricycle gear. This landing gear in itself offers numerous advantages. It permits the ship to be taxied in level position with lots of visibility from the cockpit over the straight nose. Landing can be made in a straight line with a minimum of "leveling off" and without any danger of the ship going over on its nose once the landing has been accomplished. Once contact has been made with the ground the wheels stay there with a surprising tenacity and there is no tendency to bounce because the center of gravity is well forward in the nose. Any excess speed resulting from a steep approach is quickly and effectively killed by full application of the brakes which act simultaneously on all three wheels of the tricycle gear. No matter how sudden and how hard the application of the brakes, there is no danger of putting her over on the nose due to the little third wheel far out front under the nose.

This wheel is steerable and hooked up to the rudder controls. In the two-control version of the Ercoupe the rudder and aileron controls in turn are actuated simultaneously by turning the control wheel. Hence, taxiing of the ship around the field is little different from driving a car and can be mastered by anybody used to the wheel of the automobile. Even more surprising is the simplicity of handling the ship in the air. In order to make a turn you again simply move that little steering wheel, and ailerons and rudder automatically combine in swinging the ship around in a nicely banked curve in the sky. Co-ordination of controls, the headache of many a fledgling pilot, need not worry him in the Ercoupe, because it is fully automatic. Should he throw the wheel over too hard the aileron will automatically be neutralized and prevent the ship from wheeling into a dangerous vertical bank.

Most astounding feature of all, however, was the absolute and stubborn refusal of the machine to spin after it has been stalled. When you are thumbing through the sad pages of an accident report you will read the same story over and over again; the story of the stall that crept up on the pilot and of the subsequent spin that seized control of the ship from his struggling hands. The Ercoupe, we found, definitely will not spin. Pull its nose up high with full throttle or with power off and she will stall, naturally. That is, she will lose all flying speed, but she will not drop a wing and tear away in a dizzy spin. All that will happen is that the nose will drop to a point where the ship automatically recovers its necessary flying speed. When the ship was being testflown for licensing by the C.A.B., its best pilots failed either to coax or to force it into a spin, and when tests were completed the Ercoupe was given an official license as an absolutely "spinproof" plane, the first license of its kind ever given to a ship.

So enthusiastic are they about the built-in safety features of the ship that a group of C.A.B. students at College Park, Maryland, was assigned to a flight course in the Ercoupe and the experiments proved that piloting of this type of craft can be mastered in a considerably shorter period of time than in the conventional airplane. Students taking part in this special course were soloed in as little as three hours, and were all prepared for a private pilot's rating in as little as fifteen hours, or about half the time required ordinarily.

The tricycle gear, simplified controls and the spinproof wing are here to stay. The trend has been established and other manufacturers no doubt will follow suit.

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CONTEST MODELS THAT HAVE NO EQUAL

HENRY STRUCK'S "AMERICAN ACE"

For "A", "B" or "C" Competition

54 INCH WINGSPAN

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Those who attended the 1940 National went home remembering the standout model, Henry Struck's "New Ruler." Not even introduced in kit form, it was one of the most popular ships on the field. Before the contest, the "American Ace" was designed mainly for competition in Class "B" but also suitable for small Class "C" and large Class "A" engines. The sensational "New Ruler" design in Air Trails was its inspiration. No ship has ever been designed with such painstaking care and precision. A flyer, beyond doubt, the leader in its class for contest competition.

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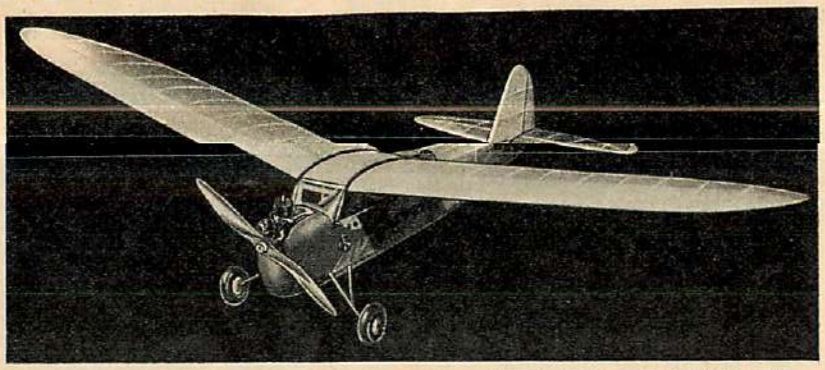

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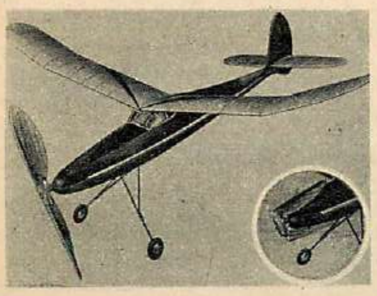

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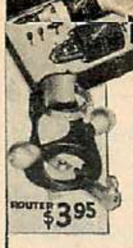

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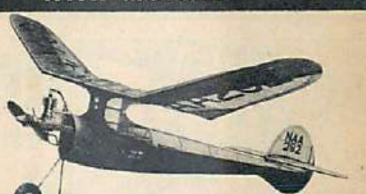

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gine with an output of well over one hundred horsepower.

In addition to all these improvements, one singularly outstanding development has taken concrete shape after years of discussion and spasmodic experiments, and that concerns simplicity and safety in flying. Light planes today seem to have an inherent dislike for anything except conventional and safe flying maneuvers. Although the recklessness and carelessness in human nature can't be erased, one can incorporate features in the machine that will do much toward canceling these faults. Wing slots incorporated in two of the most popular models, Culver and Stinson, are making it difficult to stall these particular ships to a point where they will fall off into a dangerous spin.

But the most significant innovation we've come across personally is a new light plane which is fundamentally designed as a safe flying machine without sacrifice in speed and essential maneuverability. We call it new because production got under way only last fall, believe it or not, a period of ten years, and its prototype was flown and demonstrated more than a year ago. We refer to the Ercoupe, one of which we had the good fortune to pilot recently. That was an enlightening experience!

The Ercoupe is an all-metal, low-wing light plane powered by sixty-five horses and equipped with a tricycle gear. This landing gear in itself offers numerous advantages. It permits the ship to be taxied in level position with lots of visibility from the cockpit over the straight nose. Landing can be made in a straight line with a minimum of leveling off and without any danger of the ship going over on its nose once the landing has been accomplished. Once contact has been made with the ground the wheels stay there with a surprising tenacity and there is no tendency to bounce because the center of gravity is well forward in the nose. Any excess speed resulting from a steep approach is quickly and effectively killed by full application of the brakes which act simultaneously on all three wheels of the tricycle gear. No matter how sudden and how hard the application of the brakes, there is no danger of putting her over on the nose due to the little third wheel far out front under the nose.

This wheel is steerable and hooked up to the rudder controls. In the two-control version of the Ercoupe the rudder and aileron controls in turn are actuated simultaneously by turning the control wheel. Hence, taxiing of the ship around the field is little different from driving a car and can be mastered by anybody used to the wheel of the automobile. Even more surprising is the simplicity of handling the ship in the air. In order to make a turn you again simply move that little steering wheel, and ailerons and rudder automatically combine in swinging the ship around in a nicely banked curve in the sky. Co-ordination of controls, the headache of many a fledgling pilot, need not worry him in the Ercoupe, because it is fully automatic. Should he throw the wheel over too hard the aileron will automatically be neutralized and prevent the ship from wheeling into a dangerous vertical bank.

Most astounding feature of all, however, was the absolute and stubborn refusal of the machine to spin after it has been stalled. When you are thumbing through the sad pages of an accident report you will read the same story over and over again; the story of the stall that crept up on the pilot and of the subsequent spin that seized control of the ship from his struggling hands. The Ercoupe, we found, definitely will not spin. Pull its nose up high with full throttle or with power off and she will stall, naturally. That is, she will lose all flying speed, but she will not drop a wing and tear away in a dizzy spin. All that will happen is that the nose will drop to a point where the ship automatically recovers its necessary flying speed. When the ship was being test-flown for licensing by the C.A.B., its best pilots failed either to coax or to force it into a spin, and when tests were completed the Ercoupe was given an official license as an absolutely "spinproof" plane, the first license of its kind ever given to a ship.

So enthusiastic are they about the built-in safety features of the ship that a group of C.A.B. students at College Park, Maryland, was assigned to a flight course in the Ercoupe and the experiments proved that piloting of this type of craft can be mastered in a considerably shorter period of time than in the conventional airplane. Students taking part in this special course were soloed in as little as three hours, and were all prepared for a private pilot's rating in as little as fifteen hours, or about half the time required ordinarily.

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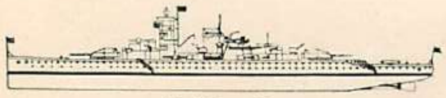
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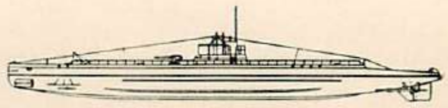
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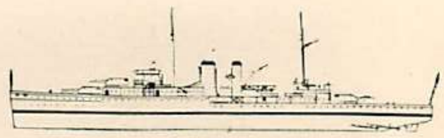
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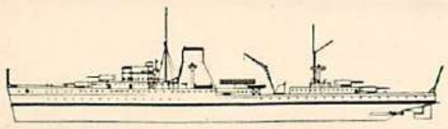
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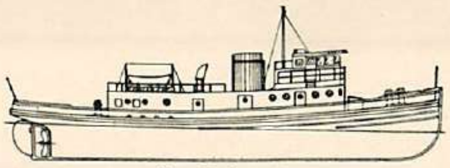
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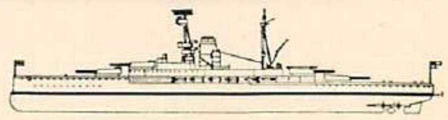
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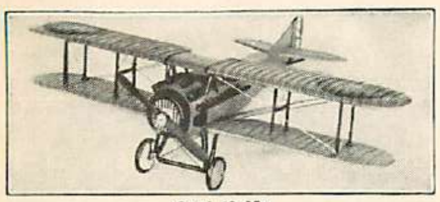
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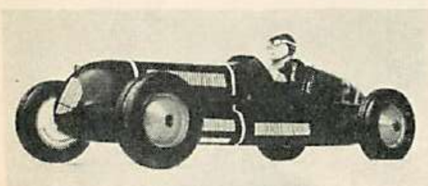
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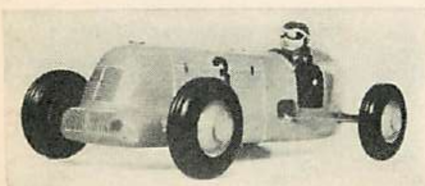
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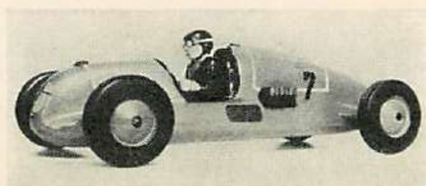
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